JAIDEV EDUCATION SOCIETY'S

J D COLLEGE OF ENGINEERING AND MANAGEMENT

KATOL ROAD, NAGPUR

Website: www.jdcoem.ac.in E-mail: info@jdcoem.ac.in

An Autonomous Institute, with NAAC "A" Grade

Education to Eternity

VISION	MISSION
"To be a Department providing high quality & globally competent knowledge of concurrent technologies in the field of Electronics and Telecommunication."	1. To provide quality teaching learning process through well-developed educational environment and dedicated faculties. 2. To produce competent technocrats of high standards satisfying the needs of all stakeholders.

MINUTES OF MEETING OF 05TH ACADEMIC COUNCIL MEETING NO./JDCOEM/05/2020-21 15/12/2021

Venue: Online through Google Meet

J. D. College of Engineering & Management, Nagpur

The 5th Meeting of Academic Council was held on 15/12/2021 at 2 pm on online through Google-Meet. The following members were present for the meeting.

Sr. No.	Category	Name of the Member	Organization/Dept
01	Officiating Principal	Dr. S. V. Sonekar	JDCOEM
02	Chairman BOS	Dr. Bhushan Mahajan	ME, JDCOEM
03		Dr. Satish Vaishnav	EE, JDCOEM
04		Mrs. Neetu Gyanchandani	ETC, JDCOEM
05		Mrs. Atika Ingole	CE, JDCOEM
06		Ms. Supriya Sawwashere	CSE, JDCOEM
07		Mr. Mirza Baig	IT, JDCOEM
08		Mr. Milind tote	AI, JDCOEM
09		Dr. Amit Gupta	FY, JDCOEM
10	Teacher of the College	Dr. S. L. Haridas	Dean Academics, JDCOEM
11		Dr. Namrata Pradnyakar	FY, JDCOEM
12		Dr. Vaishanvi Dhoke	EE, JDCOEM
13		Mr. Suhas Rewatkar	ME, JDCOEM
14		Dr. Ujwala Dange	IQAC coordinator
15		Mr. Sunil Gupta, COE	COE, JDCOEM
16	Industry Experts / Academician	Dr. Vimlesh Soni	MANIT, Bhopal
17		Dr. Prakash Awate	Ex. Professor, IIT Pawai
18		Mr. Gaurav Agrawal	IMEC, Belgium
19		Mrs. Palak Maheshwari	Arcades India Consulting Pvt. Ltd., Bangalore.
20	University Nominee	Dr. Shivajirao Jadhav	DBATU

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21		Dr. Sanjay Nalbalwar	
22	Special Invitee	Dr. P. B. Maheshwary	Dean S & T, RTMNU, Nagpur
23		Dr. J. P. Modak	JDCOEM

The following University Nominees and Industry Experts could not attend the meeting, their absence was granted by the Chairman, Academic Council.

1. Dr. Y. S. Mahajan - University Representative
2. Mr. Makrand Takle – Industry Expert
3. Dr. S. R. Choudhari – VC, RTMNU, Nagpur

The Dean Academics Dr. S. L. Haridas, sought the permission to initiate the proceedings after welcoming the experts and members of council. The following is the agenda wise transactions of the proceedings:

Item No. 1	**To Confirm the Minutes of 4th meeting of Academic Council.**

The Minutes of Fourth Meeting with relevant annexure were presented to all the members of Academic Council. No query or suggestion were received, hence the Minutes were confirmed by the house unanimously (Annexure-I).

Item No. 2	**To bring on table the action taken report of 4th Meeting of Academic Council held on 08/04/2021.**

The Action Taken Report of the 4th Meeting of Academic Council was read out. The Chairman, Academic Council informed the Actions Taken on previous minutes (Annexure-II).

Item No. 3	**To include the "Universal Human Values-2: Understanding Harmony" subject in third semester as a mandatory course with credit.**

Presently in the scheme of III-Semester of all branches "Universal Human Values-2: Understanding Harmony" is an audit subject. But according to letter no. AICTE /IPC/2020/93 received from AICTE it will be a mandatory course. House unanimously agreed to include it as a mandatory course (Annexure-III).

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Item No. 4	To approve the syllabus of subjects of III and IV - Semesters of AI.

The scheme of AI has already been approved in earlier meeting of the house. Now Board of Studies of AI course has finalized the syllabus of 2nd year (III & IV - Sem) and forwarded to the house for approval. Board of study Chairman explained the logic of designing the syllabus of their Board. The house unanimously approved the syllabi of 2nd year (3rd & 4th Sem) of AI (Annexure-IV).

Item No. 5	To approve the syllabus of subjects of V and VI - Semesters of all UG programs except AI.

The scheme of all branches has already been approved in 1st meeting of the house. The syllabi of First and Second year were also approved in the consecutive meetings. Now Board of Studies of each course has finalized the syllabus of 3rd year (V & VI - Sem) and forwarded to the house for approval. The house unanimously approved the syllabi of 3rd year (5th & 6th Sem) of all programs (Annexure-V CE, CSE, IT, EE, ETC, ME).

Item No. 6	To approve the syllabus of open elective subjects of all departments.

The curriculum under autonomy started from Academic Year 2019-20, so this is the Third year of autonomy. In sanctioned scheme we offered an open elective from V - Semester. So each BOS suggested and finalized the following subjects as an open elective for V & VI semester. The house unanimously approved the syllabi of open elective subjects for 3rd year (5th & 6th Sem) (Annexure-VI).

Item No. 7	To approve the syllabus of M. Tech. Electronics Engineering.

The scheme of M. Tech. Electronics engineering has already been approved in last meeting of the house. Now Board of study has finalized the revised syllabus of 1st year and forwarded for kind approval of the house. The house unanimously approved the syllabi of M. Tech. Electronics Engineering (Annexure-VII).

Item No. 8	To include CRT as a mandatory course in 6th sem

As training & placement is an important activity for the students and institute. To increase the seriousness of students toward the training and placement we want to include CRT as a mandatory course of one credit in 6^{th} semester. The house agreed to include CRT as a mandatory course in 6^{th} semester and approved the syllabus of it (Annexure-VIII).

Item No. 9	To include survey based mini project with one credit in second semester.

Presently we have a survey based mini project of one credit in second semester but its execution will be in the vacation of 2^{nd} semester & its credit was reflected in 3^{rd} sem grade card of the students. Now for proper execution of the mini project we want this has to be started in 1^{st} sem vacation and duly credited and reflected in 2^{nd} sem grade card of the students. The house unanimously approved to include the survey based mini project/internship in second semester (Annexure-IX).

Item No. 10	To update the syllabus of Physics, Chemistry and Mathematics.

Looking into execution and requirement updating was done in the syllabus of Physics and Chemistry. The house approves the modified syllabus of the said subjects (Annexure-X).

Item No. 11	Amendment in Ordinance of JDCOEM under various clauses.

1. In Introduction under department and table include following row (Annexure-XI)

16	Artificial Intelligence	AI

Under program Offered and under graduate programs include following row (Annexure-XII)

7	Artificial Intelligence	Course Title	7	Eligibility Criteria as laid down by the competent authority from time to time

In "TABLE-1: UG PROGRAMMES LEADING TO B.TECH. DEGREE" removes row number 4 and include last row as follow. (Annexure-XIII)

7	Artificial Intelligence	B. Tech. (Artificial Intelligence)	AI

2. Presently in R 16.8, it is mentioned that Forego facility is available for "FF (stands for examinee fails but complete course requirement" and "Z (stands for non completion of course requirement)" grades of undergraduate program. We propose, Forego facility to the examinee who has "FF" grade only and not for "Z" grade.(Annexure-XIV)

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3. In the same clause R 16.8, it is mentioned that "for the examinee opting for forego, his/her marks in continuous assessment shall be ascertained proportionately on the basis of his/her marks in the end semester theory examination of that course and equal proportion on the basis of his/her marks in practical examination". Since theory subject has both Continuous assessment (CA) & Mid Sem Exam (MSE), here is only clarification about continuous assessment is mentioned and not for Mid Sem Exam.

   Since in theory subjects CA and MSE are of 20 marks each, we propose that when a student is applying for forego with the Supplementary Exam form, he will be awarded 75% of the Supplementary exam marks proportionately in (CA + MSE) .(Annexure-XIV).

   For example, if a student has requested for forego of internal marks in a particular subject & he scores 30 marks out of 60 in the Supplementary exam. Then in CA out of 20, he will be awarded 7.5 (rounded off to 8) marks. Similarly in MSE out of 20, he will be awarded 7.5 (rounded off to 8) marks.

4. Presently in R 17.4 mentioned that "For computation of Standard Relative Grades, for the evaluation of the academic performance of an examinee in a course, in Makeup Examination, the Mean and the Standard Deviation would be the same as the Mean and Standard Deviation in the End Semester Examination for which the Makeup Examination was conducted.

   It should be "For computation of Standard Relative Grades, for the evaluation of the academic performance of an examinee in a course, in Makeup Examination and Supplementary Examinations, the cutoff would be the same as the cutoff in the End Semester Examination for which the Makeup and Supplementary Examination was conducted." The matter is placed before the house for acceptance. (Annexure-XV)

5. Presently in R19 under Award of Degree mention that "The Degrees shall be awarded by Dr. Babasaheb Ambedkar Technological University along with the name of College on the degree, on the recommendations of the Academic Council/ Governing Body."(Annexure-XVI)

   Below this add the following.

   The degree will be awarded in B. Tech. & M. Tech. with any of the following class,

   Passed in First class with Distinction (CGPA ≥ 7.5)

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Passed in First class ($6 \leq CGPA < 7.5$)

Passed Class ($5 \leq CGPA < 6$)

6. Presently in R 21.2 it is mentioned that, "a student, who has earned all the credits for the degree but fails to obtain the minimum specified CGPA for this purpose (As given in the Teaching & Examination Scheme of respective program), shall take additional courses or repeat the courses mentioned in program till the minimum CGPA is attained subject to maximum duration of program as specified in R 15.4 and R 22".

   Kindly read it as "a student, who has earned all the credits and pass the audit subjects & other courses as prescribed in the scheme but fails to obtain the minimum 5.0 CGPA after the VIII sem B. Tech. and IV sem M. Tech., shall take additional courses or repeat the courses mentioned in program till the minimum 5 CGPA is attained subject to maximum duration of program as specified in R 15.4 and R 22". (Annexure-XVI)

   This is for kind approval of house.
7. Presently in R31 (a) under Improvement of Grade/CGPA while undertaking a Program mentions that "The facility for improvement of grades will be available to the students having CGPA below 6.0". It would be modified as "The facility for improvement of grades will be available to all students irrespective of any CGPA who are not satisfied with his/her performance". This is for kind approval of the house (Annexure-XVII).
8. Presently in R31 (b) under Improvement of Grade/CGPA after successful completion of a Program mentioned that "The facility of improving CGPA at Bachelors' Degree Level through reappearance shall be available only to the candidates who have earned all credits offered in the program and have secured not less than 5 CGPA. Similarly at Masters' Degree Level through re-appearance shall be available only to the candidates who have earned all credits offered in the program and secured not less than 6 CGPA".

   It should be "The facility of improving CGPA at Bachelors' Degree Level through reappearance shall be available to all the candidates who have earned all credits in the program but not satisfied with his/her performance. Similarly at Masters' Degree Level through re-appearance shall be available to all the candidates who have earned all credits offered in the program but not satisfied with his/her performance (Annexure-XVII)..

   This is for kind approval of the house.

9. As per our Ordinance, R37 - The title of the table is "TABLE-2 (STUCTURE OF GRADING OF ACADEMIC PERFORMANCE (UG)". But it is applicable for Grading in both UG and PG, and hence it would be "TABLE-2 (STUCTURE OF GRADING OF ACADEMIC PERFORMANCE (UG & PG)". This is for kind approval of house. (Annexure-XVIII)
10. As per our Ordinance, R37- TABLE-2 (STUCTURE OF GRADING OF ACADEMIC PERFORMANCE (UG) Grade 'I' means "Incomplete course requirement due to absent in End Semester Examination".

    We wish to extend the meaning of grade 'I' as "Incomplete course requirement due to absent in End Semester Exam (ESE) or Supplementary Exam". This is for kind approval of house. (Annexure-XVIII)
11. In the Ordinance we adopted 7 Grade point systems as shown in R37- TABLE-2 (STUCTURE OF GRADING OF ACADEMIC PERFORMANCE (UG). Where 'DD' Grade (Grade Point-4) is applicable for Theory subjects only. Practical subjects are having minimum Grade 'CD' (Grade Point- 5).

    We propose to make 'CD' Grade as the lowest passing grade in Theory subject also. This is for kind information and approval. (As per the Ordinance, for award of degree of B. Tech, student must score minimum CGPA of 5). (Annexure-XVIII)

The issue is kept before the house and house accepted and permits to make the changes in the Book of "Ordinance & Regulation 2019".

Item No. 12	Any other matter with the permission of the Chair.

The officiating Principal listed the achievement of college with respect to patents, publications, awards etc. The house appreciates it.

The officiating principal summed up the deliberations followed by Vote of Thanks to the members from outside and the members present by the Dean academics, Dr. S. L. Haridas.

Chairman
Academic Council
JDCOEM, Nagpur.

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MINUTES OF MEETING FOR 06TH ACADEMIC COUNCIL MEETING NO./JDCOEM/06/2021-22

10/05/2022

Venue: Online through Google Meet
J. D. College of Engineering & Management, Nagpur

The 6th Meeting of Academic Council was held on 10th May 2022 at 2 pm on online through Google Meet. The following members were present for the meeting.

Sr. No.	Category	Name of the Member	Organization/Dept
01	Officiating Principal	Dr. S. V. Sonekar	JDCOEM
02	Chairman BOS	Dr. Bhushan Mahajan	ME, JDCOEM
03		Dr. Satish Vaishnav	EE, JDCOEM
04		Mrs. Gayatri Padole	ETC, JDCOEM
05		Mrs. Atika Ingole	CE, JDCOEM
06		Ms. Supriya Sawwashere	CSE, JDCOEM
07		Mr. Mirza Baig	IT, JDCOEM
08		Mr. Milind tote	AI, JDCOEM
09		Dr. Amit Gupta	FY, JDCOEM
10	Teacher of the College	Dr. S. L. Haridas	Dean Academics, JDCOEM
11		Dr. Namrata Pradnyakar	FY, JDCOEM
12		Dr. Vaishanvi Dhoke	EE, JDCOEM
13		Mr. Suhas Rewatkar	ME, JDCOEM
14		Dr. Ujwala Dange	IQAC coordinator
15		Mr. Sunil Gupta, COE	COE, JDCOEM
16	Industry Experts / Academician	Dr. Vimlesh Soni	MANIT, Bhopal
17		Dr. Prakash Awate	Ex. Professor, IIT Pawai
18		Mr. Gaurav Agrawal	IMEC, Belgium
19		Mrs. Palak Maheshwari	Arcades India Consulting Pvt. Ltd., Bangalore.
20	University Nominee	Dr. Shivajirao Jadhav	DBATU

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The following University Nominees, Industry Experts and invitees could not attend the meeting, their absence was granted by the Chairman, Academic Council.

1. Dr. S. N. Nalbalwar – University Representative
2. Dr. Y. S. Mahajan - University Representative
3. Mr. Makrand Takle – Industry Expert
4. Dr. S. R. Choudhari – Invitee
5. Dr. P. B. Maheshwary – Invitee
6. J. P. Modak - Invitee

The Dean Academics Dr. S. L. Haridas, sought the permission to initiate the proceedings after welcoming the experts and members of council. The following is the agenda wise transactions of the proceedings:

Item No. 1	To Confirm the Minutes of 5th meeting of Academic Council.

The Minutes of Fifth Academic Council Meeting with relevant annexure were presented to all the members of Academic Council. No query or suggestion were received, hence the Minutes were confirmed by the house unanimously (Annexure-I).

Item No. 2	To bring on table the action taken report of 5th Meeting of Academic Council held on 15/12/2021.

The Action Taken Report of the 5th Meeting of Academic Council was read out. The Chairman, Academic Council informed the Actions Taken on previous minutes (Annexure-II).

Item No. 3	To approve the syllabus of subjects of VII and VIII - Semesters of all UG programs except AI.

The scheme of all branches has already been approved in 1st meeting of the house. The syllabi of First, Second and Third year were also approved in the consecutive meetings. Now Board of Studies of each course has finalized the syllabus of 4th year (VII & VIII - Sem) and the house unanimously approved the syllabi of 4th year (VII & VIII - Sem) of all programs (Annexure-III: CE, CSE, IT, EE, ETC, ME).

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Item No. 4	To approve the syllabus of subjects of V and VI - Semesters of AI.

The scheme of AI has already been approved in 3rd meeting of the house. The syllabi of First and Second year were also approved in the consecutive meetings. Now Board of Studies of AI has finalized the syllabus of 3rd year (V & VI - Sem) and the house unanimously approved the syllabi of 3rd year (V & VI - Sem) of AI (Annexure-IV).

Item No. 5	To approve the syllabus of open elective subjects of all departments.

The curriculum under autonomy started from Academic Year 2019-20, so this is the Third year of autonomy. In sanctioned scheme we offered an open elective from V - Semester. So each BOS suggested and finalized the following subjects as an open elective for VII & VIII sem. The house unanimously approved the syllabi of open elective subjects for 3rd & 4th year (Annexure-V: CE, CSE, IT, AI, EE, ETC, ME).

Item No. 6	To approve the modified scheme & syllabus of M. Tech. Computer Science and Engineering.

Presently college has M. Tech. Computer Science and Engineering as per DBATU scheme. Corresponding Board of Studies of the course has modified scheme & finalized the syllabus. The house unanimously approved the scheme & syllabi of M. Tech. Computer Science and Engineering (Annexure-VI).

Item No. 7	To update the syllabus of Basics of Electrical & Electronics Engineering.

Looking into execution and requirement updating was done in the syllabus of **Basics of Electrical & Electronics Engineering** of first year. The house approves the modified syllabus of the said subjects (Annexure-VII).

Item No. 8	To update the scheme & syllabus of second year Civil Engineering.

Looking into requirement & recommendation of BOS of Civil Engineering updating was done in the syllabus of some subjects of second year Civil Engineering. The house approves the modified scheme and syllabus of second year Civil Engineering (Annexure-VIII).

Item No. 9	To approve the absorption & equivalence scheme for the students from University pattern to JDCOEM Autonomous pattern.

The autonomy started from 2019-20, so this is the Third year of autonomy. To absorb ex-students in our autonomous curriculum at final year level for which the equivalence scheme is required for each subject (branch). All respective BOS have prepared the absorption schemes. The house approves the all absorption schemes (Annexure-IX: CE, CSE, IT, EE, ETC, ME).

Item No. 10	To approve the absorbed students in various semester.

The attached students are absorbed under our autonomy from university pattern in the session 2020-21 & 2021-22. The house approves the list of absorbed students (Annexure-X).

Item No. 11	Amendment in Ordinance of JDCOEM under R7 (b).

In R7 (b) under VARIOUS COMPONENTS FOR CALCULATING THE MARKS OUT OF 100 ARE AS BELOW, modify the table as below (Annexure-XI).

SN	Components of marks	Marks
1	Online certificate course of min 3 credits offered by MOOCS / NPTEL / other platform approved by Academic council. (Passes/attended)	80/40
2	Research/innovation competitions organized by institute of repute / Govt. Of India / Professional bodies.(Winner / Participated)	100/60
3	Patent filed Jointly with JDCOEM/Filed independently	100/80
4	Research paper accepted for publication in indexed journal/UCG approved journals/ Conference(Marks will be distributed amongst authors)in intra	100/60
5	Inter collegiate competition / Intra University (Winner / Participation) Extracurricular activities.	100/30
6	State / National Level competitions (Winner/Participation) Extracurricular activities	100/60
7	Participation in NSS/NSS activities.	50
8	Recognized achievement outside the college / All office bearers of college Clubs / Department Association	90/80/40
9	Organization of Co-curricular & extra –Curricular activity	40
10	Completion of Swachchha Bharat Abhiyan Internship	100
11	Working on Govt./Private Live project for final year.	80/60
12	Placement	80
13	Passing of Competitive Exam like GATE, CAT etc	80

The issue is kept before the house and house accepted and permits to make the changes in the Book of "Ordinance & Regulation 2019".

Item No. 12	Any other matter with the permission of the Chair.

The officiating Principal listed the achievement of college with respect to patents, Ph. D. etc. The house appreciates it. Also the following suggestions are received from experts.

1. Mr. Jadhav pointed out in the scheme; there should be course code instead of subject code. He also suggested including aim, objectives and prerequisite in the syllabus.
2. Mr. Gaurav Agrawal pointed out the growth in Semiconductor industries and suggested to prepare competent students for it.

The officiating principal summed up the deliberations followed by Vote of Thanks to the members from outside and the members present by the Dean academics, Dr. S. L. Haridas.

11/05/2022

Chairman
Academic Council
JDCOEM, Nagpur.

11/02/2021

Venue: Webex Cloud Meet

The **04th** meeting of the **Board of Studies** will be held on **Thursday 11thFeb, 2021 at 2.30 p.m.** at **Room TS-211, Department of Mechanical Engineering, JDCOEM, Nagpur**. The following members were present:

1.	Dr. B. R. Mahajan, HoD, Mechanical Department	Chairman
2.	Mr. Suhas A. Rewatkar, Assistant Professor, DOME	Member
3.	Mr. Praful P. Ulhe, Assistant Professor, DOME	Member
4.	Mr. Anup A. Junankar, Assistant Professor, DOME	Member
5.	Mr. Pravin M. Gupta, Assistant Professor, DOME	Member
6.	Mr. Amir R. Sayed, Assistant Professor, DOME	Member
7.	Mr. Jitendra S. Panchbhai, Assistant Professor, DOME	Member
8.	Mr. Gaurav M. Gohane, Assistant Professor, DOME	Member
9.	Mr. Dharmesh Agrawal, Assistant Professor, DOME	Member
10.	Mr. Sidharth Ghosh, Assistant Professor, DOME	Member
11.	Mr. Hemant Baitule, Assistant Professor, DOME	Member
12.	Mr. Rohit Sharma, Assistant Professor, DOME	Member
13.	Mr. Rahul Deshmukh, Assistant Professor, DOME	Faculty
14.	Mr. Shamal Chakravarty, Assistant Professor, DOME	Faculty
15.	Mrs. Leena Bhoyar, Assistant Professor, DOME	Faculty
16.	Mr. Nikhil Bhende, Assistant Professor, DOME	Secretary

The following persons were invited to attend the meeting:

1.	Dr. A. M. Kuthe, Subject Expert, VNIT, Nagpur	Invitee
2.	Dr. A. B. Deoghare, Subject Expert, NIT, Silchar	Invitee
3.	Mr. Vinood Saboo, Industry Expert, Saboo Plstics Pvt. Ltd	Invitee
4.	Dr. P. B. Maheshwary, Professor, JDCOEM, Nagpur	Invitee
5.	Dr. J. P. Modak, Technical Advisor, JDCOEM, Nagpur	Invitee

Item No. 1	Conformation of previous BOS Minutes.

The Secretary welcomed the Chairman of Board of Studies, Subject Experts Dr. A. M. Kuthe, Professor, VNIT, Nagpur and Dr. A. B. Deoghare, NIT, Silchar, Industry Expert Mr. Vinood Saboo, Dr. J. P. Modak, Technical Advisor, JDCOEM, Nagpur, all members of BoS and faculties of department. The Secretary presented agenda of the meeting through power point presentation. Further, the Action taken report from the previous meeting were presented and discussed one by one point in the presence of the members. Following are the points:

1. Detailed finalization of scheme and syllabus of 3rd and 4th Semester subject wise done.
2. Emphasis given on inclusion on newer technology based subjects in the syllabus.
3. Due to COVID-19 situation implementation of "Digital Learning" i.e. ICT Tools done that includes use of Google meet, Zoom, Webex portal for conducting live online classes, use of Virtual lab for practical's, use of Google classroom for assignment and activity submission, use of Google forms for conducting exams, etc.

   After action taken report presentation Secretary requested the Chairmen to convene the meeting.

Item No. 2	Action taken report of previous BOS Meeting.

The detailed action taken report presented by the Secretary based on 3rd BoS meeting. Further Secretary requested the Chairmen to convene the meeting.

Item No. 3	Conformation of new members at DOME Board of Studies.

Chairmen of the BoS welcomed Dr. A. B. Deoghare from NIT, Silchar as Subject Expert. No new member added to in the BoS of Department of Mechanical Engineering, JDCOEM, Nagpur.

Item No. 4	Absorption & Equivalence Scheme for 5th Semester students of Mechanical Engineering & Implementation.

Chairmen presented absorption and equivalence scheme to the board for the 3rd year (5th sem) students of mechanical engineering and how it will be implemented for the next session of autonomous batch.

Item No. 5	Review of 2nd Year Syllabus.

A detailed review of 2nd year syllabus (3rd and 4th sem) done. Dr. J. P. Modak suggested to visit manless industries as well as to show videos in practical session. Dr. A. M. Kuthe suggested that faculties are doing research work and hence asked to involve students for the same. Inclusion of Mechanical Linkages and Mechanism Synthesis can be done in TOM-I subject.. At 4th sem syllabus the Manufacturing Lab to be replaced by Machine Lab.

Item No. 6	Discuss the Modalities of online courses to be opted by the students in 3 & 4 Semester.

Chairmen discussed about modalities of online courses to be adopted by the students in 3rd and 4th sem students. Dr. J.P. Modak suggested to for NPTEL dedicated faculty can be alloted

Item No. 7	Discuss B.Tech. (honors) Major & Minor domain specialization.

Kuthe sir put up the point that faculty and students must give too much priority to NPTEL as student may find difficult to digest the high level learning. He also suggested that major/minor domain benefits must be evaluated properly.

Item No. 8	Finalize the scheme of upcoming 5th semester.

- Dr. J. P. Modok suggested to visit manless industry for practical exposure.
- Dr. Kuthe suggested to include videos in practical session.
- Dr. Kuthe suggested to make involve students in their research work so that they get actual knowledge of research work.
- Dr. J. P. Modok suggested to make any 2 subject completely in NPTEL learning form and dedicated teacher to be allotted.
- Manufacturing Engineering Lab name to be replaced with Machine Lab.
- Dr. Deogahre asked faculties to be aware of elementary tools in physical form.
- Emphasis on Entrepreneurship/Startup development to be given.

Item No.9	Any other matter with the permission of the Chair.

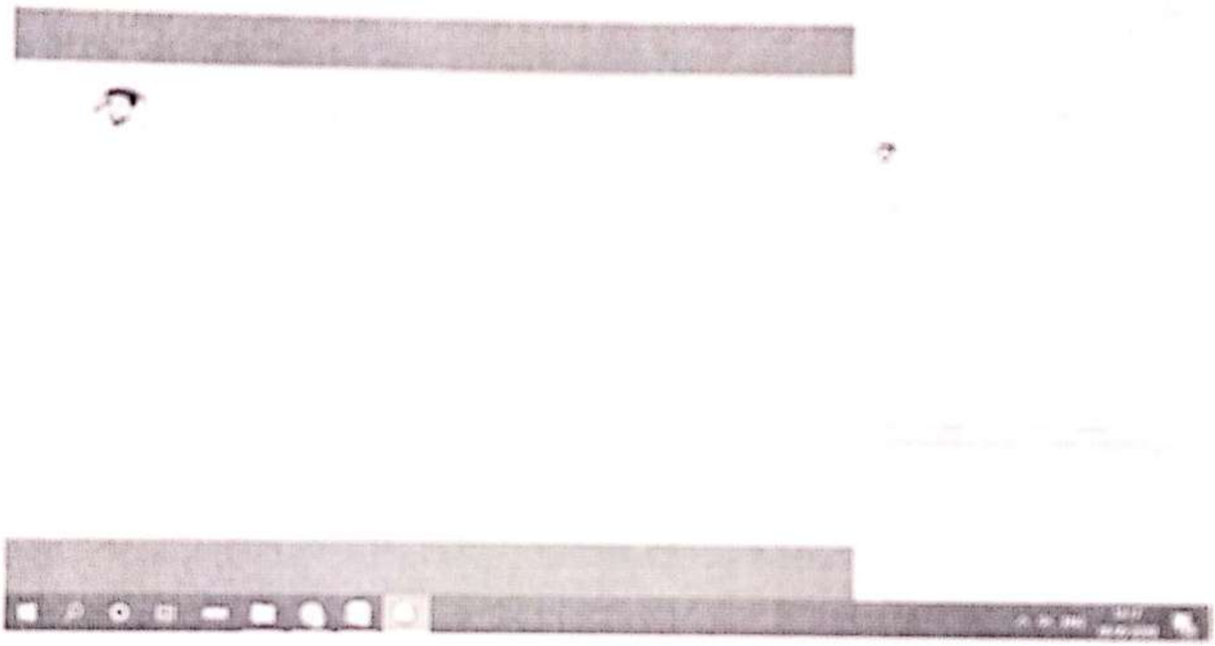
No other issue was raised by any members the meeting was concluded with vote of thanks.

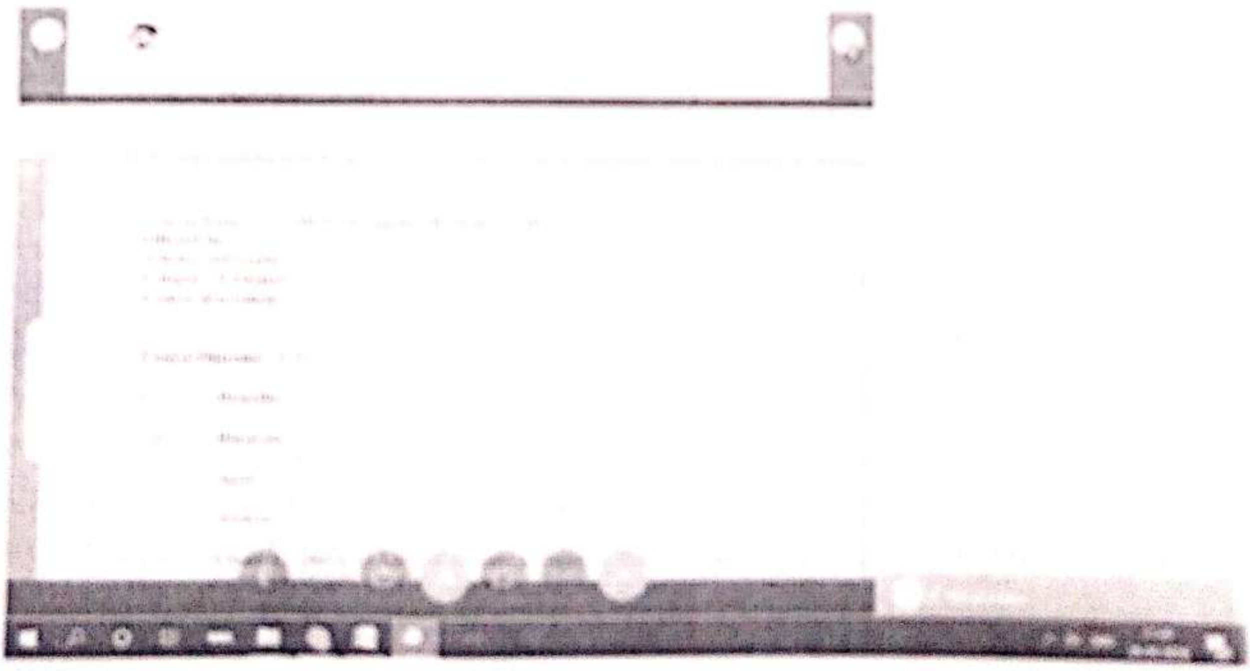
No.	Name of the BoS Members	Designation	Sign
1.	Mr. Nikhil Bhende, Assistant Professor, DOME	Secretary	
2.	Mrs. Leena Bhoyar, Assistant Professor, DOME	Faculty	
3.	Mr. Shamal Chakravarty, Assistant Professor, DOME	Faculty	
4.	Mr. Rahul Deshmukh, Assistant Professor, DOME	Faculty	
5.	Mr. Rohit Sharma, Assistant Professor, DOME	Member	
6.	Mr. Hemant Baitule, Assistant Professor, DOME	Member	
7.	Mr. Sidharth Ghosh, Assistant Professor, DOME	Member	
8.	Mr. Dharmesh Agrawal, Assistant Professor, DOME	Member	
9.	Mr. Gaurav M. Gohane, Assistant Professor, DOME	Member	
10.	Mr. Jitendra S. Panchbhai, Assistant Professor, DOME	Member	
11.	Mr. Amir R. Sayed, Assistant Professor, DOME	Member	
12.	Mr. Pravin M. Gupta, Assistant Professor, DOME	Member	
13.	Mr. Anup A. Junankar, Assistant Professor, DOME	Member	
14.	Mr. Praful P. Ulhe, Assistant Professor, DOME	Member	
15.	Mr. Suhas A. Rewatkar, Assistant Professor, DOME	Member	
4.	Dr. J. P. Modak, Technical Advisor, JDCOEM, Nagpur	Invitee	
5.	Dr. A. M. Kuthe, Subject Expert, VNIT, Nagpur	Subject Expert	
6.	Mr. Vinood,Saboo, Industry Expert, Saboo Plastics, Nagpur	Industry Expert	
7.	Dr. B. R. Mahajan, HoD, Mechanical Department	Chairman	

Following members could not attend the meeting as leave of absence was granted to them.

Sr. No.	Name of the BoS Members	Designation
1.	Mr. N. H. Patil, Associate Professor, JDCOEM	Member
2.	Dr. P. B. Maheshwary, Professor, JDCOEM	Member

CC:
Hon' Directors, JES
Respected Principal, JDCOEM
Respected Vice- Principal & Dean Admin
Dean (Academics /Student/Capacity Building/Development, A&P)
All concerned faculty members.
Pictures from Meeting:





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At: Khandala, Post- Valni, Kalmeshwar Road, Near Fetri, Nagpur

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AGENDA FOR [illegible] **03/02/2021**

Venue: Room TS-211, Department of Mechanical Engineering, JDCOEM, Nagpur

The **04th** meeting of the **Board of Studies** will be held on **Thursday 11thFeb, 2021 at 2.30 p.m.** at **Room TS-211, Department of Mechanical Engineering, JDCOEM, Nagpur.** All the members of the Board of Studies are requested to attend the meeting. The agenda for the meeting will be as below.

Item No. 1	Conformation of previous BOS Minutes.

To review work done based on previous meeting agenda.

Item No. 2	Action taken report of previous BOS Meeting.

To prepare and present action taken over previous meeting.

Item No. 3	Conformation of new members at DOME Board of Studies.

To welcome new member in the Board of Studies of Mechanical Department.

Item No. 4	Absorption & Equivalence Scheme for 5th Semester students of Mechanical Engineering & Implementation.

To approve, discuss and finalize absorption and equivalence scheme for 5th semester students from University pattern to JDCOEM Autonomous pattern.

Item No. 5	Review of 2nd Year Syllabus.

To discuss and modify 2nd year syllabus if any.

Item No. 6	Discuss the Modalities of online courses to be opted by the students in 3 & 4 Semester.

To review status online course for 3rd sem and planning for 4th sem.

Item No. 7	Discuss B.Tech. (honors) Major & Minor domain specialization.

To discuss and finalize B.Tech. (honors) Major & Minor domain specialization.

Item No. 8	Finalize the scheme of upcoming 5th semester.

To finalize the scheme for 5th sem B.Tech. (Autonomous) mechanical engineering for 2021-2022.

Item No. 9	Decide about the Teaching and evaluation of the courses for the Diploma lateral entry students for Session 2020-2021.

To decide and finalize teaching and evaluation of the courses for diploma students admitted in the session 2020-2021.

Item No. 10	Finalize scheme and syllabus for 4th sem.

To finalize scheme and syllabus for B.Tech. 4th sem (Autonomous) mechanical engineering.

Item No. 11	Question paper setting and moderation for various subjects.

To discuss question paper setting and moderation for various subjects.

Item No. 12	Any other points with the permission of the Chair.

Mr. Nikhil V. Bhende
Secretary, Board of Studies,
Asst. Prof., Deptt. of Mech. Engg.
JDCOEM, Nagpur.

CC:
Hon' Directors, JES
Respected Principal, JDCOEM
Respected Vice- Principal & Dean Admin
Dean (Academics /Student/Capacity Building/Development, A&P)
All concerned faculty members.

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KATOL ROAD, NAGPUR
DEPARTMENT OF MECHANICAL ENGINEERING

List of courses with syllabus revision

Sr No.	Name of Course	Course code	Semester	% Revision	Revised topics
1	TOM-1	MET305	3rd	20%	Mechanical Linkages & Mechanism Synthesis
2					
3					
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Note: All documents should be duly signed and sealed

Curriculum for Semester- III [Second Year]

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				
				L	T	P	CA	MSE	ESE	Total	Credit
1	BSC	ME3T001	Applied Math's-III	3	1	0	20	20	60	100	4
2	ESC	ME3T002	Rigid Body Mechanics	3	0	0	20	20	60	100	3
3	PCC	ME3T003	Material Science	3	0	0	20	20	60	100	3
4	PCC	ME3T004	Engineering Thermodynamics	3	0	0	20	20	60	100	3
5	PCC	ME3T005	Theory Of Machines-I	3	0	0	20	20	60	100	3
6	PCC	ME3T006	Manufacturing Engineering-I	3	0	0	20	20	60	100	3
7	PCC	ME3L003	Material Science Lab	0	0	2	60	0	40	100	1
8	PCC	ME3L006	Manufacturing Engineering-I Lab	0	0	2	60	0	40	100	1
9	ESC	ME3L007	Machine Drawing and Computer Graphics	1	0	2	60	0	40	100	2
10	HSMC	ME3T008	Universal Human Value	3	0	0	20	20	60	100	3
				22	**2**	**6**	**320**	**140**	**540**	**1000**	**26**

ME3T005	Theory of Machine -I	3 Credit

Course Objectives:

1. The study of theory of machine is concerned with understanding of relationships between the geometry and the motions of the parts of a machine.

2. The overall objective of this course is to learn how to define, explain, compute, analyse the motions of mechanisms, design mechanisms to give desired motions.

3. This course includes relative motion analysis, design of gears, gear trains, cams and linkages, graphical and analytical analysis of position, velocity and acceleration, friction clutches, brakes & dynamometers.

Course Outcomes: At the end of the course, students will be able to

1. Define various types of mechanisms, velocity and acceleration images, cam and follower, Laws of friction, clutches and brakes, gear terminology and gear trains.
2. Explain the concepts of simple mechanism, velocity and acceleration images, types of cam and follower, theory of friction, clutches, brakes & dynamo meters, gear kinematics with gear train.
3. Compute the degree of freedom,velocity and acceleration in simple mechanisms and cam and follower, power lost due to friction for clutches, braking torque, efficiency of various gears and gear trains.
4. Analyze various mechanisms, cams and follower, clutches and brakes,gears and gear trains.

5. Design the various mechanisms,cam and follower, clutches and breaks,gears and gear trains for specific application.

Course Contents:

Unit -I Basic Concept of Mechanism: [07 Hours]

Basic concept of mechanisms, links, kinematic pairs, kinematic chain, mechanisms, machine, Types of mechanisms, Degree of freedom of link and planer mechanism, Classification of four-bar chain (Class I and Class II) Inversion of four bar chain, Slider crank chain and double slider crank chain. Study of various mechanisms such as approximate straight line mechanisms, pantograph, Geneva mechanism, steering gear mechanisms and Hooke's joint.

Unit -II Kinematic Analysis of Mechanisms: **[07Hours]**

Velocity, acceleration analysis of planer mechanism by graphical method using relative velocity/ acceleration. Concept of velocity and acceleration image, Coriollis component of acceleration, Instantaneous centre of rotation, body and space centrodes, body centrodes and their applications, Kennedy’s theorem and its applications. Velocity and acceleration of slider crank mechanism by analytical method and Klein’s construction. Mechanical Linkages & Mechanism Synthesis.

Unit-III Cam Mechanisms: **[07Hours]**

Types of cams, follower and applications. Synthesis of cam for different types of follower motion like constant velocity, parabolic SHM, cycloidal etc. With velocity and acceleration.

Unit –IV Friction: **[07 Hours]**

Laws of friction, Friction of inclined plane, Friction in journal bearing-friction circle, Pivots and collar friction-uniform pressure and uniform wear. Clutches, Brakes & Dynamo meters: Single, multiple and cone clutch, Shoe brake, Band brake, Band and Block brake, Absorption and transmission type dynamo meters.

Unit V:-Toothed Gear **[07 Hours]**

Classification of gears, Terminology of spur gears, Conjugate action, Involute and cycloidal profiles, Path of contact, Contact ratio, Interference, Undercutting, Effect of centre distance variations, Friction between gear teeth, Internal gears. Helical gear terminology, Normal and transverse module, Virtual number of teeth, Torque transmitted by helical gears, Tooth forces and geometric relationship, Torque capacities.

Unit VI: - Gear Train **[07 Hours]**

Velocity ratios, Types of gear trains like Simple, Compound, Reverted and Epicyclic gear train.

Text Book:-

1. S. S. Rattan, “Theory of Machines”, Tata McGraw Hill Publications, New Delhi.
2. Thomas Beven, “Theory of machines”, CBS Publishers, Delhi, 1984.
3. A. Ghosh, A. K. Malik, “Theory of Mechanisms and Machines”, Affiliated East-West Press Pvt. Ltd., New Delhi.

Reference Book:

1. J. E. Shigely, J. J. Uicker, “Theory of Machines and Mechanisms”, Tata McGraw Hill Publications, New York, International Student Edition, 1995.
2. Rao J.S., Dukki Patti R.V “Mechanisms & Machines Theory,”, New age Int, 2nd
3. Sandor G.N., Erdman A.G “Theory of Machines”, Prentice Hall Publications, 1984.

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An Autonomous College, Affiliated to DBATU, Lonere
At: Khandala, Post- Valni, Kalmeshwar Road, Near Fetri, Nagpur
DEPARTMENT OF MECHANICAL ENGINEERING
Session: 2021-22

Notice No.:BOS/ME/05/2021

Date: 08/07/2021

Notice

This is informing to all BoS Members that the 05thmeeting of the **Board of Studies** will be held on**12thJuly, 2021**at**02.30 P.M.**via Google Meet cloud meeting. The agenda for the meeting is attached herewith.

All the members of the Board of Studies are requested to attend the meeting using the link below:

5thBoS Meeting of Mechanical Department.

Friday, July 12 · 2:30 – 4:30pm
Google Meet joining info
Video call link: https://meet.google.com/pca-jbfr-vxh
Join by video system
Dial 917955282@meetingsapac24.webex.com
You can also dial 210.4.202.4 and enter your meeting number.

Mr. Nikhil V. Bhende
Secretary, Board of Studies,
Asst. Prof., Deptt. of Mech. Engg.
JDCOEM, Nagpur.

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AGENDA FOR 05TH BOARD OF STUDIES MEETING NO. BOS/DOME/05/2021 | **09/07/2021**

Venue: Room TS-211, Department of Mechanical Engineering, JDCOEM, Nagpur

The **05th**meeting of the **Board of Studies** will be held on**12th July, 2021**at**2.30 p.m.**at**Room TS-211, Department of Mechanical Engineering, JDCOEM, Nagpur**. All the members of the Board of Studies are requested to attend the meeting. The agenda for the meeting will be as below.

Item No. 1	**Conformation of previous BOS Minutes.**

To review work done based on previous meeting agenda.

Item No. 2	**Action taken report of previous BOS Meeting.**

To prepare and present action taken over previous meeting.

Item No. 4	**Status of online course for 4th sem and planning for 3rd, 5th & 7th sem**

To review status online course for 4th sem and planning for 3rd, 5th & 7th sem

Item No. 6	**To finalize the syllabus of 5th & 6th Semester.**

To approve, discuss and finalizethe syllabus of 5th & 6th Semester.

Item No. 7	**To finalize the syllabus for open elective subjects.**

To approve, discuss and finalizethe syllabus for open elective subjects.

Item No. 8	**Finalization of Co-guide for PhD Course**

To finalize the provision for Co-guide for PhD mechanical engineering course of 2021-2022.

Item No. 11	**Question paper setting and moderation for various subjects.**

To discuss question paper setting and moderation for various subjects.

Item No. 12	**Any other points with the permission of the Chair.**

Mr. Nikhil V. Bhende
Secretary, Board of Studies,
Asst. Prof., Deptt. of Mech. Engg.
JDCOEM, Nagpur.

CC:
Hon' Directors, JES
Respected Principal, JDCOEM
Respected Vice- Principal& Dean Admin
Dean (Academics /Student/Capacity Building/Development, A&P)
All concerned faculty members.

Sr. No.	Name of the BoS Members	Designation	Sign
1.	Mr. Nikhil Bhende, Assistant Professor, DOME	Secretary	
2.	Mr. Rohit Sharma, Assistant Professor, DOME	Member	
3.	Mr. Hemant Baitule, Assistant Professor, DOME	Member	
4.	Mr. Sidharth Ghosh, Assistant Professor, DOME	Member	
5.	Mr. Dharmesh Agrawal, Assistant Professor, DOME	Member	
6.	Mr. Gaurav M. Gohane, Assistant Professor, DOME	Member	
7.	Mr. Jitendra S. Panchbhai, Assistant Professor, DOME	Member	
8.	Mr. Amir R. Sayed, Assistant Professor, DOME	Member	
9.	Mr. Pravin M. Gupta, Assistant Professor, DOME	Member	
10.	Mr. Anup A. Junankar, Assistant Professor, DOME	Member	
11.	Mr. Praful P. Ulhe, Assistant Professor, DOME	Member	
12.	Mr. Suhas A. Rewatkar, Assistant Professor, DOME	Member	
13.	Dr. B. R. Mahajan, HoD, Mechanical Department	Chairman	

MINUTES OF MEETING FOR 05th BOARD OF STUDIES MEETING NO. BOS/ME/ 05/2021-22 12/07/2021

Venue: TS-207, DOME, JDCOEM and Online Google Meet

The 5th Meeting of the Board of Studies was held on **12th July, 2021** at **2.30 p.m.** at **Room TS-211, Department of Mechanical Engineering, JDCOEM, Nagpur** and via Google Meet for Experts.

1.	Dr. B. R. Mahajan, HoD, Mechanical Department	Chairman
2.	Mr. Suhas A. Rewatkar, Assistant Professor, DOME	Member
3.	Mr. Praful P. Ulhe, Assistant Professor, DOME	Member
4.	Mr. Anup A. Junankar, Assistant Professor, DOME	Member
5.	Mr. Pravin M. Gupta, Assistant Professor, DOME	Member
6.	Mr. Amir R. Sayed, Assistant Professor, DOME	Member
7.	Mr. Jitendra S. Panchbhai, Assistant Professor, DOME	Member
8.	Mr. Gaurav M. Gohane, Assistant Professor, DOME	Member
9.	Mr. Dharmesh Agrawal, Assistant Professor, DOME	Member
10.	Mr. Sidharth Ghosh, Assistant Professor, DOME	Member
11.	Mr. Hemant Baitule, Assistant Professor, DOME	Member
12.	Mr. Rohit Sharma, Assistant Professor, DOME	Member
13.	Mr. Sidharth Ghosh, Assistant Professor, DOME	Faculty
14.	Mr. Shamal Chakravarty, Assistant Professor, DOME	Faculty
15.	Mr. Dinesh Yelure, Assistant Professor, DOME	Faculty
16.	Mr. Nozendra Meshram, Assistant Professor, DOME	Faculty
17.	Mr. Nikhil Bhende, Assistant Professor, DOME	Secretary

The following persons were invited to attend the meeting:

1.	Dr. A. M. Kuthe, Subject Expert, VNIT, Nagpur	Invitee
2.	Mr. Vinood Saboo, Industry Expert, Saboo Plstics Pvt. Ltd	Invitee
3.	Dr. A. B. Deoghare, Subject Expert, Assistant Professor, NIT, Silchar	Invitee
4.	Dr. J. P. Modak, Technical Advisor, JDCOEM, Nagpur	Invitee

Item No. 1	**Review of the Previous Meeting.**

The Secretary welcomed the Chairman of Board of Studies, Subject Expert Dr. A. M. Kuthe, Professor, VNIT, Nagpur, Industry Expert Mr. Vinood Saboo, Dr. A. B. Deogharc, Subject Expert, NIT, Silchar, Dr. J. P. Modak, Technical Advisor, JDCOEM, Nagpur, and all members of BoS and faculties of department. The Secretary presented agenda of the meeting through power point presentation. Further, the Action taken report from the previous meeting were presented and discussed one by one point in the presence of the members. Following are the points:

Sr. No.	4th BoS Meetings	Action Taken Report
1.	Dr. J. P. Modok suggested to visit manless industry for practical exposure.	Due to pandemic scenario members prepared various manless industry case studies and presented in department under III Cell.
2.	Dr. Kuthe suggested to include videos in practical session	Videos on working machines related to practicals were prepared for students.
3.	Dr. Kuthe suggested to make involve students in their research work so that they get actual knowledge of research work.	Faculties like NVB, ARS, SAR, AAJ started taking project based on their research work.
4.	Dr. J. P. Modok suggested to make any 2 subject completely in NPTEL learning form and dedicated teacher to be allotted.	8th semester students now can enrol for NPTEL subjects (2 subjects each) and included in scheme. Mentors also assigned for same.
5.	Manufacturing Engineering Lab name to be replaced with Machine Lab.	Replaced.
6.	Industrial visit should be increases.	It is decided after COVID protocols gets over Industrial Visits will be planned.
7.	Dr. Deogahre asked faculties to be aware of elementary tools in physical form.	Advance version of instruments like digital caliper, vernier exposure given to students.
8.	Emphasis on Entrepreneurship/Startup development to be given.	Department will be actively involved in startup activities. Under Entrepreneurship Cell activities like guest lectures conducted. Alumni interaction also done.

Item No. 2	Status of online course for 4th sem and planning for 3rd, 5th & 7th sem

Chairman of BoS begin the main agenda of the meeting i.e. Syllabus Finalization for 3rd, 5th & 7th Semester by explaining Scheme first. Later he requested the entire concerned subject teachers to present their syllabus scheme, course outcomes, detailed syllabus, books and laboratory details. Following are the key highlight of the meetings:

1. In **Heat Transfer** subject Saboo Sir asked to reduce topics in the syllabus as it will be too heavy for students. He also asked to add Holman book in the list of the text book.
2. In **Theory of Machine - II** Subject Saboo Sir asked to reduce syllabus to some extent like vibration which are already covered in elective subjects and book by Norton to be included in the list of text books. Dr. J. P. Modak sir also suggested to eliminate gyroscope and governor topic.

3. In **Renewable Energy Source** Subject, Dr. J. P. Modak sir suggested to introduce strain energy noise conversation.
4. In Analysis and Synthesis subject, experts appreciated for the contents in the syllabus and suggested to integrate with robotics.
5. In Advance Manufacturing Technology Subject, Dr. Deoghare Sir suggested to include real time based applications in syllabus.
6. In Finite Element Method subject Saboo sir suggested to make expose of topics like ANSYS, APDL Language, Coding, and Interfacing, MATLAB tool and demonstration.

Item No.3	Question paper setting and moderation for various subjects.

Three sets of question sets for each subject prepared with blooms level and CO mapped question-wise.

Item No.4	Any other points with the permission of the Chair.

Saboo sir suggested to include 2 wheeler and 4 wheeler vehicle in lab for practical demonstration, video of railway engine locomotives can also be included.

Sr. No.	Name of the BoS Members	Designation	Sign
1.	Mr. Nikhil Bhende, Assistant Professor, DOME	Secretary	
2.	Mr. Nozendra Meshram, Assistant Professor, DOME	Faculty	
3.	Mr. Shamal Chakravarty, Assistant Professor, DOME	Faculty	
4.	Mr. Dinesh Yelure, Assistant Professor, DOME	Faculty	
5.	Mr. Rohit Sharma, Assistant Professor, DOME	Member	
6.	Mr. Hemant Baitule, Assistant Professor, DOME	Member	
7.	Mr. Sidharth Ghosh, Assistant Professor, DOME	Member	
8.	Mr. Dharmesh Agrawal, Assistant Professor, DOME	Member	
9.	Mr. Gaurav M. Gohane, Assistant Professor, DOME	Member	
10.	Mr. Jitendra S. Panchbhai, Assistant Professor, DOME	Member	
11.	Mr. Amir R. Sayed, Assistant Professor, DOME	Member	
12.	Mr. Pravin M. Gupta, Assistant Professor, DOME	Member	
13.	Mr. Anup A. Junankar, Assistant Professor, DOME	Member	
14.	Mr. Praful P. Ulhe, Assistant Professor, DOME	Member	
15.	Mr. Suhas A. Rewatkar, Assistant Professor, DOME	Member	
16.	Mr. Pravin Borkar, , DOME	4th Year Student	
17.	Ms. Sakshi Ingole, DOME	4th Year Student	
18.	Mr. Pravin Jadhav, F6 Solutions, Nagpur	Industry Expert	
19.	Mr. Imran Khan, IGTR, Nagpur	Industry Expert	
20.	Dr. Sachin Bagde, Assistant Professor, YCCE, Nagpur	Industry Expert	
21.	Dr. J. P. Modak, Technical Advisor, JDCOEM, Nagpur	Invitee	
22.	Dr. A. B. Deoghare, Subject Expert, NIT,Silchar	Subject Expert	
23.	Mr. Vinood,Saboo, Industry Expert, Saboo Plastics, Nagpur	Industry Expert	

	Dr. B. R. Mahajan, HoD, Mechanical Department	Chairman	

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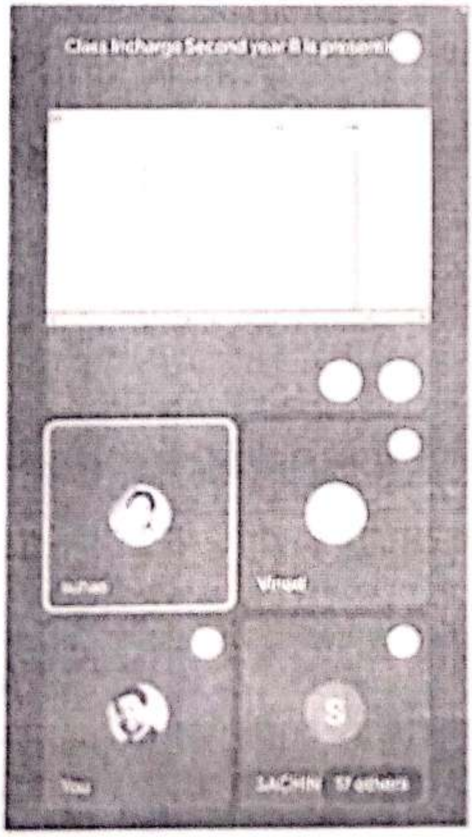
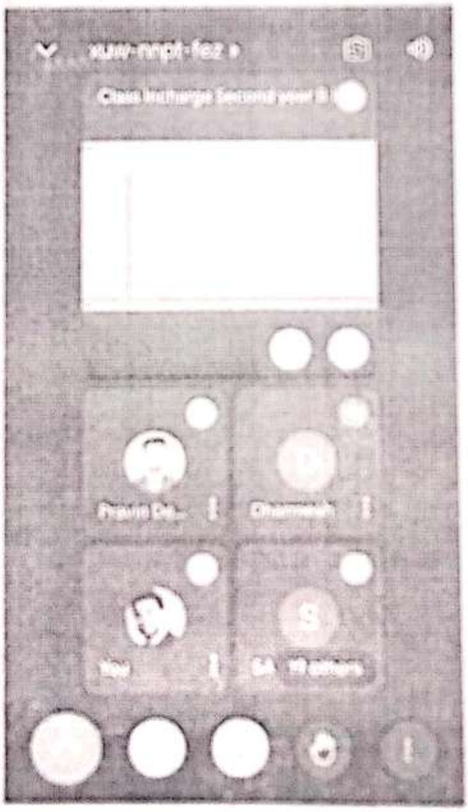


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DEPARTMENT OF MECHANICAL ENGINEERING

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List of courses with syllabus revision

Sr No.	Name of Course	Course code	Semester	% Revision	Revised topics
1	Heat Transfer	ME5T001	5th	10%	Internal Heat Generation, Error in Temperature Measurement topics removed
2	Theory Of Machines-II	ME5T002	5th	20%	Viberation and it's Subtopic removed
3	Renewable Energy Sources	ME5TE01A	5th	10%	Strain Energy Noise Conversion topic added
4	Analysis and Synthesis of Mechanisms	ME5TE01B	5th	10%	Robotics topic included
5	Advanced Manufacturing Technology	ME5TE01C	5th	15%	Included topic real time based applications
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Note: All documents should be duly signed and sealed

5th Semester Mechanical Engineering

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				
				L	T	P	CA	MSE	ESE	Total	Credit
1	PCC	ME5T001	Heat Transfer	3	0	0	20	20	60	100	3
2	PCC	ME5T002	Theory Of Machines-II	3	0	0	20	20	60	100	3
3	PCC	ME5T003	Measurement and Quality Control	3	0	0	20	20	60	100	3
4	PEC	ME5TE01	Elective-I	3	0	0	20	20	60	100	3
5	OEC	ME5O001	Open elective I	4	0	0	20	20	60	100	4
6	PCC	ME5L001	Heat Transfer Lab	0	0	2	60	0	40	100	1
7	PCC	ME5L002	Theory Of Machines-II Lab	0	0	2	60	0	40	100	1
8	PCC	ME5L003	Measurement and Quality Control Lab	0	0	2	60	0	40	100	1
9	PROJECT	ME5P004	Mini Project	0	0	0	0	0	50	50	1
10	MC	ME5T005	Consumer Affair	2	0	0	10	15	25	50	Audit
11	PCC	ME5L004	Basics of python & SQL			2	60		40	100	1
							350	**115**	**535**	**1000**	**21**

Course Code	PEC-I	Course Code	Open Elective-I
ME5TE01A	Renewable Energy Sources	ME5O001A	Automobile Vehicle Maintenance
ME5TE01B	Analysis and Synthesis of Mechanisms	ME5O001B	Product Development
ME5TE01C	Advanced Manufacturing Technology		

ME5T001	Heat Transfer	3 Credit

COURSE OBJECTIVES

1. To understand the importance of heat transfer in mechanical engineering
2. To understand heat effect on various processes in mechanical engineering

COURSE OUTCOMES

At the end of the course students will be able to

1. State Fourier law, Newton's law of cooling, Stefan Boltzmann law & define Critical thickness, Boiling, Condensation, Extended Surface, Heat Exchanger, Radiation Shield, Shape Factor etc.
2. Classify, Critical thickness, Electrical Analogy, Natural & force convection, Lump theory, Boundary layer concept, Continuity Equation, Momentum Equation, Energy Equation black body concept, LMTD, NTU.
3. Apply concept of heat transfer in day today works and classify steady & unsteady process, 1D, 2D & 3D heat transfer processes, combined heat transfer processes.
4. Analyse problems associate with heat transfer through Wall, Cylinder, Sphere in various applications like Manufacturing Industries, Automobiles, Boilers, Hospitals, Space machineries, Refrigeration and Air Conditioning Units etc. and Investigate its effect on system which is associated with heat transfer process like human body etc.
5. Combine Knowledge of conduction, convection, radiation, heat exchanger, mass transfer, to design and prepare activity to form a solution of a problem.
6. Evaluate performance of an activity designed base on heat transfer knowledge, express own opinion based on expressed concept, idea, activity, test, result and recommend improvements.

Unit 1: Basic modes of Heat Transfer & their mechanisms **[06 Hours]**

Introduction, Conduction: Fourier law of heat conduction, Thermal conductivity & thermal diffusivity, General conduction equation, One Dimensional, steady-state, without heat generation heat transfer, Concept of thermal resistance and electrical analogy, Conduction through composite slab/cylinders/spheres. Contact resistance/ Fouling Factor, Overall heat transfer coefficient, Critical thickness of Insulation

Unit 2: Internal heat generation & Extended surface **[07 Hours]**

Analysis of extended surfaces: Types of Fins, Rectangular profile longitudinal fins/ spines, Fin efficiency and effectiveness, Lumped heat capacitance method of unsteady analysis. Heisler charts.

Unit 3: Forced Convection **[06 Hours]**

physical significance of non-dimensional parameters, Flow over flat plate, Hydrodynamic & thermal boundary layer, Local and average heat transfer coefficient, Empirical relations for external flows, Flow through ducts.

Unit 4: Free or Natural Convection **[08 Hours]**

horizontal and vertical plate, empirical co-relations for Cylinders and sphere, Heat transfer with phase change, Condensation: Film-wise and Drop-wise condensation, Nusselt theory for film-wise condensation on vertical plates & horizontal tubes, Bank of Tubes, Pool Boiling Curve. Introduction to heat pipe.

Unit 5: Radiation **[08 Hours]**

nature of thermal radiation, Black body radiation, Laws of Radiation-laws of radiation-Kirchoffs, Planks, Weins displacement, Stefen-Boltzmann and Lamberts Cosine law. Black body, Grey body & Coloured body, Shape factor & its properties, Radiation exchange between two gray surfaces. radiation between parallel plates, Cylinder and sphere, radiation shields.

Unit 6: Heat Exchanger **[08 Hours]**

Classification of heat exchangers, LMTD Approach for parallel, Counter flow & cross flow heat exchangers, NTU-Effectiveness approach for parallel/ Counter flow heat exchangers, Design aspects of heat exchangers. introduction to compact heat exchanger. Introduction to TEMA standard & Mass Transfer

Text Books

1) R. K. Rajput, “Heat & Mass Transfer”, S. Chand Publication.

2) P. K. Nag, “Heat & Mass Transfer”, Tata McGraw Hill Publications.

3) “Fundamentals of Heat & Mass Transfer” by C. P. Kothandaraman, New Age Publication.

4) “Heat Transfer”, by J. P. Holman, Tata McGraw Hill Publications.

Reference Books

1)Y. A. Cengel, “Heat Transfer”, Tata McGraw Hill Publications.

2) David P. Dewitt,“ Fundamentals of Heat and Mass Transfer”, John wiley & Sons.

3) Heat Transfer By R. Yadav.

ME5T002	Theory of Machines-II	3 Credit

COURSE OBJECTIVES

1. To understand the force-motion relationship in components subjected to external forces and analysis of standard mechanisms.
2. To understand the undesirable effects of unbalances resulting from prescribed motions in mechanism.
3. To understand the effect of Dynamics of undesirable vibrations.
4. To understand the principles in mechanisms used for speed control and stability control.

COURSE OUTCOMES

At the end of the course students will be able to

1. Explain the helical, bevel, worm gear, flywheel, governor, gyroscopic effect and vibrations concept..
2. Classify the helical, bevel, worm gear, flywheel, governor, gyroscope effect and vibrations for a particular application
3. Solve the basic parameter for helical, bevel, worm gear, flywheel, governor, gyroscope effect and vibrations for a particular application
4. Compare the helical, bevel, worm gear, flywheel, governor, gyroscope and vibrations in the mechanical systems.
5. Select the helical, bevel, worm gear, flywheel, governor, gyroscope and vibrations for a particular application
6. Design /formulate the helical, bevel, worm gear, flywheel, governor, gyroscope and vibrations for a particular application.

Unit 1: Dynamic force analysis [06 Hours]

Introduction, D'alembert's principle, equivalent offset inertia force, dynamic analysis of four link mechanism, dynamic analysis compound chain,dynamic analysis of slider crank mechanism, velocity & acceleration of piston, angular velocity & angular acceleration of connecting rod, engine force analysis, dynamically equivalent system ,correction couple, inertia of the connecting rod, inertia force in reciprocating engines.

Unit 2: Toothed Gear [07 Hours]

Helical gear terminology, Normal and transverse module, Virtual number of teeth, Torque transmitted by helical gears, Spiral gears, Efficiency of spiral gears, Worm gears, Bevel gear terminology, Tooth forces and geometric relationship, Torque capacities.

Unit 3: Flywheel **[06 Hours]**

Flywheel: Turning moment diagram, Fluctuation of energy and speed, Determination of flywheel size for different types of prime movers and machines.

Unit 4: Gyroscope **[08 Hours]**

Principles of gyroscopic action, Precession and gyroscopic acceleration,
gyroscopic couple, Effect of the gyroscopic couple on ships, aeroplanes and vehicles,
inclined rotating discs, gyroscopic stabilization.Queuing Model: Kendall's notation for representing queue, single channel Poisson arrivals with exponential service times, infinite populations.

Unit 5 Static and dynamic balancing **[08 Hours]**

Balancing of rotating masses – Balancing a single cylinder engine – Balancing of Multi-cylinder inline, V-engines – Partial balancing in engines –

Unit 6 Basic features of vibratory systems **[08 Hours]**

Balancing of linkages – Balancing machines-Field balancing of discs and rotors– Degrees of freedom – single degree of freedom

Text Books

1. S. S. Rattan, "Theory of Machines", Tata McGraw Hill Publications, New Delhi.
2. Thomas Beven, "Theory of machines", CBS Publishers, Delhi, 1984.3. Kelly, Graham S., "Mechanical Vibrations", Schaum's Outline Series, McGraw
Hill, New York, 1996.
4. Rao, J.S., "Introductory Course on Theory and Practice of Mechanical Vibration", New
age International (P) Ltd, New Delhi, 2nd edition, 1999.

Reference Books

1. Rao Singiresu, "Mechanical Vibrations", Pearson Education, New Delhi, 4th edition 2004.
2. J. E. Shigley, J. J. Vicker, "Theory of Machines and Mechanisms", Tata McGraw Hill
International.

ME5TE01A	Renewable Energy Sources	3 Credit

COURSE OBJECTIVES

This course will provide an exposure regarding aspects and utilization of renewable energy systems towards sustainable development of the society.

COURSE OUTCOMES

At the end of the course students will be able to,

1. List the primary renewable energy sources, their feasibility and challenges.
2. Explain the various renewable energy systems such as solar energy collectors, wind turbine, geothermal systems, MHD, ocean thermal electric conversion system, biogas and biomass system.
3. Apply mathematical treatment related to solar energy collectors and wind power generation
4. Analyze the performance of renewable energy system such as solar energy collectors and wind power generation.
5. Choose the suitable renewable energy system for the desired application.

Unit 1: Introduction to renewable energy sources and solar energy [07 Hours]

Introduction to renewable energy sources: Global energy scenario, conventional and non-conventional sources of energy, merits and challenges.

Solar Energy: Introduction, spectral distribution of solar radiation, beam and diffused radiations, measurement of solar radiation, solar radiation geometry, estimation of daily average solar radiations on horizontal and tilted surfaces and estimation of hourly solar radiation.

Unit 2:Solar flat plate collectors [07 Hours]

Liquid flat plate collector & their analysis, collector efficiency factor and heat removal factor, collector efficiency, concept of selective surfaces, some novel designs of solar collectors, solar air heaters and their analysis

Unit 3: Applications of solar energy and concentrators [06 Hours]

Applications of solar energy: Water heating, space heating, drying, refrigeration, distillation, cooking, PV systems, Thermal Energy Storage (sensible, latent and thermochemical) and solar pond

Concentrators: Cylindrical parabolic collectors, compound parabolic collectors, their construction and principle of operation, advantages and drawbacks, tracking systems, and central receiver concept of power generations.

Unit 4:Geothermal and MHD power generation **[06 Hours]**

Geothermal energy: Introduction, classification of geothermal systems vapour dominated, liquid dominated system, total flow concept, petro-thermal systems, magma resources, applications of geothermal operational & environmental problems.

Magneto Hydro Dynamic power generation: Introduction, principles of MHD, power generation, MHD open and closed systems, power output from MHD generators, design problems of MHD generation, gas conductivity, seeding. Strain Energy Noise Conversion.

Unit 5: Wind and Ocean **[06 Hours]**

Wind & Ocean Energy: Power in wind, basic principles of wind power generation and its numericals, basic components of WEC Systems, site selection Savonius and Darrieus rotors, application of wind energy, wind energy potential and installation in India.

Ocean energy: Introduction, Ocean Thermal Electric Conversion (OTEC), open and closed cycle of OTEC, hybrid cycle, energy from tides, generation components of tidal power plants, single and double basin design arrangement, estimation of tidal power and energy.

Unit 6:Bio-Energy **[07 Hours]**

Bio-Gas: Introduction to biogas generation, fixed dome & floating drum biogas plants, their constructional details, raw material for biogas production, factors affecting generation of biogas, utilization of biogas.

Biomass: Introduction, methods of obtaining energy from biomass, Incineration, thermal gasification. Up draft and down draft gasifiers, their constructional details, applications of producer gas.

Text Books

1. G. N. Tiwari and M. K. Ghoshal, Renewable Energy Sources Basic Principles And Applications, Narosa Publishing House, New Delhi.

2. S.P. Sukhatme, Solar Energy: Principles of Thermal Collection And Storage, Tata Mcgraw-Hill

Reference Books

1. John Twidell , Tony Weir , Renewable Energy Resources, Taylor & Francis; 2nd edition, 2005

2. Duffie, J. A. & W. A. Beckman.Solar Engineering of Thermal Processes, 3rd ed. John Wiley & Sons, Inc., 2006

3. Boyle, G.. Renewable energy: Power for a sustainable future. Oxford University press, Oxford, UK., 2004

4. G.D. Rai, Non Conventional Energy Sources, Khanna Publishers, New Delhi.

5. S. Rao And B.B. Parulekar, Energy Technology: Nonconventional, Renewable And Conventional Khanna Publisher, New Delhi.

ME5TE01B	Analysis and Synthesis of Mechanism	3 Credit

COURSE OBJECTIVES

1. To study the kinematic analysis and design of mechanisms
2. To apply kinematic theories to synthesize the real-world mechanisms

COURSE OUTCOMES

At the end of the course students will be able to

1. **Identify** degree of freedom, equivalent linkages, transmission angle, Type Synthesis, Number Synthesis, Dimensional Synthesis, coupler curve equation, Roberts-Chebyshev theorem, Force Analysis of Planar Mechanisms, and Analytical synthesis of Planar Mechanisms.

2. **Explain** degree of freedom, methods of kinematic analysis, concept of mechanism synthesis and types, Type synthesis, Number synthesis, Dimensional synthesis, Static force analysis, constraint and applied forces, static equilibrium, dynamic force analysis of planar mechanisms, coupler curve equation, double points and symmetry, Roberts-Chebyshev theorem, Force Analysis of Planar Mechanisms, and Analytical synthesis of Planar Mechanisms.

3. **Compute** mechanical advantage and transmission angle, Dimensional synthesis, Accuracy points, coupler curve equation, constraint and applied forces, and errors in linkages

4. **Analyze** four bar linkage, static and dynamic forces for planar mechanism, mechanisms using Kineto-static analysis by matrix method, elastic linkage model, four-bar function generator and slider-crank mechanism.

5. **Decide** appropriate method for force analysis of planar mechanisms and equation for synthesis of Planar Mechanisms

Unit 1:Introduction **[07 Hours]**

Basic definitions, criterions, degree of freedom, construction of mechanisms, applied mechanisms and equivalent linkages. Mechanical advantage and transmission angle. Review the methods of kinematic analysis. Concept of mechanism synthesis and types.

Unit 2:Type Synthesis, Number Synthesis, Dimensional Synthesis **[07 Hours]**

Type synthesis, Number synthesis, Dimensional synthesis, Accuracy points, Spacing of of accuracy points, Chebyshev polynomials.

Unit 3:Synthesis of four Bar Mechanisms **[08 Hours]**

Four bar linkage, coupler curve, coupler curve equation, double point cuts of a coupler curve, Harding's Notations, Class I and Class II four bar chain, two positions synthesis, synthesis of crank rocker and time ratio, transmission angle ,synthesis for optimum angle linkage bear combinations for large output angle of oscillations, overlays methods for coordinated crack position.

Unit 4: Force Analysis of Planar Mechanisms **[08 Hours]**

Static force analysis, constraint and applied forces, static equilibrium. Dynamic force analysis of planar mechanisms, inertia forces linkages, Kineto-static analysis of mechanisms by matrix method. Analysis of elastic mechanisms, elastic linkage model, equations of motions. Robotics and its applications.

Unit 5:Analytical synthesis of Planar Mechanisms **[08 Hours]**

Type, number and dimensional synthesis, function generation, path generation and rigid body guidance, accuracy (precision) points, Chebychev Spacing, Freudenstein's equation, displacement, velocity and acceleration equations. Synthesis of , Complex number method of synthesis. Four and five accuracy point synthesis, errors in linkages.

Text Books

1) Theory of Machines and Mechanisms, A. Ghosh and A.K.Mallik, Affiliated EastWest Press
2) Theory of Machines and Mechanisms, J. E. Shigleyand J. J. Uicker, 2nd Ed., McGraw-Hill

Reference Books

1) Kinematic Synthesis of Linkages, R. S. Hartenberg and J. Denavit, McGraw-Hill
2) Mechanism Design - Analysis and Synthesis (Vol.1and 2), A. G. Erdman and G. N. Sandor, Prentice Hall of India
3) Design of Machinery: An Introduction to the Synthesis and Analysis of Mechanisms and Machines, Robert L.Norton, Tata McGraw-Hill, 3rd Edition.
4) Kinematics and Linkage Design, A.S.Hall, Prentice Hall of India

ME5TE01C	ADVANCED MANUFACTURING TECHNOLOGY	3 Credit

COURSE OBJECTIVES

1. To understand the importance of advanced machining and joining processes in manufacturing sector

2. To understand the significance of non-metallic material's processing in manufacturing sector

COURSE OUTCOMES

At the end of the course students will be able to

1. Define different advanced machining, joining, plastic,rapid prototyping & smart manufacturing processes.

2. Classify the various advanced machining processes, joining process, plastic processes,rapid prototyping process & smart manufacturing processes on the basis of their applications.

3. Identify working principles and applications of various advanced manufacturing processes.

4. Select different job using different operations performed in advanced machining, joining, plastic, rapid prototyping processes & smart manufacturing processes.

Unit 1: Advanced Machining Processes **[07 Hours]**

Introduction of advanced machining - Ultrasonic machining (USM), Abrasive water jet machining (AWJM), Electrochemical machining (ECM), Electro discharge machining (EDM), Electron beam machining (EBM), Laser beam machining (LBM)

Unit 2: Advanced Joining Processes **[07 Hours]**

Introduction of advanced joining process - Electron beam welding (EBW), Laser beam welding (LBW), Ultrasonic welding (USW), Explosive welding, Underwater welding, Spray welding, Laser cladding

Unit 3: Plastic Processing **[07 Hours]**

Production of Polymer and types of structures, Thermosets and thermoforming plastic, Extrusion Processes, Injection Moulding, Blow Moulding, Rotational Moulding, Thermoforming; Compression Moulding, Transfer Moulding, Foam Moulding, Cold Forming and Solid-phase Forming, Processing Elastomers

Unit 4: Rapid Prototyping **[07 Hours]**

Rapid Prototyping operations: subtractive and additive processes, FDM, Stereo lithography, Selective laser sintering, 3D printing, Laminated object manufacturing, Rapid tooling, Applications, Advantages, Limitations.

Unit 5: Introduction To Smart Manufacturing **[07 Hours]**

What is “smart manufacturing” really and how does it differ from conventional/legacy manufacturing, Computer Integrated Manufacturing Systems Structure and functional areas of CIM system, - CAD, CAPP, CAM, CAQC, ASRS. Advantages & Disadvantages of CIM. Real time based applications of Smart Manufacturing.

Text Books

1) Serope Kalpakjian and Steven R. Schmid, “Manufacturing Engineering and Technology”, Addison Wesley Longman (Singapore) India Ltd., 6th edition, 2009.

2) Geoffrey Boothroyd, Winston Knight, “Fundamentals of Machining and Machine Tools”, Taylor and Francis, 3rd edition, 2006.

Reference Books

1) Milkell P. Groover, “Fundamentals of Modern Manufacturing: Materials, Processes, and Systems”, John Wiley and Sons, New Jersey, 4th edition, 2010.

2) Paul De Garmo, J. T. Black, Ronald A. Kohser, “Materials and Processes in Manufacturing”, Wiley, 10th edition, 2007

JAIDEV EDUCATION SOCIETY'S
J D COLLEGE OF ENGINEERING AND MANAGEMENT
KATOL ROAD, NAGPUR
DEPARTMENT OF MECHANICAL ENGINEERING

List of Mechanical Department electives introduced

Sr No.	Name of Course	Course code	Semester	Year of Introduction
1	Renewable Energy Sources	ME5TE01A	5TH	2021
2	Analysis and Synthesis of Mechanisms	ME5TE01B	5TH	2021
3	Advanced Manufacturing Technology	ME5TE01C	5TH	2021
4	Automobile Vehicle Maintenance	ME5O001A	5TH	2021
5	Product Development	ME5O001B	5TH	2021
6	Power plant engineering	ME6TE02A	6TH	2021
7	Automobile Engineering	ME6TE02B	6TH	2021
8	Industrial Engineering	ME6TE02C	6TH	2021
9	Solar Technologies	ME6O002A	6TH	2021
10	Industrial Safety	ME6O002B	6TH	2021
11				
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14				
15				
16				

B.O.S Secretraty B.O.S Chairmam

Note: All documents should be duly signed and sealed

JD COLLEGE OF ENGINEERING & MANAGEMENT

An Autonomous College, Affiliated to DBATU, Lonere
At: Khandala, Post- Valni, Kalmeshwar Road, Near Fetri, Nagpur

Education to Eternity

6TH BOARDOFSTUDIESMEETINGNO.BOS/CSE/06/2021-22 22/03/2022

Mode: Online Google Meet
Link: https://meet.google.com/fcv-otci-vtx

The 6th Meeting of the Board of Studies was held on Tuesday, 23th March, 2022 at 02:00 P.M. in Department of Computer Science and Engineering, JDCOEM through Online Google Meet App. The following members were present in the meeting:

Sr. No.	Name of faculty	Designation
1	Prof. Supriya Sawwashere	Chairman
2	Dr. Mahendra Gaikwad	Member (Expert)
3	Mr. Shrikant Ardhapurkar	Member (Industry)
4	Prof. Ajay Karare	Member (Expert)
5	Prof. Nisha Dable	Secretary
6	Prof. Ashish Nanotkar	Member
7	Prof. Aniket Bhoyar	Member
8	Prof. Kiran Bode	Member

Minutes of Meeting

1) Meeting Started on 23rd March 2022 at 02.00 P.M. by welcoming Dr. Mahendra Gaikwad (G. H. Raisoni College of Engineering), Mr. Shrikant Ardhapurkar (Crypto Forensics, Nagpur) and Mr. Ajay Karare (Asst. Prof., RKNEC, Nagpur) and all members of BOS Committee by Prof. Nisha Dable (Secretary, BoS CSE)

2) Prof. Nisha Dable explained the action taken report on 5thMeeting of BOS & Overview the agenda of Current Meeting.

Item No. 1	Confirmation of the previous BOS meeting.

The previous meeting (5th BOS Meeting) was held on 06/07/2021 for discussion on the finalization of scheme and syllabus of third year. B. Tech and Revised under Autonomous scheme & "Introduction to Computer Programming" in I semester under self-study mode through NPTEL/Sway am portal.

Item No. 2	Action Taken Report of the Previous BOS Meeting

The secretary presented the minutes of BOS/CSE/05/2021-22, to all the members and action taken on it. Following points were presented under this item.

Sr. No.	Item	Action Taken
1	To approve the absorption & equivalence scheme for the 5th semester students from University pattern to JDCOEM Autonomous pattern.	There is no need for the students to appear for any equivalent subject to absorb the students from DBATU to Autonomous in V SEM (III year) from session 2021-22.
2	In finalization of the scheme for 5th Semester 1. To cover the contents from basics in python up to the packages (ex. Panda) in "Python Programming Lab" in V SEMCSE. 2. To include "High Performance Computer Architecture" as an Elective I in 5th semester CSE.	The suggestions have been incorporated.
3	To consider the subject "Introduction to Computer Programming" in I semester under self-study mode through NPTEL/Swayam portal. The course "Programming in C" has been finalized for the said subject in the scheme.	The enrollment process of NPTEL courses has been closed and semester I has been started late. The suggestions will be incorporated in next academic year.

ItemNo.3	To Check Status of Syllabus

- The designed syllabus and schemewere discussed, and we have shown the 5thsem and 6thsem syllabus with all required changes suggested by expert. All the expert are approved the scheme of 5thsem and 6thsem.
- We have also revised Mtech Scheme of CSE with some minor changes in the scheme. All the expert are approved the scheme.

ItemNo.4	Tofinalizethesyllabusof5th& 6thSemester

The designed syllabus and scheme were discussed, all the experts havesuggested that thereis some minor changes in syllabus.

1) In elective IV i.e. **"Digital Image Processing"** to adopt a some Image technique.
2) In elective IV i.e. **"Randomized Algorithm"** to minimize the syllabus.
3) To revised the syllabus of **"Bio-Medical"** informatics.
4) In **"Research Methodologies"** subject add some testing module, testing methods and some Testing component.
5) Try to minimize the syllabus and set syllabus according to Hours.

ItemNo.5	To Check the Credit & Reduce the Syllabus

The Experts have suggested that to check the syllabus content and credit of the for the particular subjects. Manage the syllabus according credit and hours which is mention in the scheme. Try to minimize the syllabus.

ItemNo.5	To approve the scheme and syllabus of M.Tech. CSE

The experts have approved the revised scheme and syllabus of MTech Computer Science & Engineering.

The meeting was concluded with vote of thanks.

Prof. Supriya Sawwashere
Chairman,
Board of Studies,
JDCOEM, Nagpur

Sr. No.	Name of the Faculty	Sign
1.	Prof. Supriya Sawwashere	
2.	Prof. Nisha Dable	Ndable
3.	Prof. Aniket Bhoyar	
4.	Prof. Ashish Nanotkar	
5.	Prof. Kiran Bode	KBode
	External Member	
1	Dr. M. A. Gaikwad	
2	Mr. Shrikant Ardhapurkar	
3	Mr. Ajay Karare	

ACTION TAKEN REPORT OF 6TH BOARD OF STUDIES MEETING NO. BOS/CSE/06/2021-22

23/03/2022

Sr. No.	Item	Action Taken
1	Confirmation of the previous BOS meeting of 06/06/2021	Confirmed by the Chairman of BOS
2	Action taken report for last meeting minutes	Verified all the Members
3	To update the syllabus of: 1. In elective IV i.e. **"Digital Image Processing"** to adopt a some Image technique. 2. In elective IV i.e. **"Randomized Algorithm"** to minimize the syllabus. 3. To revised the syllabus of **"Bio-Medical"** informatics. 4. In "**Research Methodologies**" subject, add some testing module, testing methods and some Testing component.	The syllabus was modified as per suggestions given by Experts.
4	The minor domains of NPTEL, courses to be revised. Separate minor domains should be run under every Engineering program	The changes in the minor domains have been incorporated.
5	The revised scheme and syllabus of M.Tech Program has to be incorporated from the session 2022-23.	The scheme and syllabus has been incorporated from the session 2022-23.

Prof. Supriya Sawwashere,
Chairman, BOS CSE,
JDCOEM, Nagpur

MINUTES OF MEETING FOR 05TH BOARD OF STUDIES MEETING NO. BOS/DOCE/05/2021	09/07/2021

Mode of Conduct: Online

The 05th Meeting of the Board of Studies was held on Friday, 09th July, 2021 at 12 noon via online mode. The following members were present:

Name of the Faculty	Designation
1. Mrs. Atika Ingole, Asst. Prof., Civil Engineering Department, JDCOEM	Chairman, BOS
2. Mr. Atul Gautam, Asst. Prof., Civil Engineering Department, JDCOEM	Member, BOS
3. Mr. Nilesh Pal, Asst. Prof. Civil Engineering Department, JDCOEM	Member, BOS
4. Mr. Shahrukh Kureshi, Asst. Prof., Civil Engineering Department, JDCOEM	Member, BOS
5. Ms. Shital Navghare, Asst. Prof., Civil Engineering Department, JDCOEM	Member, BOS
6. Dr. Snehal Abhyankar, Asst. Prof., Civil Engineering Department, JDCOEM	Member, BOS
7. Ms. Tina Khandale, Asst. Prof., Civil Engineering Department, JDCOEM	Member, BOS
8. Ms. Tejaswini Junghare, Asst. Prof., Civil Engineering Department, JDCOEM	Secretary, BOS

The following persons were invited to attend the meeting:

1.	Dr. P. D. Pachpore	Subject Expert
2.	Dr. A. M. Pande	Subject Expert
2.	Dr. Rahul Ralegaonkar	VC nominated Subject Expert

Item No. 1 — Confirmation of the previous BOS meeting.

Secretary, BOS welcome Invitees, Subject experts, BOS Committee Chairman and Members. Meeting was started with review of previous minutes of meetings. Chairman, Mrs. Atika Ingole precedes the meeting as per the agenda.

Item No. 2 — Action taken report for last meeting minutes.

Action taken report of previous minutes of meeting has been reviewed in the meeting.

Item No. 3 — Replace nomination of BOS Chairman and BOS Secretary

The changes in the nomination of BOS, Chairman and BOS, Secretary has approved in meeting.

Item No. 4 — Status of online course for 4th Semester and planning for 3rd, 5th & 7th Semester

The institute policies of 20% online courses have been discussed in the meeting.

Item No. 5 — Finalize the syllabus of 5th & 6th Semester.

There should be the prerequisites for the open electives including maximum and minimum capacity and the courses under that category should be applicable to all branches. There should be the inclusion of Disaster Management course for every programme.

The reshuffling of courses is required for V and VI Semester, the core courses should be in initial semester followed by professional electives in next VI Semester.

The course name for internship/field visit in every semester should be different and duration should be mentioned in the syllabus.

The subject experts will convey the corrections required in the syllabus of V and VI semester through mail and the syllabus of Introduction to Earthquake Engineering and Research Methodology should be revised.

Ms. Tejaswini Junghare
BOS, Secretary
Assistant Professor,
Department of Civil Engineering,
JDCOEM, Nagpur

Following members of Board of Studies were present for the meeting:

Sr No	Name of the BOS Members	Designation
1	Dr. P. D. Pachpore, Professor, R.K.N.E.C., Nagpur	Subject Expert
2	Dr. A. M. Pande, Professor, Y.C.C.E., Nagpur	Subject Expert
3	Dr. Rahul Ralegaonkar, Professor, VNIT, Nagpur	Subject Expert
4	Ms. Tejaswini Junghare, Asst. Prof., Civil Engineering Department, JDCOEM	Secretary, BOS
5	Ms. Tina Khandale, Asst. Prof., Civil Engineering Department, JDCOEM	Member, BOS
6	Dr. Snehal Abhyankar, Asst. Prof., Civil Engineering Department, JDCOEM	Member, BOS
7	Ms. Shital Navghare, Asst. Prof., Civil Engineering Department, JDCOEM	Member, BOS
8	Mr. Shahrukh Kureshi, Asst. Prof., Civil Engineering Department, JDCOEM	Member, BOS
9	Mr. Nilesh Pal, Asst. Prof., Civil Engineering Department, JDCOEM	Member, BOS
10	Mr. Atul Gautam, Asst. Prof., Civil Engineering Department, JDCOEM	Member, BOS
11	Mrs. Atika Ingole, Asst. Prof., Civil Engineering Department, JDCOEM	Chairman, BOS

MINUTES OF MEETING FOR 06TH BOARD OF STUDIES MEETING NO. BOS/DOCE/05/2022 — 21/03/2022

Mode of Conduct: Online

The 06th Meeting of the Board of Studies was held on Monday, 21st March, 2022 at 3.00 pm via online mode. The following members were present:

Name of the Faculty	Designation
1. Mrs. Atika Ingole, Asst. Prof., Civil Engineering Department, JDCOEM	Chairman, BOS
2. Mr. Atul Gautam, Asst. Prof., Civil Engineering Department, JDCOEM	Member, BOS
3. Mr. Nilesh Pal, Asst. Prof., Civil Engineering Department, JDCOEM	Member, BOS
4. Mr. Shahrukh Kureshi, Asst. Prof., Civil Engineering Department, JDCOEM	Member, BOS
5. Ms. Shital Navghare, Asst. Prof., Civil Engineering Department, JDCOEM	Member, BOS
6. Ms. Tina Khandale, Asst. Prof., Civil Engineering Department, JDCOEM	Member, BOS
7. Ms. Tejaswini Junghare, Asst. Prof., Civil Engineering Department, JDCOEM	Secretary, BOS

The following persons were invited to attend the meeting:

1. Dr. P. D. Pachpore — Subject Expert
2. Dr. A. M. Pande — Subject Expert
3. Dr. Rahul Ralegaonkar — VC nominated Subject Expert

Item No. 1 | Confirmation of the previous BOS meeting.

Secretary, BOS welcome Invitees, Subject experts, BOS Committee Chairman and Members. Meeting was started with review of previous minutes of meetings. The Chairman, Mrs. Atika Ingole proceeds the meeting as per the agenda.

Item No. 2 | Action taken report for last meeting minutes.

Action taken report of previous minutes of meeting has been reviewed in the meeting. Subject experts suggested to revise the ATR format and advised to attach the updated documents.

Item No. 3 | VII and VIII Semester Scheme and Syllabus Finalization.

The experts advised to add the sum of credits, lecture, tutorials and practical in the scheme for every semester.

The list of open electives and professional electives offered in VII and VIII Semester should be revised and syllabus of the same should be optimized as per the references available for the students and teachers.

The policy for the students those will be placed during their academic year and will offer the internship from their placement should be mentioned in the syllabus of internship.

Item No. 4 | III and IV Semester Scheme Revision

The experts advised that the revision can be possible in the syllabus content up to 20% only, whole subject cannot be revised.

Item No. 5 | Absorption and Equivalence Scheme.

The absorption scheme should be prepared for all the semesters in combined manner.

Item No. 6	Any other matter with the permission of the Chair.

Board of studies required the nomination of industry experts and for the same, the Chairman, BoS had requested to the experts for their suggestions for the same in the meeting. The nomination of Dr. Virendra P. Dehadrai, Director, Aquades Structural Consultants (P) Ltd., for industry experts had received from the experts.

The experts suggested to include the adjunct professors in the department.

The projects for the students should be industry oriented, the advice received form the subject experts.

T. S. Junghare

BOS, Secretary
Assistant Professor,
Department of Civil Engineering,
JDCOEM, Nagpur

Sr No	Name of the BOS Members	Designation	Sign
1	Dr. P. D. Pachpore, Professor, R.K.N.E.C., Nagpur	Subject Expert	
2	Dr. A. M. Pande, Professor, Y.C.C.E., Nagpur	Subject Expert	
3	Dr. Rahul Ralegaonkar, Professor, VNIT, Nagpur	Subject Expert	
4	Ms. Tejaswini Junghare, Asst. Prof., Civil Engineering Department, JDCOEM	Secretary, BOS	
5	Ms. Tina Khandale, Asst. Prof., Civil Engineering Department, JDCOEM	Member, BOS	
6	Ms. Shital Navghare, Asst. Prof., Civil Engineering Department, JDCOEM	Member, BOS	
7	Mr. Shahrukh Kureshi, Asst. Prof., Civil Engineering Department, JDCOEM	Member, BOS	
8	Mr. Nilesh Pal, Asst Prof., Civil Engineering Department, JDCOEM	Member, BOS	
9	Mr. Atul Gautam, Asst. Prof., Civil Engineering Department, JDCOEM	Member, BOS	
10	Mrs. Atika Ingole, Asst. Prof., Civil Engineering Department, JDCOEM	Chairman, BOS	

AGENDA FOR 5TH BOARD OF STUDIES (EE) MEETING NO. BOS/EE/05/2021-22 05/07/2021

The 5th meeting (Online) of the Board of Studies(EE) will be held on **08th July, 2021** at **2 p.m.** All the members of the Board of Studies are requested to attend the meeting. The agenda for the meeting will be as below.

Item No. 1	**Confirmation of the MOM of 4th BOS meeting.**

MOM of 4th BOS meeting, which was held on 8th Feb, 2021 to be discussed.

Item No. 2	**Action taken report for 4th BOS meeting, which was held on 8th Feb, 2021**

Action taken report on the last meeting to be presented.

Item No. 3	**Confirmation of new members and replacement of nomination .**

Some Old BOS members to be removed and new BOS members to be added.

Item No. 4	**Status of online course for 4th sem and planning for 3rd, 5th & 7th sem**

Status of online courses for 4th Semester to be discussed. Also planning for 3rd, 5th & 7th sem also to be discussed.

Item No. 5	**Discussion regarding B. Tech. (honors) Major & Minor domain specialization**

Major & Minor domains offered for B.Tech (honors) to be discussed.

Item No. 6	**Finalization of the syllabus of 5th & 6th Semester**

Syllabus of 5th and 6th Semester (Autonomous) to be finalized.

Item No. 7	**To finalize the syllabus for open elective subjects**

Syllabus of open Elective subjects belonging to department to be finalized.

Item No. 8	**Question paper setting and moderation for various subjects**

Status of Question paper setting & moderation for various subjects to be discussed.

Item No. 9	**Any other matter with the permission of the Chair**

Any other matter as per permission of chair to be discussed.

Joshi

Mr. A.V.Joshi,
Member Secretary, Board of Studies,
Dept. ofElectrical. Engg.
JDCOEM, Nagpur.

Dr. S.R. Vaishnav
Chairman, Board of Studies
Dept. of Electrical. Engg.
JDCOEM, Nagpur

AGENDA FOR 5TH BOARD OF STUDIES (EE) MEETING NO. BOS/EE/04/2020-21 09/07/2021

Venue: Online Google Meet Meeting

The 5th meeting of the Board of Studies (Electrical) was held on **9th July, 2021** at **1:00 p.m.** via Online Google Meet App. Following members of the Board of Studies were present in the meeting.

1	Dr. S.R.Vaishnav	Chairman
2	Dr. N.D. Ghawghawe	Expert
3	Dr. S. G. Tarnekar	Expert
4	Prof.J.S. Joshi	Expert
5	Prof. A.V. Joshi	Member Secretary
6	Dr. V.S. Dhok	Member
7	Prof. P.P. Panchbhai	Member
8	Prof. Y.P.Mundhada	Member
9	Prof. S.V. Jethani	Member
10	Prof. M.S.Isasare	Member
11	Prof. P.V. Ambade	Member

Item No. 1	Confirmation of the previous BOS meeting.

The Member Secretary welcomed the Chairman of Board of Studies, Expert Dr.S.G.Tarnekar, Dr. N.D. Ghawghawe , Prof.J.S. Joshi & all members of BOS. The Secretary presented Agenda of the meeting and requested the Chairman to convene the meeting.
The Chairman summarized the MOM of previous BOS meeting held on 08/02/2021 and confirmation on it was taken.

Item No. 2	Action taken report for last meeting minutes.

The Secretary of BOS presented the Action taken report for the previous meeting held on 08/02/2021 and discussed it in front of the members. Following were the ATR of the previous BOS Meeting.

1. As per suggestion of experts, one extra lecture was added in the subject Electrical Machines-I.

2. As per suggestion from Dr. Nitin Ghawghawe , DSP was already included in the syllabus as Elective-VI in seventh semester.
3. Advance Control System Lab - The lab course was removed from scheme and the credit was adjusted in the subject 'HVE' in 7th semester.
4. The name of Subject 'Theory of Electrical Engineering' was changed to 'Fundamentals of Electrical Engineering' as per suggestion of experts.
5. The name of Subject 'Introduction to DC and AC drives' was changed to 'Introduction to AC and DC drives' as per suggestion of experts.
6. Skill development course list was modified and course named 'Introduction to IoT' is added as per suggestion of Dr. Nitin Ghawghawe.
7. Absorption scheme for 3rd year was presented.

Item No. 3	Scheme and syllabus for 5th and 6th Sem

5th and 6th Sem syllabus was presented by Member Secretary for suggestions and approval. Following are the suggestions:

1. As per suggestions received from Prof. J. Joshi sir regarding power electronics course outcomes terminology should be based on Blooms Taxonomy.
2. Power Electronics (V Sem): Dr. Tarnekar suggested that notes should be available with the students the only the course will be completed within given hours.
3. Control System (V sem): Prof. J. Joshi suggested that the syllabus is tough and time consuming so scheme for the subject should be (3+1).
4. Electrical Utilization and Practice (V Sem): Prof. J. Joshi suggested LED lamp should be included in Unit 3.
5. Electrical Installation and Design (V sem) : Prof. J. Joshi suggested Unit 1 should be divided in part A and B
   Unit 5 and 6 : Design of PCC and MCC should be included and it is of 8 hours.
6. Energy Safety and Management (Open Elective):
   i. Elective should not be more than 3 credited
   ii. Syllabus description should be minimum
7. Consumer Affair: Audit Course should be satisfactory /unsatisfactory instead of credits.

Item No. 4	**Subject under online conduction from online (NPTEL) resources**

Subject under online conduction from online (NPTEL) resources was presented and discussed.

Item No. 5	**Skill development Courses**

List of Skill development Courses was presented for suggestions and was approved by experts.

Item No. 6	**Approval of new BOS members**

The following changes have been approved by Experts:

1. Mr. M. S. Isasare has replaced Mr. S. T. Telrandhe in Board of Studies (EE).
2. Mr. A. V. Joshi is now a Member Secretary, Board of Studies (EE) in place of Mr. A. A. Kakde.

Item No. 7	**Absorption & equivalence scheme for the 5th sem students from University pattern to JDCOEM Autonomous pattern.**

The absorption & equivalence scheme for the 5th sem students from University pattern to JDCOEM Autonomous pattern was discussed with expert members.

Prof. J. Joshi advised to check how many subjects have to absorb the students.

Item No. 8	**B.Tech. (Honors) Major & Minor domain specialization.**

B.Tech. (Honors) Major & Minor domain specialization pattern was presented for suggestions and approval

Dr. N. D. Ghawghawe suggested that Major domain subject should be other than the regular subject.

Item No. 09	**Any other matter with the permission of the Chair.**

The meeting Concluded with vote of thanks by Chairman.

Mr. A.V.Joshi,
Member Secretary, Board of Studies,
Dept. ofElectrical. Engg.
JDCOEM, Nagpur.

Dr. S.R. Vaishnav
Chairman, Board of Studies
Dept. ofElectrical. Engg.
JDCOEM, Nagpur

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MINUTES OF 4TH BOARD OF STUDIES MEETING NO. BOS/ETC/04/2020-21 12/02/2021

Venue: Online via Google Meet Platform

Department of Electronics & Telecommunication Engineering

The 4th meeting of the Board of Studies was held on **11th February, 2021 at 2.00 P.M.** The mode of conduction of the meeting was online through **Google Meet due to an outbreak of COVID-19.**

Following members were present for this meeting.

Sr. No.	Name of the Faculty	Designation
1.	Mrs. Neetu N. Gyanchandani	Chairman
2.	Dr. Kishor M. Bhurchandi	Member (VC Nominated)
3.	Dr. Raghavendra B. Deshmukh	Member (Academician)
4.	Mr. Sandeep Darwhekar	Member (Industry)
5.	Dr. Sanjay L. Haridas	Member
6.	Mr. Shailesh M. Sakhare	Secretary
7.	Mrs. Gayatri V. Padole	Member
8.	Mr. Amol B. Dhankar	Member
9.	Mr. Firoz Akthar	Member
10.	Mr. Avinash K. Ikhar	Member
11.	Mr. Shyam D. Bawankar	Member
12.	Ms. Shweta S. Sharma	Member
13.	Ms. Pranali R. Langde	Member
14.	Ms. Shafaque F. Khan	Member
15.	Dr. Neeta Thune	Member
16.	Mr. Tushar Muratkar	Member
17.	Mr. Dharamveer Choudhari	Member

The Secretary Mr. Shailesh Sakhare welcomed the members of the Board of Studies and the Chairman Mrs. Neetu Gyanchandani introduced the new members Dr. K. M. Bhurchandi, Dr.

Neeta Thune, Mr. Tushar Muratkar and Mr. Dharamveer Choudhari along with the experts Dr. Raghavendra B. Deshmukh and Mr. Sandip Darwhekar to the forum.

With the permission of chair the discussion started as per the agenda. Following points were discussed.

Item No. 1	**Confirmation of the previous BoS meeting.**

The previous meeting (3rd BoS meeting) was held on 28th May, 2020, to welcome members for the Board of Studies and discussion related to the scheme for all semesters and syllabus of 3rd and 4th semester was done.

Item No. 2	**Action taken report for last meeting minutes.**

The Secretary presented the Minutes of BOS/ETC/03/2019-20, to all the members and action taken on it. Following points were presented under this item.

Item No.	Item	Action Taken
01	Inclusion of New Members and transfer of charge of Secretary	**Dr. Sanjay L. Haridas** was introduced and included as the member of the Board. Also the charge of Secretary was transferred from Mr. Nilesh A. Mohota to Mr. Shailesh M. Sakhare.
02	Approval to UG Syllabus Suggestion by Dr. R. B. Deshmukh	All the suggested changes/modifications were incorporated in the respective subjects. The changes were made in the practicals as suggested and the syllabus is finalized. The final draft of syllabus of 3rd and 4th semester is ready.

Item No. 3	**Inclusion of New Members.**

Inclusion of new members to Board Dr. K. M. Bhurchandi, (VC Nominated) VNIT, Nagpur, Dr. Neeta Thune, Mr. Tushar Muratkar and Mr. Dharamveer Choudhari, Assistant Professor, ETC Department, JDCOEM, Nagpur which was accepted by the forum.

Item No. 4	**Absorption scheme for 3rd Semester**

Discussion on absorption scheme (From DBATU to Autonomy and RTMNU to Autonomy) and subject equivalence for 3rd semester was discussed and accepted by the forum.

Item No. 5	**Reframing of PG Scheme (M. Tech. Electronics)**

Reconsideration and correction in the scheme of PG course (M. Tech Electronics) is discussed. As per the discussion following changes are proposed in the existing scheme

Microelectronics subject of 1st semester is proposed to be replaced by embedded system design. Communication skills and PG Lab-1 is to be replaced by Embedded System Design Lab and VLSI System Design Lab.

In 2nd semester it was proposed to replace Nano electronics subject by some advanced subject like Advanced embedded system design which should cover RTOS and other operating systems. It is also suggested to include one Lab in course in 2nd semester. Entrepreneurship & Innovation & Incubation is proposed to be included in 2nd semester.

The existing course of Project Management and Intellectual Property Rights of 3rd semester is proposed to be split into two courses namely Project Management, Intellectual Property Rights and student has to choose these courses either from NPTEL/SWAYAM/MOOC pool and submission of course completion certificate is mandatory. There is no change in 4th semester course.

Regarding the discussion on electives subjects is was proposed to offer 6 subjects in each elective group instead of 5 as per existing scheme. Some electives are replaced by new electives like Digital System Design is to be replaced by Advanced Digital System Design & Architecture, Wearable Medical devices is proposed in place Medical Electronics, MIMO system is included as 6th subject in Elective-1 group. In Elective-2 group Cognitive Radio is included as 6th subject and Embedded system design is replaced by MEMS.

From elective-3 group System on chip is to be replaced by Artificial Intelligence and Smart Antennas is proposed as 6th subject. In elective-4 Hardware Implementation of AI is proposed as 6th subject. Finally in elective-5 group Quantum computing is proposed in place of Linear algebra and Broadband communication as 6th subject in group. All the proposed changes are discussed and accepted by the forum.

Item No. 6	**Any other matter with the permission of the Chair.**

Dr. S. L. Haridas introduced about the planning that is adopted for academic activities of direct second year students like commencement of classes, conduction of Sessional exam and MSE, Planning regarding the coverage of syllabus. Finally the tentatively proposed absorption scheme for 5th semester students is discussed.

No other matter is discussed. Finally the meeting was concluded by the vote of thanks proposed by the chairman and secretary of the board.

Mr. Shailesh M. Sakhare
Secretary BOS
ETC Board

Mrs. Neetu N. Gyanchandani
Chairman BOS
ETC board

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MINUTES OF 5TH BOARD OF STUDIES MEETING NO. BOS/ETC/05/2020-21 12/07/2021

Venue: Online via Google Meet Platform
Department of Electronics & Telecommunication Engineering

The 5th meeting of the Board of Studies was held on **9th July, 2021 at 1.00 P.M.** The mode of conduction of the meeting was online through **Google Meet due to an outbreak of COVID-19.**

Following members were present for this meeting.

Sr. No.	Name of the Faculty	Designation
1.	Mrs. Neetu N.Gyanchandani	Chairman
2.	Dr. Kishor M. Bhurchandi	Member (VC Nominated)
3.	Dr. Raghavendra B. Deshmukh	Member (Academician)
4.	Dr. Sanjay L. Haridas	Member
5.	Mr. Shailesh M. Sakhare	Secretary
6.	Mrs. Gayatri V. Padole	Member
7.	Mr. Amol B. Dhankar	Member
8.	Mr. Firoz Akthar	Member
9.	Mr. Avinash K. Ikhar	Member
10.	Mr. Shyam D. Bawankar	Member
11.	Ms. Mohammad Hassan	Member
12.	Ms. Pranali R. Langde	Member
13.	Dr. Dharamveer P. Choudhari	Member
14.	Dr. Neeta N. Thune	Member
15.	Mr. Tushar S. Muratkar	Member

The Secretary Mr. Shailesh Sakhare welcomed the members of the Board of Studies and the Chairman Mrs. Neetu Gyanchandani introduced the new member Mr. Mohammad Hassan, along with the experts Dr. Raghavendra B. Deshmukh and Dr, Kishor M. Bhurchandi to the forum. With the permission of chair the discussion started as per the agenda. Following points were discussed.

Item No. 1	To confirm the minutes of 4th BoS meeting

The 4th BoS meeting was held on **11th Feb, 2021.** The new members in the Board of Studies were introduced and discussion on reframing of PG scheme was done.

Item No. 2	To bring on table the action taken report of 4th meeting of BoS held on 11th February 2021

The Secretary presented the Minutes of 4th BoS BOS/ETC/04/2020-21, to all the members and action taken on it. Following points were presented under this item.

Item No.	Item	Action Taken
01	Inclusion of New Members (VC Nominated)	**Dr. Kishor M. Bhurchandi** was introduced and included as the VC Nominated member of the Board.
02	Discussion on reframing of PG scheme	The reframing of PG (M. Tech Electronics) scheme was discussed and approved by the forum. One additional subject as an elective was added to the list of each electives. Also some old courses are replaced with new courses.

Item No. 3	Inclusion and Confirmation of new members and replacement of member Prof. Shweta Sharma with Prof. Mohammad Hassan

Inclusion and Confirmation of new members and replacement of member, Prof. Shweta Sharma with Prof. Mohammad Hassan, Assistant Professor, ETC Department, JDCOEM, Nagpur which was accepted by the forum.

Item No. 4	To finalize the minor corrections in the Scheme of UG

Discussion on finalization of minor corrections in the scheme of UG was done and accepted by the forum. Following changes were made in the existing UG scheme

Sr. No.	Semester	Existing Subject	To be Replaced with
1	III	Innovation and Entrepreneurship Development	Universal Human Values
2	IV	Universal Human Values	Innovation and Entrepreneurship Development
3	V	Analog & Digital Circuit Simulation Lab	Software Workshop Lab
4	VI	Constitution of India	Education, Technology and Society
5	VI	Professional Elective Course-III	OPEN Elective Course-II
6	VII	OPEN Elective Course-II	OPEN Elective Course-III
7	VIII	OPEN Elective Course-III	Professional Elective Course-VI

Item No. 5	To finalize the syllabus of B. Tech 5th & 6th semester

Discussion on finalization of the syllabus of B. Tech 5th & 6th Semester was done and accepted by the forum. As per the discussion following changes are proposed in the syllabus.

In 5^{th} semester syllabus most of the subject's syllabus were accepted by the forum. Some minor changes were proposed like MATLAB and PSpice to be replaced with Scilab and Spice respectively in Software workshop Lab, some experiments on serial port communication to be added in Microcontroller and Applications Lab.

In 6^{th} semester syllabus it was proposed to change the subject name from CNN and Cloud Computing to Computer Networks and Cloud Computing also it was suggested to change the name of subject from Advanced Microprocessor (ARM) & it's interfacing with RTOS to Embedded Processor & it's interfacing with RTOS. One module on Internet protocols to be added in Computer Networks and Cloud Computing subject.

In Electronic Product Design Engineering Lab it was suggested either to change the Lab name as Electronic Design Lab/Workshop Practices Lab or add the design aesthetics in the syllabus. No other changes were proposed.

Item No. 6	To finalize the syllabus for open elective subjects

Discussion on finalization of the syllabus for open elective subjects was done and accepted by the forum. As per the discussion following changes are proposed in the syllabus.

It was suggested to add and open any generalised subject so that the students of any branch can choose it as an elective. In open elective course Pattern Recognition it was suggested to add some classifier examples on SVM or SVR in Module 6. Module 6 can be based on Perceptron that includes multilayer perceptron, multilevel perceptron followed by fuzzy pattern classifier. No other changes were proposed in open elective subjects' syllabus.

Item No. 7	Reframing of PG Syllabus (M. Tech. Electronics)

Discussion and finalization on reframing of PG syllabus (M. Tech Electronics) was done and accepted by the forum

Item No. 8	Any other matter with the permission of the Chair.

No other matter is discussed. Finally the meeting was concluded by the vote of thanks proposed by the chairman and secretary of the board.

Mr. Shailesh M. Sakhare
Secretary BOS
ETC Board

Mrs. Neetu N. Gyanchandani
Chairman BOS
ETC board

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6TH BOARD OF STUDIES MEETING NO. BOS/IT/05/2021-22 22/03/2022

Venue: Lab 1, Department of Information Technology, J. D College of Engineering & Management, Nagpur.

The 6th Meeting of the Board of Studies was held on Tuesday, 22nd March, 2022 at 2:00 P.M. in Department of Information Technology, JDCOEM. The mode of conduction of the meeting was online through **Google Meet App due to an outbreak of COVID-19.**

The following members were present in the meeting:

Sr.No.	Name of faculty	Designation
1	Mr. M. M. Baig	Chairman
2	Dr. Latesh Malik	(Member, Academician)
3	Prof. Durgesh Sharma	Member (Alumni)
4	Ms. Bhagyashree Madan	Secretary
5	Mr. Manoj Lade	Member
6	Ms. Jolly Nikhade	Member

Minutes of Meeting

1) Meeting started on 22nd March 2022 at 2.00 P.M. by welcoming Dr. Latesh Malik (HOD of CSE ,Government College of Engineering, Nagpur) and Prof. Durgesh Sharma (Asst. Prof., GHRCE, Nagpur) and all members of BOS Committee by Ms. Bhagyashree Madan(Secretary, BoS IT)
2) Ms. Bhagyashree Madan explained the action report on 6th Meeting of BOS & overview the agenda of Current Meeting.

Item No. 1 Confirmation of the previous BoS meeting.

The previous meeting (5th BOS Meeting) was held on 06/07/2021 for discussion on the finalization of scheme and syllabus of Third year B.Tech under Autonomous scheme.

Item No. 2 Action Taken Report of the previous BoS meeting.

The secretary presented the minutes of BOS/IT/06/2020-21, to all the members and action taken on it. Following points were presented under this item.

Item No.	Item	Action Taken
01	• Approval to UG Syllabus	All the suggested changes/modifications were incorporated in the respective subjects. The changes were made in the theory as well as in practical's as suggested

	• Suggestion by Dr. Latesh Malik (Member, Academician) and Mr.Durgesh Sharma (Member, Alumni)	and the syllabus is finalized. The final draft of syllabus of 5th and 6th semester is ready.

Item No. 3	To Check Status of online course for 7th Semester & planning for 8th semester

1) In VII semester, under autonomous scheme, 20 % courses are considered to be studied by the students in self study mode through NPTEL/Swayam Portal. The subject "Design and Analysis of Algorithm " has been completed under 20% category.
2) In VI semester, the subject "Cloud Computing", has been taken as 20 % online in self study mode

Item No. 4	To discuss B. Tech. (Honors) Major & Minor domain specialization.

The concept "Major and Minors at B.Tech. level" is introduced to enhance learning skills of the students, acquisition of additional knowledge, in domains other than the disciplines being pursued by the students through Online mode, to make the students better employable with additional knowledge and encourage students to pursue cross discipline research.

The experts appreciated the scheme of different domains of major in IT and minors in cross discipline.

Item No. 5	Review of 4th Year Syllabi.

In the review of Fourth Year Syllabus
1) The expert has suggested to include one more text book for the subject "**Data Science**"(VII SEM IT).

2) Experts have suggested to split the 1st unit into two and remove the 4th unit i.e expert system in the syllabus of **AI & Cognitive Robotics** (VII SEM IT).

3) Dr. Latesh Malik suggested to verify all the contents are in book or not for **Computer Forensic** subject (VII SEM).

4) Add one unit related to programming in **Robotics & Automation** (VII SEM IT), also add reference book related to it.

5) Add the topic Sentimental Analysis to the subject **NLP** (VII SEM)

6) Include content related to AI in **AI in Digital Forensic** subject. (VII SEM)

7) Ensure that availability of Textbook and Reference Books in College Library.

8) Experts suggested to include NPTL Related software in **Middleware Technologies (Lab)** (VII Sem)

9) Merge the topic CSS & HTML. Include Database and MYSQL in **Full Stack Development subject.** (VII SEM)

Item No. 6	Question paper setting and moderation for various subjects.

BoS Chairman, expert and members decided to continue the current pattern for Question paper setting and moderation for various subjects for the academic year and no further modification required.

Item No. 7	Any other matter with the permission of the Chair.

No other matter is discussed.

The meeting was concluded with vote of thanks.

Prof. Mirza M.Baig
Chairman, Board of Studies,
JDCOEM, Nagpur

Sr. No.	Name of the Faculty	Sign
1.	Mr. M.M.Baig	
2.	Ms. Bhagyashree Madan	
3.	Ms. Jolly Nikhade	
4.	Mr. Manoj Lade	
External Member		
1	Dr.Latesh Malik	
2	Mr.Durgesh Sharma	

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Session: 2020-21

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Course Structure and Syllabus (Autonomous)

For

Third Semester B. Tech. in Electronics and Telecommunication Engineering

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				Credit
				L	T	P	CA	MSE	ESE	Total	
1	BSC	ET3T001	Multivariate Calculus	2	1	0	20	20	60	100	3
2	ESC	ET3T002	Electronic Devices & Circuits-I	3	1	0	20	20	60	100	4
3	PCC	ET3T003	Analog communication system	2	1	0	20	20	60	100	3
4	PCC	ET3T004	Digital Circuits and microprocessor	2	1	0	20	20	60	100	3
5	PCC	ET3T005	Integrated circuit and application	3	1	0	20	20	60	100	4
6	PCC	ET3T006	Network synthesis and analog filter	2	1	0	20	20	60	100	3
7	ESC	ET3L002	Electronic Devices & Circuits-I lab	0	0	2	60	0	40	100	1
8	PCC	ET3L003	Analog communication system lab	0	0	2	60	0	40	100	1
9	PCC	ET3L004	Digital Circuits and microprocessor Lab	0	0	2	60	0	40	100	1
10	Internship	ET3F007	Field Training-1	0	0	0	0	0	50	50	1
11	MC	ET3T008	Innovation and Entrepreneurship Development	2	0	0	10	15	25	50	Audit
			Total	**16**	**6**	**6**	**310**	**135**	**555**	**1000**	**24**

ET3T001	Multivariate Calculus	3 Credit

Course outcomes:

Students will be able to:

1. Describe properties of Laplace transform, Convolution Theorem, Fourier integral theorem, Parseval's identity, Cauchy's integral theorem, Cauchy's residue theorem.
2. Illustrate the examples using Laplace transform, Fourier Transform, Partial differential equation, Function of Complex Variables, Matrices.
3. Apply the knowledge of Laplace transform, Z-transform, function of complex variable, Advance partial differential equation.
4. Analyze the question on Laplace transform, Fourier Transform, Partial differential equation, Function of Complex Variables
5. Create a modal using Laplace transform, Fourier Transform, Theory of probability, Function of Complex Variables, Matrices.

Course Contents:

Module-1: Matrices **[6 Hrs]**

Characteristics equation, Eigen values and Eigen vectors, Statement and Verification of Cayley Hamilton Theorem [without proof], Reduction to Diagonal form, Sylvester's theorem [without proof.]

Module-2: Laplace Transform **[5 Hrs]**

Definition – conditions for existence; Properties of Laplace transforms; Transforms of some special functions- periodic function, Heaviside-unit step function.

Module-3: Inverse Laplace Transform **[5 Hrs]**

Introductory remarks; Inverse transforms of some elementary functions; Partial fraction method and Convolution Theorem for finding inverse Laplace transforms; Applications to find the solutions of differential equations.

Module-4: Z-Transform **[5 Hrs]**

Definition, Convergence of Z-transform and Properties, Inverse Z-transform by PartialFraction Method, Residue Method (Inversion Integral Method), Solutions of DifferenceEquations with Constant Coefficients by Z- transform.

Module-5: Theory of Probability **[6 Hrs]**

Axioms of Probability, Conditional Probability, Baye's Rule, Random variables: Discrete and Continuous random variables, Probability function and Distribution function, Joint distributions, Independent Random Variables, Conditional Distributions.

Module-6: Functions of Complex Variables **[5 Hrs]**

Analytic functions; Conjugate functions; Cauchy- Riemann equations in Cartesian and polarforms; Harmonic functions in Cartesian form, Cauchy's integral theorem; Bilinear transform Cauchy's integral formula; Residues; Cauchy's residue theorem (All theorem without proofs)

Text Books:

1. Higher Engineering Mathematics by B. S. Grewal, Khanna Publishers, NewDelhi.

2. Advanced Engineering Mathematics by Erwin Kreyszig, John Wiley & Sons, NewYork.

3. A Course in Engineering Mathematics (Vol III) by Dr. B. B. Singh, Synergy Knowledgeware, Mumbai.

4. A Text Book of Applied Mathematics (Vol I & II) by P. N. Wartikar and J. N.Wartikar, Pune VidyarthiGriha Prakashan, Pune.

5. Higher Engineering Mathematics by H. K. Das and Er. RajnishVerma, S. Chand & CO.Pvt. Ltd., NewDelhi.

Reference Books:

1. Higher Engineering Mathematics by B. V. Ramana, Tata McGraw-Hill Publications, NewDelhi.

2. A Text Book of Engineering Mathematics by Peter O' Neil, Thomson Asia PteLtd., Singapore.

3. Advanced Engineering Mathematics by C. R. Wylie & L. C. Barrett, TataMcgraw-Hill Publishing Company Ltd., NewDelhi.

4. Integral Transforms and Their Engineering Applications by Dr.B.B.Singh, Synergy. Knowledgeware, Mumbai.

5. Integral Transforms by I. N. Sneddon, Tata McGraw-Hill, NewYork.

6. Advanced Mathematics for Engineers by Chandrika Prasad

ET3T002	Electronics Devices and Circuits-I	4 Credit

Prerequisites: Basic knowledge of Semiconductor Physics (FYT106 and FYT110)

Course Objectives:

1. To understand properties, characteristics and behaviour of basic solid state devices such as PN junction diode/BJT/JFET
2. To know and analyse different amplifier configurations.
3. To introduce concepts of feedback in electronic circuits
4. To design Electronic circuits using diodes and transistors

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Explain the working principle, operation and characteristics of basic solid state devices such as PN junction diode, BJT and JFET.
2. Apply the concept of biasing techniques and feedback to improve stability of circuits.
3. Categorize amplifiers and oscillators based on feedback topology.
4. Analyse different amplifier configurations and DC bias circuitry of BJT.
5. Interpret BJT circuits for small signal at low and high frequencies.
6. Design Electronic circuits using diodes and transistors.

Course Contents:

Module-1: Semiconductor Theory and PN Junction Devices **[5 Hrs]**

Energy bands in silicon, intrinsic and extrinsic silicon, Carrier transport in silicon diffusion current, drift current, mobility, and resistivity. Generation and recombination of carriers. P-N junction diode theory, Zener diode, Zener as a Voltage regulator, Tunnel diode, LED, Schottky diode, Varactor Diode operation, characteristics and applications such as Rectifiers, Filters

Module-2: Bipolar Junction Transistors **[5 Hrs]**

BJT Structure, Operation, Input and Output Characteristics in CE, CB and CC configuration, Comparison of transistor configurations,Ebers-Moll model, BJT biasing techniques, Load line concept, Thermal Runaway, Stability factor, Stabilization Techniques, Ratings and specifications of BJT from data sheet.

Module-3: Single Stage Amplifiers **[5 Hrs]**

BJT small signal model – Analysis of CE, CB, CC amplifiers, Concept of frequency response, Miller's theorem, Effect of coupling, bypass, junction and stray capacitance on frequency response of BJT amplifiers

Module-4: Power Amplifiers **[5 Hrs]**

Classes of Power amplifiers – Class A, Class B, Class AB, Class C and Class D amplifiers, Analysis of Class A, Class B, Class AB amplifiers, Distortions in amplifiers, concept of Total Harmonic Distortion, Comparison of power amplifiers

Module-5: Feedback Amplifiers and Oscillators **[5 Hrs]**

Feedback Concept, Classification of amplifiers based on feedback topology, (Voltage, Current, Transconductance and Transresistance amplifiers), Effect of negative feedback on various performance parameters of an amplifier, Analysis of one circuit for each feedback topology. Oscillators: Condition for oscillations, Phase shift – Wien bridge, Hartley, Colpitts and Crystal oscillators

Module-6: Junction Field Effect Transistors **[5 Hrs]**

JFET:-Structure, Symbol, Basic Operation, Drain and Transfer Characteristics, Biasing arrangements for JFET, Biasing against device variation, biasing for zero current drift.

Universal JFET bias curve, Ratings and specifications of JFET from data sheet.

Text Books:

1. Millman & Halkies, "Electronic Devices and Circuits", Second Edition, Tata McGraw Hill.

2. Boylestead & Nashelsky, "Electronic devices and Circuits Theory" Eighth edition, PHI

3. S. Salivahanan, N.Suresh Kumar,"Electronic devices and Circuits", Fourth Edition ,McGraw Hill Education (India) Private Ltd

4. Donald Neaman, "Electronic Circuit Analysis and Design", Third Edition, Tata McGraw Hill

Reference Books.

1. MillmanHalkies, "Integrated Electronics", Seventh edition,Tata McGraw Hill.

2. David A. Bell,"Electronic Device and Circuits", Fourth Edition, PHI.

3. Gupta.J.B, "Electron Devices and Circuits", Second Edition,S.K.Kataria& Sons,

4. Floyd,"Electronic Devices", Seventh Edition, Pearson.

5. Sedra and Smith, "Microelectronic Circuits", Oxford University Press, 2004.

6. Ben G. Streetman "Solid State Electronic Devices", Sixth Edition ,Pearson

E-Resources:

1. https://nptel.ac.in/courses/122/106/122106025/
2. https://onionesquereality.wordpress.com/.../more-video-lectures-iit-open
3. http://www.nesoacademy.org/electronics-engineering/analog-electronics/analog
4. http://www.electronics-tutorials.ws/transistor/tran_1.html
5. http://www.allaboutcircuits.com/textbook/semiconductors/chpt-1/active-versus-passivedevices/

ET3T003	Analog Communication System	3 Credit

Course Objectives:

1. To introduce the concepts of analog communication systems and to make the students understand the functions of major building blocks of communication system and noise performance.
2. To develop a clear insight into techniques involved in different types of modulation and demodulation of AM & FM signals.
3. To introduce the fundamental concepts of sampling theorem.
4. To describe the effect of noise in analog and pulse modulation systems

Course Outcomes:

At the end of this course, the students should be able to,

1. Explain signal to noise ratio, noise figure and noise temperature for single and cascaded stages in a communication system.
2. Distinguish between different types of analog modulation techniques based on bandwidth Occupied and power transmitted.
3. Analyze the performance of analog communications in the presence of noise by evaluating the figure of merit for different schemes of modulation
4. Evaluate different components of analog communication systems such as modulator, demodulator, mixer, receiver etc in time and frequency domain.
5. Design the modulators, demodulators for amplitude and frequency modulated systems.
6. Develop the ability to compare and contrast the strengths and weaknesses of various communication systems.

Course Contents:

Module-1: AM Transmission **[5 Hrs]**

Introduction Overview: Signals and their classifications, Fourier analysis of Signals and Systems. Elements of a Communication System, Need for modulation, Channel, Noise, and Band pass transmission: Complex low pass representation of narrowband signals and systems,
Equivalent low pass transmission model.

Module-2: AM Reception **[6 Hrs]**

Amplitude modulation DSB-FC, DSB-SC, SSB, VSB and ISB transmissions: mathematical Analysis-time and frequency domain analysis, modulation index, generation and detection methods, power requirement of these systems, Comparison of AM modulation schemes, Quadrature Carrier Multiplexing(QAM), frequency division multiplexing.

Module-3: FM Transmission **[6 Hrs]**

Angle Modulation Frequency Modulation (FM),: Single Tone Frequency Modulation, Spectrum Analysis, Narrowband FM, Wideband FM, Transmission Bandwidth of FM Waves, Generation of FM waves: Direct and Indirect Methods, Demodulation of FM, Phase Locked Loops, Limiting of FM waves, comparison between AM & FM, Phase Modulation, Relation between FM and PM.

Module-4: FM Reception **[5 Hrs]**

Radio Receivers and performance in the noise Basic receiver (TRF), Super heterodyne receiver for AM and FM, performance parameters for receiver such as sensitivity, selectivity, fidelity, image frequency rejection etc., AGC technique, Sources of noise, Signal to Noise Ratios, Figure of Merit Calculations, Noise in AM, Pre emphasis and De-emphasis in FM, Comparison of Noise Performance of different modulation schemes.

Module-5: Applications of AM and FM **[4 Hrs]**

Applications of AM and FM AM Radio, Television: Video Bandwidth, Choice of Modulation, Colour Television, HDTV, FM Radio, FM Stereo Multiplexing.

Module-6: Acoustics **[5 Hrs]**

Acoustics: Introduction to acoustic transducers, microphone and loud speakers, construction, types, characteristics and applications, Block schematic of Public address system, High quality audio such as stereophonic, Dolby, surround, 3-D etc.

Text Books:

1. J. G. Proakis and M. Salehi, “Communication system engineering”, 2/e, Pearson Education Asia, 2002.

2. R. E. Ziemer, W. H. Tranter, “Principles of Communications: Systems, Modulation, and Noise”, 5/e, John Wiley & Sons, 2001.

3. Simon Haykins and Michael Moher,”Communication Systems”, 5th Edition, John Wiley and sons, 201

4. Communication Systems - Analog and digital, Singh and Sapre, 2nd edition, 2007, TMH.

Reference Books:

1. Wayne Tomasi, "Electronic Communications Systems – Fundamentals Through advanced", 5th Edition Pearson Education, 2012

2. H. Taub and D. L. Schilling, Principles of Communication Systems, 3rd Reprint,McGraw Hill, 2006.

3. George Kennedy and Bernard Davis," Electronic Communication systems", 4thEdition, TMH, 2008

4. Modern digital and analog Communication systems, B. P. Lathi, 3rd edition, 2015, Oxford University Press.

5. Roddy and Coolen, "Electronic Communication Systems", Pearson Education.

6. Frank R. Dungan, "Electronic Communication Systems", Delmar Publishers.

ET3T004	Digital Circuits and Microprocessor	3 Credit

Course Objectives:

1. Develop a strong foundation of digital electronics.
2. Understand concepts of combinational and sequential circuits.
3. Develop and design synchronous circuits and sequential machines.
4. Understand the concepts of processors

Course Outcomes:

Students will be able to:

1. Define Logic Families and Programmable Devices and understand the architecture of logic families and combinational digital circuits and describe the basic concept and interrupts in microprocessors.
2. Classify SOP and POS forms, combinational and sequential circuits, synchronous and asynchronous circuits.
3. Apply the principles of Boolean algebra to manipulate, minimize design logic circuits using logic gates and K-map and Use HDL & appropriate EDA tool for digital logic design and simulation.
4. Analyze combinational logic circuits and sequential circuits.
5. Recommend various combinational logic circuits like code converters, multiplexers, adders in the design of complex hierarchical combinational blocks like multipliers, fast adders etc and Validate sequential logic circuits elements like latches, flip-flops for counters, registers, simple finite state machine and similar circuits.
6. Design modular combinational circuits, synchronous sequential logic circuits and interface various devices with microprocessor.

Course Contents:

Module-1: Logic Simplification **[6 Hrs]**

Boolean Algebra and De Morgan's Theorem, SOP & POS forms, Logic Gates, combinational Logic Optimization Techniques, Canonical forms of Boolean expression. Implementations of Boolean expressions using logic gate, Introduction to logic families & their characteristics such as Fan-In, Fan-out, Propagation delay, Power dissipation, Noise Margin

Module-2: Combinational logic Design **[5 Hrs]**

Comparators, Multiplexers, Demultiplexer, Encoder, Decoder, K-Map, half and full adders, Subtractors, serial parallel adders, Barrel Shifter, ALU. VHDL constructs and codes for combinational circuits.

Module-3: Sequential circuits **[5 Hrs]**

Latches and flip-flops: SR-FF, D-FF, JK-FF, Master-Slave JK-FF & T-FF's, Excitation &Truth Table, Flip-flop conversions, Shift registers. Introduction to Synchronous Counters: Ring counter, Johnson counter.

Module-4: Synchronous machines **[5 Hrs]**

Classification of synchronous machines, Design of synchronous sequential machines using Moore & Mealy circuits: Sequence detector, State diagram and implementation.

Module-5: Fundamentals of Microprocessor **[5 Hrs]**

Basic 8085 microprocessor architecture and its functional blocks, 8085 microprocessor IC pinouts and signals.

Module-6: Programming with 8085 **[6 Hrs]**

Assembly Language Programming Basics, Addressing Modes, Instruction set of microprocessor, Instruction timing diagram. Writing, Assembling & Executing Assembly Language Programs, Memory Interfacing.

Text Books:

1. An approach to digital Design: Morris Mano, Pearson Publications.
2. Microprocessor Architecture, Programming and Applications with the 8085:Ramesh Gaonkar, Penram International Publications.
3. Engineering Approach to Digital Design: W. Fletcher, PHI Publications.

Reference Books:

1. Fundamentals of digital circuits: A. Anand Kumar, Prentice-Hall of India, 4Edition.t
2. Modern digital Electronics: R.P. Jain, Tata McGraw Hill, 4Edition.r
3. Digital Electronic Principles: Malvino, PHI, 3Edition.

ET3T005	Integrated Circuit and Applications	4 Credit

Prerequisites:

1. Concepts of Basic Electrical Engineering.
2. Fundamentals of Engineering Mathematics

Course Objectives:

1. To understand characteristics of various Analog Circuits.
2. To study and interpret the datasheet
3. To study various op-amp parameters and their significance for Op-Amp.
4. To analyze and identify linear and nonlinear applications of Op-Amp.
5. To understand functionalities of PLL.

Course Outcomes:

Students will be able to:

1. Understand and explain the basic concepts of OPAMP.
2. Demonstrate the working principle of various analog circuits.
3. Conduct experiments using analog electronic components, electronic instruments and modern tool.
4. Analyze analog circuits to evaluate various performance parameters.
5. Compare multivibrator circuits, Data converters.
6. Design and realize filters, Oscillators, linear and non-linear applications of Op-Amp.

Course Contents:

Module-1: Introduction to Operational Amplifier **[6 Hrs]**

Op-Amp Fundamentals: Block diagram of operational amplifier, Op-Amp parameters, virtual ground concept, Differential amplifiers, Interpreting datasheet. Inverting & non invertingconfigurations

Circuits with resistive feedback: Concept of feedback & their types.

Module-2: OP-Amp Linear Applications **[6 Hrs]**

Voltage follower, Summing amplifier, scaling and averaging amplifier, Instrumentation amplifier and applications, Integrator and differentiators (Practical considerations and design), current to voltage converters, voltage to current converters, Peak detector, using Op-Amp & Transistor and analog multipliers.

Module-3: OP-Amp Non Linear Applications **[6 Hrs]**

Comparators, Log and antilog amplifiers, Schmitt trigger, Clipper and Clamper, Precision Rectifier. Multivibrators: Bistable, Monostable, Astable multivibrator circuits using Op-Amp, Sample/Hold circuits.

Module-4: Signal Generator **[6 Hrs]**

Principle of Oscillators, Barkhausen's criterion, Oscillator types: RC, LC oscillators, Triangular wave generator, Saw tooth wave generators. Monolithic timer IC 555, applications of IC 555, V to F and F to V converters.

Module-5: Design of Converters and filters **[6 Hrs]**

D-A conversion techniques, A-D Conversion techniques, First and second order Low Pass filter, High Pass filter, Band Pass filter, Band Select and All pass active filters.

Module-6: Phase Locked Loops & multipliers **[6 Hrs]**

Block diagram of PLL free running frequency, lock range, capture range and Sample circuits for each block. Applications of PLL - Frequency synthesizer FM demodulator, AM demodulator, FSK demodulator, Analog multiplier, Multiplier IC.

Text Books:

1. David A. Bell, 'Op-amp & Linear ICs', Oxford, 2013.
2. D. Roy Choudhary, SheilB.Jani, 'Linear Integrated Circuits', II edition, New Age, 2003.
3. Ramakant A. Gayakward, 'Op-amps and Linear Integrated Circuits', IV edition, Pearson Education, 2003 / PHI. 2000.
4. N. C. Goyal and Khetan 'A Monograph on Electronics Design Principals', Khanna Publications
5. Sergio Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", McGraw Hill.

Reference Books:

1. Fiore, "Opamps& Linear Integrated Circuits Concepts & Applications", Cengage, 2010.
2. Floyd ,Buchla, "Fundamentals of Analog Circuits", Pearson, 2013.
3. Jacob Millman, Christos C. Halkias, "Integrated Electronics – Analog and Digital circuits system", Tata McGraw Hill, 2003.
4. Robert F. Coughlin, Fredrick F. Driscoll, 'Op-amp and Linear ICs', PHI Learning, 6th edition, 2012.
5. Tobey, Graham, Huelsman "Operational Amplifier Design and Applications" McGraw Hill.

ET3T006	Network Synthesis and Analog Filter	3 Credits

Prerequisites:

Basic knowledge of network analysis, Ohms law, Kirchoff's Current and Voltage law.

Course Objectives:

1. To review basic components of electric network.
2. To appreciate the consequences of linearity using various network theorems.
3. To analyze Analog circuits that include energy storage elements using Laplace transforms for circuit analysis.
4. To analyze and synthesize waveforms for different electrical parameters.
5. To analyze four terminal networks using two-port parameters
6. To learn about the basics of analog Filters

Course outcomes:

Students will be able to:

1. Define various terminologies and network theorems.
2. Understand the basics of Network synthesis and analog filters.
3. Apply knowledge of mathematics to solve numerical based on network simplification and it will be used to analyze the same.
4. Analyze steady state and transient response of electrical circuits
5. Characterize the transfer function for two – port networks.
6. Design various electrical circuits using network theorems.

Course Contents:

Module-1: Basics of electric circuits **[5 Hrs]**

Basics of electric circuits, circuit elements and their voltage – current relationship,classification of circuit elements, sources – their types and characteristics, concept of equivalent sources, source transformation, nodal analysis of circuits containing resistors, inductors, capacitors, transformers, and both independent and dependent sources to determine current, voltage, power, and energy. Series Circuit, Parallel Circuit, Source shifting, Principe of duality, concept of V-shift and I-shift.

Module-2: Basics of Network Analysis **[5 Hrs]**

Mutual inductance, coefficient of coupling, dot convention, dot marking in coupled coils, mesh analysis of circuits containing resistors, inductors, capacitors, transformers, and both independent and dependent sources to determine current, voltage, power, and energy.

Module-3: Network Theorems **[5 Hrs]**

Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem, Reciprocity Theorem.

Module-4: Laplace Transform **[5 Hrs]**

Review of Laplace Transform, concept of complex frequency, transform impedance and admittance, s – domain impedance and admittance models for resistor, inductor and capacitor, series and parallel combinations of elements. Transformed network on loop and mesh basis, mesh and node equations for transformed networks, time response of electrical network with and without initial conditions by Laplace transform, Transient analysis.

Module-5: Introduction to Active Filters **[6 Hrs]**

Aspects of filter design problem, approximation problem in network theory, maximally flat low pass filter approximation (Butterworth), Chebyshev approximations.

Module-6: Synthesis of Active filters **[5 Hrs]**

Synthesis of Active filters: Low Pass, Band Pass, RC-CR Transformation, Sensitivity, Biquad Circuits.

Text Books:

1. Franklin Kuo, "Network Analysis & Synthesis", Wiley International.
2. Govind Daryanani, "Analysis and Synthesis of Filters".

Reference Books:

1. Kendall Su, "Analog Filters", Kluwer Academic Publisher, 2nd Edition, 2002.
2. John O' Malley, "Basic Circuit Analysis", Schaum's series.
3. Van Valkenberg, "Network Analysis", Pearson Education.

ET3L002	**Electronics Devices and Circuits-I Lab**	**1 Credit**

Prerequisites: Basic knowledge of Semiconductor Physics and theoretical knowledge about the practical.

Course Objectives:

1. To identify Basic electronic components and devices
2. To observe the characteristics of diodes and Transistors
3. To analyze different amplifier configurations and their Frequency response
4. To design Electronic circuits using diodes and transistors

Course Outcomes:

At the end of the laboratory work, students will demonstrate the ability to:

1. Acquire the basic concepts of different semiconductor components and understand the use of semiconductor devices in different electronic circuits.
2. Identify basic devices such as diodes, BJT and JFET from their package information by referring to manufacturer's data sheets.
3. Plot and study the characteristics of semiconductor devices.
4. Simulate Electronic circuits using SPICE.
5. Calculate different performance parameters of transistor.
6. Design, build and test the performance of various circuits.

List of Experiments:

1. To Plot the V- I characteristics of PN junction diode (Silicon), Zener diode, LED under forward and reverse bias conditions.
2. To find the i) Voltage regulation ii) Load Regulation of a Zener shunt regulator
3. To design Half wave rectifier (with and without Filter) and find ripple factor and efficiency of Half wave Rectifier
4. To plot input and output wave forms of the Full Wave Rectifier (with and without Filter) and find ripple factor and efficiency of Full wave Rectifier
5. To observe the action of a Transistor as an Electronic switch
6. To plot input and Output Characteristics of Common Base Transistor configuration
7. To plot input and Output Characteristics of Common Emitter Transistor configuration
8. To obtain Frequency Response of single stage CE Amplifier and Find performance parameters
9. To plot Drain and Transfer characteristics of Field Effect Transistor (JFET) and Find gm,rd and μ from characteristics

10. Design and simulate LC Oscillators (Compare practical and theoretical oscillation frequency)
11. Build and test RC oscillator
12. Design and simulate Power Amplifiers - Class A, Class B, Class AB
13. Design and simulate Voltage Shunt Feedback Amplifiers
14. Design and simulate Current Series Feedback Amplifiers
15. Applications of Diodes: To verify the truth table for Logic Gates (AND & OR) using Diodes

ET3L003	Analog Communication System Lab	1 Credit

Course outcomes:

Students will be able to:

1. Observe SSB detection techniques.
2. Realize various modulation technique..
3. Generate signals using Scilab.
4. Identify and design different analog modulation techniques.
5. Analyze multiplexing systems such as FDM, TDM and QAM.
6. Compare different communication systems by analysing in time and frequency domain.

List of Experiments:

1. To generate amplitude modulated wave and determine the percentage modulation.
2. To generate frequency modulated signal and determine the modulation index and bandwidth for various values of amplitude and frequency of modulating signal.
3. To generate SSB using phase method and detection of SSB signal using Synchronous detector.
4. To generate DSB using phase method and detection of DSB signal using Synchronous detector
5. To generate the pulse amplitude modulated and demodulated signals
6. To implement the pulse width modulated and demodulated signals
7. To Design & generate the pulse position modulated and demodulated signals
8. To Study Differential PULSE Code Modulation & Demodulation
9. Implement and Study the AM Superhetrodyne radio receiver
10. To construct the frequency division multiplexing and demultiplexing circuit and to verify its operation
11. To perform the AM DSB-SC signal Generation and Detection using Scilab Simulink.
12. To perform the FM signal Generation and Detection using Scilab Simulink.
13. Quadrature Amplitude Modulation and Demodulation.
14. Time Division Multiplexing and Demultiplexing.
15. Study of phase modulator.

ET3L004	Digital Circuits and Microprocessor Lab	1 Credit

Course Objectives:

1. To acquire the basic knowledge of digital logic levels and application of knowledge to understand digital electronics circuits.

2. To prepare students to perform the analysis and design of various digital electronic circuits.

3. To study programming based on 8085 microprocessor

Course Outcomes:

Students will be able to:

1. Find and prevent various hazards and timing problems in a digital design.

2. Understand the fundamental of basic gates and their use in combinational and sequential circuits Outline the use of digital components as a switching elements.

3. Develop ability to handle arithmetic operations using assembly language programming.

4. Analyze basic arithmetic and logical circuits required in microcomputer systems.

5. Examine the structure of various number systems and its application in digital design.

6. Design various combinational and sequential circuits and develop skill to build, and troubleshoot cost effective digital circuits.

List of Experiments:

1. Verification and interpretation of truth table for AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR gates.

2. Construction of half / full adder using XOR and NAND gates and verification of its operation.

3. To Study & Verify Half and Full Subtractor.

4. Verify the truth table of RS, JK, T and D flip-flops using NAND & NOR gates.

5. Implementation and verification of decoder/de-multiplexer and encoder using logic gates.

6. Implementation of 4x1 multiplexer and 1x4 demultiplexer using logic gates.

7. Design and verify the 4- Bit Synchronous/ Asynchronous Counter using JK flip flop.

8. Verify Binary to Gray and Gray to Binary conversion using NAND gates only.

9. Verify the truth table of one bit and two bit comparator using logic gates.

10. Write a Program Using 8085 & Verify for:

a. Addition of Two 8-Bit Numbers.

b. Addition of Two 16-Bit Numbers. (With Carry)

11. Write a Program Using 8085 & Verify for:

a. Subtraction of Two 8-Bit Numbers. (Display of Borrow)

b. Subtraction of Two 16-Bit Numbers. (Display of Borrow)

12. Write a Program Using 8085 & Test for Typical Data:

a. Multiplication of Two 8-Bit Numbers by Bit Rotation Method

b. Division of Two 8-Bit Numbers by Repeated Subtraction Method

13. Write a Program to Move a Block of Data Using 8085 & Verify

14. Write a Program to Arrange Number in Ascending Order Using 8085 & Verify.

15. Write a Program to Check Number of 1's and 0's in Given Number Using 8085 &Verify.

ET3T008	Innovation and Entrepreneurship Development	Audit

Course Objectives

1. To understand the importance of Innovation and Idea Generation
2. To understand the concept of entrepreneurship.

Course Outcomes

At the end of the course students will be able to

1. Identify and validate of ideas.
2. Remember Patent registration of Innovation.
3. Understand roles and responsibilities of Entrepreneurship.

Module 1: Innovation **[06Hrs]**

Concept of creativity, innovation, invention, discovery. Methods for development of creativity, convergent & divergent thinking etc. Introduction to Intellectual Property Rights (IPR), Patent and laws related to patents.

Module2: Entrepreneurship **[06Hrs]**

Concept of entrepreneurship, its relations in economic developments, Eventuation of concept of entrepreneur, characteristics of an Entrepreneur, Types of entrepreneurs, Qualities of entrepreneur, Factors affecting growth of entrepreneurship

Module 3: Role of Entrepreneurial Bodies **[06Hrs]**

Theory of achievement, motivation, Medelland's. Experiment, Women entrepreneurship, Role of SSI, its advantages & limitations, policies governing small scale industries, Procedure to set up small scale industrial unit, Advantages and limitations of SSI.

Module4: Role of Entrepreneurial Support **[06 Hrs]**

Factors governing project selection, Market survey, Preparation of project report. Financial, technical & market analysis of project. Entrepreneurial support systems, Role of consultancy organization like, District Industrial Centre, State Industrial Development Corporation, Financial institution, Latest SSI schemes of DIC (to be confirmed from DIC from time to time.

Text Book

1) Entrepreneurship Development, S. S. Khanka, S. Chand Publishers.

Reference Book

1) Creativity Innovation & Entrepreneurship, Zechariah James Blanchard, Needle Rat Business Publishers.

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Education to Eternity

Department of Electronics and Telecommunication Engineering

"Rectifying Ideas, Amplifying Knowledge"

Session: 2020-21

Course Structure and Syllabus (Autonomous)

For

Fourth Semester B. Tech. in Electronics and Telecommunication Engineering

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				Credit
				L	T	P	CA	MSE	ESE	Total	
1	BSC	ET4T001	Partial differential equation and Numerical Methods	2	1	0	20	20	60	100	3
2	ESC	ET4T002	Basics of Python Programming	3	0	0	20	20	60	100	3
3	ESC	ET4T003	Electrical Machines and Instruments	2	1	0	20	20	60	100	3
4	ESC	ET4T004	Electronic Devices and circuits-II	2	1	0	20	20	60	100	3
5	PCC	ET4T005	Signal and system	3	0	0	20	20	60	100	3
6	PCC	ET4T006	Electromagnetic Field	3	1	0	20	20	60	100	4
7	ESC	ET4L003	Electrical Machines and Instruments lab	0	0	2	60	0	40	100	1
8	ESC	ET4L004	Electronic Devices and circuits-II	0	0	2	60	0	40	100	1
9	PCC	ET4L005	Signal and system lab	0	0	2	60	0	40	100	1
10	Internship	ET4F006	Field Training-2	0	0	0	20	0	30	50	1
11	MC	ET4T007	Universal Human Values	2	0	0	10	15	25	50	Audit
			Total	**17**	**4**	**6**	**330**	**135**	**535**	**1000**	**23**

ET4T001	Partial Differential Equation and Numerical Methods	3 Credit

Course Objectives:

1. To prepare students for successful career in industries, for Post Graduate programme and to work in research institutes.
2. To understand different numerical techniques used for solving algebraic and transcendental equations.
3. To understand numerical methods to solve a system of linear equations.
4. To understand numerical integration and differentiation techniques.

Course Outcomes:

At the end of course students will be able to

1. Understand calculation and interpretation of various errors in numerical methods and partial differential equations.
2. Familiar with finite precision computation.
3. Solve nonlinear equations in a single variable and find numerical solutions.
4. Apply Numerical analysis which has enormous application in the field of science and some fields of Engineering.
5. Analyze the numerical integration and differentiation, numerical solution of ordinary differential equation.
6. Design mathematical model for various electronic applications.

Course Contents:

Module-1: Error Analysis **[6 Hrs]**

Significant figures, round-off, precision and accuracy, approximate and true error, truncation error and Taylor series, machine epsilon, data uncertainties, error propagation, importance of errors in computer programming.

Module-2: Solution of Transcendental / Polynomial Equations and System of Linear Equation **[6 Hrs]**

Solution of Transcendental / Polynomial Equations: Finding root of polynomial equations deploying computational methods such as Bisection, Regula-falsi, Newton-Raphson, Seccant, Successive approximation. System of linear equation: Solving linear equations deploying computational methods such as Gauss elimination, Gauss Jordan, Partial pivoting, Matrixtriangularisation (LU decomposition), Cholesky, Gauss Seidel and Jacobi methods.

Module-3: Interpolation and Polynomial Approximation **[6 Hrs]**

Least square approximation, Orthogonal polynomials Chebyshev polynomials, Finite difference operator and their relations, Forward, backward, central and divided difference, Newton's forward divided difference, Backward difference interpolation, Sterling interpolation, Lagrange"s interpolation polynomials, Spline interpolation, Least square approximation.

Module-4: Numerical Integration and Differentiation **[5 Hrs]**

Numerical Integration: Methods based on interpolation such as Trapezoidal rule, Simsons 1/3and 3/8 rules. Numerical differentiation: Euler's method, Modified Euler's method, Taylor'sseries, RungeKutta 2ndand 4th order, Stability analysis of above methods.

Module-5: Advance Partial Differential equations **[6 Hrs]**

Introduction Partial differential equation, method of separation of variables, Application of partial differential equations. (Heat equation, wave equation, Laplace Equation)

Module-6: Object Oriented Programming **[6 Hrs]**

Software Evaluation, Object oriented programming paradigm, Basic concepts of object oriented programming, Benefits of OOP, Object oriented languages, Applications of OOP Beginning with C++: Structure of C++ program, creating the source file, Compiling & linking, Basic data types, User defined data types, Symbolic constants, Declaration of variables, Dynamic initialization of variables, Reference variables, Operators in C++, Scope resolution operator, Type cast operator. Functions in C++: Function prototyping, Inline functions, Function overloading, Friend and virtual functions. Classes and Objects: Specifying a class, Defining member functions, C++ program with class, Arrays within a class, Memory allocation for objects, Constructors, Multiple constructor in class, Dynamic initialization of objects, Dynamic constructor, Destructors.

Texts Books:

1. Steven C Chapra, Reymond P. Canale, "Numerical Methods for Engineers", Tata McGraw Hill Publications, 2010.

2. E. Balaguruswamy, "Numerical Methods", TataMcGraw Hill Publications, 1999.

References Books:

1. V. Rajaraman, "Fundamental of Computers", Prentice Hall of India,NewDelhi, 2003.

2. S. S. Sastri, "Introductory Methods of Numerical Methods", Prentice Hall of India, NewDelhi 3rd edition, 2003.

3. K. E. Atkinson, “An Introduction to Numerical Analysis”, Wiley,1978.
4. M.J. Maron, “Numerical Analysis: A Practical Approach”, Macmillan, New York, 1982D.Ravichandran, "Programming with C++", TMH
5. E. Balagurusamy, "Object-Oriented Programming with C++", TMH, New Delhi,2001, 2ndEdition
6. YeshwantKanetkar, "Let us C++, BPB Pub.", Delhi, 2002, 4thEdition

ET4T002	Basics of Python Programming	3 Credits

Prerequisites: The prerequisite for learning Python is basic knowledge of concepts like Variables, Loops, and Control Statements etc.

Course Objectives:

To make students aware about

1. To understand the role computation can play in solving problems.
2. To understand why Python is a useful scripting language for developers.
3. To learn how to design and program Python applications.
4. To learn how to read and write files in Python
5. To learn how to design object□oriented programs with Python classes.
6. To learn how to use exception handling in Python applications for error handling.

Course Outcomes:

Students will be able to

1. Remember variables, types, operators, data structures, arguments, object oriented programming and libraries.
2. Understand assignment, keyword, expressions, lists, modules, exceptions and standard libraries.
3. Apply variables, types, operators, data structures, arguments, object oriented programming and Libraries.
4. Analyse modern updates in python for keyword, expressions, lists, modules, exceptions, standard libraries.
5. Evaluate storage space required to program python scripts, variables, types, operators and data structures.
6. Create python code to make functional Electronics hardware.

Course Contents:

Module-1: Introduction **[6 Hrs]**

History of Python, Need of Python Programming, Applications Basics of Python Programming Using the REPL(Shell), Running Python Scripts, Variables, Assignment, Keywords, Input-Output, Indentation.

Module-2: Types, Operators and Expressions **[6 Hrs]**

Types – Integers, Strings, Booleans; Operators - Arithmetic Operators, Comparison(Relational) Operators, Assignment Operators, Logical Operators, Bit-wise Operators, Membership Operators, Identity Operators, Expressions and order of evaluations Control Flow- if, if-elif-else, for, while break, continue, pass.

Module-3: Data Structures **[6 Hrs]**

Lists, Operations, Slicing, Methods; Tuples, Sets, Dictionaries, Sequences, Comprehensions.

Module-4: Default Arguments **[6 Hrs]**

Variable-length arguments, Anonymous Functions, Fruitful Functions (Function Returning Values), Scope of the Variables in a Function- Global and Local Variables. Modules: Creating modules, import statement, from. Import statement, name spacing, Python packages, Introduction to PIP, Installing Packages via PIP, Using Python Packages.

Module-5: Object-Oriented Programming OOP in Python **[6Hrs]**

Classes, self-variable Methods, Constructor Method, Inheritance, Overriding Methods, Data hiding, Error, and Exceptions: Difference between an error and Exception, Handling Exception, try except for block, Raising Exceptions, User Defined Exceptions.

Module-6: Brief Tour of the Standard Library **[6 Hrs]**

Operating System Interface – String Pattern Matching, Mathematics, Internet Access, Dates and Times, Data Compression, Multithreading, GUI Programming, Turtle Graphics Testing: Why testing is required ?, Basic concepts of testing, Unit testing in Python, Writing Test cases, Running Tests.

Text Books:

1 Python Programming: A Modern Approach, Vamsi Kurama, Pearson

2. Learning Python, Mark Lutz, Orielly

Reference Books:

1 Think Python, Allen Downey, Green Tea Press

2. Core Python Programming, W.Chun, Pearson

3. Introduction to Python, Kenneth A. Lambert, Cengage

E-Resources:

1.https://www.python.org/

2.https://swayam.gov.in/nd1_noc19_cs41/preview

3. https://www.codecademy.com/learn/learn-python

4. https://www.learnpython.org/

5. https://developers.google.com/edu/python/
6. https://www.datacamp.com/tracks/python-programming
7. https://www.udemy.com/courses/search/?q=python+programming
8. https://docs.python.org/3/tutorial/index.html
9. http://www.pythonchallenge.com/
10. https://www.tutorialspoint.com/python/index.htm

ET4T003	Electrical Machines and Instruments	3 Credit

Course Objectives:

1. Develop a basic foundation of Electrical Machines.

2. Understand the basic principle, construction &operation, of ac and dc machines and electrical Instruments.

3. Understand the performance characteristics of ac and dc machines and electrical Instruments

4. Understand the applications of ac and dc machines as well as electrical Instruments in day today life.

Course outcomes:

Students will be able to:

1. Remember basic principles & construction, of electrical instruments and ac & dc machines.

2. Understand the operation, performance and characteristics of electrical instruments and ac & dc machines.

3. To identify the different issues related to the electrical instruments, speed control and torque improvement in ac & dc machines.

4. Analyse the performance indices of electrical instruments and ac & dc machines. Dc machines during various conditions..

5. Evaluate the operation of ac and dc machines along with the testing of electrical instruments.

6. Solve the different problems related to operation, & performance indices of electrical instruments ac and dc machines.

Course Contents:

Module-1: DC Machines **[5 Hrs]**

Construction, working principle (motor & generator), EMF equation of DC Machine (motor and generator), Types and its characteristics of DC machines (motor and generator), back emf, starters of dc machine, Speed control of DC motor ,Breaking of DC motor, applications of DC machines (motor and generator).

Module-2: Synchronous Machines **[5 Hrs]**

Construction, types, armature reaction, circuit model of synchronous machine, determination of synchronous reactance, phasor diagram, power angle characteristics, parallel operation of synchronous generators, synchronous motor operation, synchronous condenser.

Module-3: Three phase Induction (Asynchronous) Motor **[5 Hrs]**

Types of induction motor, flux and mmf waves, development of circuit model, power across air gap, torque and power output, starting methods, cogging and crawling, speed control, deep bar/ double cage rotor, induction generator, efficiency .of induction motors

Module-4: Special Machines **[5 Hrs]**

Construction, working and application of steeper motor, variable reluctance motor, servo motor, FHP motor, hysteresis, repulsion, linear IM.

Module-5: Electrical Instruments **[6 Hrs]**

Classification selection of transducers strain gauges, LVDT, Temperature transducers, piezoelectric, photosensitive transducers, Hall Effect transducers, proximity devices Digital transducers need of signal conditioning and types, interfacing techniques of transducers with microprocessor and controller.

Module-6: Applications of Electrical Instruments **[5 Hrs]**

Measurement of electrical telemetry thickness vibration,, humidity, thermal conductivity and gas analysis emission computerized tomography, smoke and fire detection, burglar alarm, object counter level measurement, on /off timers, RTC, sound level meter, tachometer, VAW meter.

Text Books:

1. Electrical Machines by Ashfaqu Husain, Dhanpatrai and publication

2. Instrumentation Devices System edition C. S. Rajan, G. R. sharma.

Reference Books:

1. A course in Electrical and Electronic Measurement and Instrumentation" by A. K. Sawhney (Publisher name: Dhanpat Rai& Co.)

2. Electronics Instrumentation by H.S. Kalsi (Publisher McGraw Hill)

3. Abhijit Chakrabarti & Sudipta Debnath, "Electrical Machines", Tata McGraw-hill Publication.

4. William H Hayt, Jack E Kimmerly and Steven M. Durbin, "Engineering Circuit Analysis",Tata McGraw Hill.

5. A.E. Fitzgerald, Charles Kingsley & Jr. Stephen D. Umans, "Electrical Machinery", TataMcGraw-hill Publication 6th Edition.

6. I.J Nagarath& D.P Kothari, "Electrical Machines", Tata McGraw-hill Publication 4thEdition.

7. T. J. E. Miller, "Brushless permanent-magnet and reluctance motor drives", OxfordUniversity Press (1989).

8. B. L. Theraja, "Electrical technology" volume 2, S. Chand.

ET4T004	Electronics Devices and Circuits-II	3 Credit

Prerequisites: Basic knowledge of Semiconductor Physics

Course Objectives:

1. To introduce semiconductor devices MOSFET, it's characteristics, DC analysis, biasing and applications
2. To analyze and interpret MOSFET circuits for small signal
3. To study the different types of voltage regulators
4. To design different electronic circuits

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Explain the working principle, operation and characteristics of Semiconductor devices such as MOSFET
2. Apply Knowledge of semiconductor devices and concepts to implement various electronic circuits.
3. Analyze different amplifier configurations.
4. Evaluate the small signal model and performance parameters of the device.
5. Design different oscillator circuits for various frequencies
6. Build and test the performance of electronic circuits

Course Contents:

Module-1: MOSFET **[6 Hrs]**

Structure, Symbol, Construction of n-channel E-MOSFET, MOS Transistor operation, EMOSFET Characteristics& parameters, non-ideal voltage current characteristics viz. Finite output resistance, body effect, sub-threshold conduction, breakdown effects and temperature effects, N-MOS, P-MOS and CMOS devices

Module-2: MOSFET Biasing and its DC Analysis **[5 Hrs]**

Common source circuit, Load Line & Modes of operation, Common MOSFET configurations: DC Analysis, constant current source biasing, MOSFET as switch, diode/active resistor, Current sink and source, Current mirror

Module-3: CMOS Inverter **[5 Hrs]**

Principle of operation, dc characteristics, transient characteristics, noise margin, static loadMOS inverter, transmission gate

Module-4: Study of CMOS Logic

[6 Hrs]

Study of Combinational logic, gates, compound gates, multiplexers, and memory elements using CMOS technology

Module-5: Oscillators

[5 Hrs]

Barkhausen criterion, stability with feedback. Classification of oscillators, RC Oscillators: FET RC Phase Shift oscillator, Wein bridge oscillator, LC Oscillators: Hartley and Colpitts oscillators, Crystal oscillators, UJT Relaxation oscillator

Module-6: Voltage Regulators

[5 Hrs]

Block diagram of an adjustable three terminal positive and negative regulators (317,337) typical connection diagram, current boosting, Low drop out voltage regulators, Introduction to Switch Mode Power supply (SMPS), Block diagram of SMPS, Types of SMPS. Comparison of Linear Power supply and SMPS

Text Books:

1. Neil Weste and David Harris, Addison-Wesley "CMOS VLSI Design – A Circuits and Systems Perspective", Fourth edition, Pearson

2. R.L.Boylestad & Nashlesky, "Electronic devices and Circuits Theory" Nineth Edition, Prentice Hall of India

3. Donald Neaman, "Electronic Circuit Analysis and Design", Third Edition,TataMcGraw Hill

4. Millman, Halkias, "Integrated Electronics- Analog and Digital Circuits and Systems",Second Edition , Tata McGraw Hill

Reference Books:

1. BrijeshIyer, S. L. Nalbalwar, R. Dudhe, "Electronics Devices & Circuits", SynergyKnowledgeware Mumbai, 2017. ISBN:9789383352616

2. David A. Bell,"Electronic Devices and Circuits", Fourth Edition, PHI

3. Floyd," Electronic Devices", Seventh Edition, Pearson

4. Sedra and Smith, "Microelectronic Circuits", Oxford University Press, 2004

E-Resources:

1. https://nptel.ac.in/content/storage2/courses/117101058/downloads/
2. http://www.nesoacademy.org/electronics-engineering/analog-electronics/analog
3. https://onionesquereality.wordpress.com/.../more-video-lectures-iit-open
4. http://www.electronics-tutorials.ws/transistor/tran_1.html
5. http://www.allaboutcircuits.com/textbook/semiconductors/chpt-1/active-versus-passivedevices/

ET4T005	Signal and System	3 Credit

Prerequisites:

1. Basic Idea of Transform and its mathematical descriptions (Laplace, Fourier and ZTransform)
2. Differential equations and Integrals (advanced level)
3. Ordinary differential equations
4. Series and expansions
5. Fourier analysis and complex Fourier Series/transform
6. Applications of Fourier series, Fourier Transform to circuits.

Course Objectives:

1. To develop a strong foundation of continuous and discrete time signal and system.
2. Introduce ideas for analysis of various types of continuous & discrete time system.
3. Learn fundamental concepts and transforms as relevant to time and frequency domain Signals.
4. Understand the process of sampling and interpolation in real time signal transmission.

Course Outcomes:

1. Understand different types of signals & systems.
2. Familiar with the properties of LTI (Linear Time Invariant System) system and process involved in analysis of signals before transmission.
3. Solve various complex mathematical problems for signal analysis and conversion of signals from one domain to another.
4. Apply knowledge of sampling and interpolation to sample and reconstruct signals during real time signal transmission and reception.
5. Analyze continuous and discrete systems in time and frequency domain.
6. Design Various Mathematical models to Investigate stability of the system.

Course Contents:

Module-1: Basics of signals and system **[6 Hrs]**

Introduction and Classification of signals, Definition of signal, Continuous time and discrete time signal, Classification of signals as even, odd, periodic and non-periodic, Deterministic and non-deterministic, energy and power, elementary signals used for testing, Exponential, sine, impulse, step and its properties, ramp, rectangular, triangular, signum, sinc, Operations on signals, Amplitude scaling, addition, multiplication, differentiation, integration, time scaling, time shifting and time folding, Systems Definition, Classification, linear and non-linear, time variant and invariant, causal and non-causal, static and dynamic, stable and unstable, invertible.

Module-2: Time Response Analysis **[6 Hrs]**

Continuous-Time and Discrete-Time Signals, Transformations of the Independent Variable, Continuous-Time and Discrete-Time Systems, Basic System Properties, Discrete-Time LTI (Linear Time Invariant System) Systems, the Convolution Sum, Continuous-Time LTI Systems, the Convolution Integral, Properties of Linear Time-Invariant Systems, Causal LTI Systems Described by Differential and Difference Equations.

Module-3: Fourier Series Analysis **[6 Hrs]**

The Response of LTI Systems to Complex Exponentials, Fourier Series Representation of Continuous-Time Periodic Signals, Convergence of the Fourier Series, Properties of Continuous-Time Fourier Series, Fourier Series Representation of Discrete-Time Periodic Signals, Properties of Discrete-Time Fourier Series, Fourier Series and LTI Systems, Examples of Continuous-Time Filters Described by Differential Equations, Examples of Discrete-Time Filters Described by Difference Equations.

Module-4: Fourier Transform Analysis **6 Hrs**

The Continuous-Time Fourier Transform, Representation of Aperiodic Signals, The Fourier Transform for Periodic Signals, Properties of the Continuous-Time Fourier Transform, Systems Characterized by Linear Constant-Coefficient Differential Equation, The Discrete-Time Fourier Transform, Representation of Aperiodic Signals, The Fourier Transform for Periodic Signals, Properties of the Discrete-Time Fourier Transform, Systems Characterized by Linear Constant-Coefficient Difference Equations.

Module-5: Frequency Response Analysis **[6 Hrs]**

The Magnitude-Phase Representation of the Frequency Response of LTI Systems, Concept ofFrequency Response, Group Delay, Phase Delay, Time-Domain Properties of Ideal Frequency-Selective Filters, Time- Domain and Frequency-Domain Aspects of Non ideal Filters, First-Order and Second-Order Continuous-Time Systems, Discrete-Time System, Representation of a Continuous-Time Signal by its Samples, the Sampling theorem, Reconstruction of a Signal from Its Samples Using Interpolation, Aliasing effect, Discrete-Time Processing of Continuous-Time Signals.

Module-6: Laplace and Z-Domain Analysis **[6 Hrs]**

The Laplace Transform, Region of Convergence for Laplace Transforms, Inverse Laplace Transform, Properties of the Laplace Transform, Analysis and Characterization of LTI Systems Using Laplace Transform, System Function Algebra and Block Diagram Representations, The Unilateral Laplace Transform, The z-Transform, Region of Convergence for the z-Transform, Inverse z-Transform, Properties of z-Transform, Analysis and Characterization of LTI Systems Using z-Transforms, System Function Algebra and Block Diagram Representations, The Unilateral z-Transform.

Text Books:

1. Simon Haykin, Barry van Veen, "Signals and Systems", John Wiley and Sons (Asia), Private Limited,
2. B. P. Lathi, "Linear Systems and Signals", OXFORD University Press.
3. A.V. Oppenheim, A.S. Willsky and I.T. Young, "Signals and Systems", Prentice Hall,1983.
4. "Signals and Systems", A. NagoorKanni, 2nd Edition, McGraw Hill.

Reference Books:

1. J. Nagrath, S. N. Sharan, R. Ranjan, S. Kumar, "Signals and Systems", TMH New Delhi,2001.
2. M. J. Roberts, "Signals and Systems - Analysis using Transform methods and MATLAB",TMH, 2003.
3. Signals Systems and Transforms, 3rd Edition, 2004, C. L. Philips, J.M.Parr and EveA.Riskin ,Pearson education.
4. S.S. Soliman& M.D. Srinath, "Continuous and Discrete Signals and Systems", Prentice-Hall, 1990.
5. ShailaDinkarApte "Signals and Systems" Principles and Applications",CambridgeUniversityPress.

E-Resources:

1. NPTEL link principal of signals and system.
https://www.youtube.com/watch?v=xrVWB9VYZ64&list=PLq-Gm0yRYwTjwxaqapPsSAHzs4_nkQLVr
2. E-BOOK Signal and Systems Simon Haykin Wiley
https://www.academia.edu/38588821/Signal_and_Systems_Simon_Haykin_Wiley
3. E-BOOK B. P. Lathi, "Linear Systems and Signals",
https://india.oup.com/productPage/5591038/7421214/9780198062271

ET4T006	Electromagnetic Fields	4 Credits

Course Objectives:

Learners can be able to explore their knowledge in the area of EM Waves and its analysis.

1. To learn basic coordinate system, significance of divergence, gradient, curl and its applications to EM Waves.
2. To understand the boundary conditions for different materials /surfaces.
3. To get insight on finding solution for non-regular geometrical bodies using Finite
4. Element Method, Method of Moments, Finite Difference Time Domain.
5. To get the basics of microwave, transmission lines and antenna parameters.
6. Students get acquainted with different physical laws and theorems and provide basic platform for upcoming communication technologies.

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Understand characteristics and wave propagation on high frequency transmission lines
2. Carryout impedance transformation on TL
3. Use sections of transmission line sections for realizing circuit elements
4. Characterize uniform plane wave
5. Calculate reflection and transmission of waves at media interface
6. Analyze wave propagation on metallic waveguides in modal form
7. Understand principle of radiation and radiation characteristics of an antenna

Course Contents:

Module-1: Maxwell's Equations **[6 Hrs]**

Maxwell's Equations Basics of Vectors, Vector calculus, Basic laws of Electromagnetics, Maxwell's Equations, Boundary conditions at Media Interface

Module-2: Uniform Plane Wave **[6 Hrs]**

Uniform Plane Wave Uniform plane wave, Propagation of wave, Wave polarization, Poincare"s Sphere, Wave propagation in conducting medium, phase and group velocity, Power flow and Poynting vector, Surface current and power loss in a conductor.

Module-3: Transmission Lines **[6 Hrs]**

Equations of Voltage and Current on TX line, Propagation constant and characteristic impedance, and reflection coefficient and VSWR, Impedance Transformation on Loss-less and Low loss Transmission line, Power transfer on TX line, Smith Chart, Admittance Smith Chart, Applications of transmission lines: Impedance Matching, use transmission line sections as circuit elements.

Module-4: Plane Waves at a Media Interface **[6 Hrs]**

Plane wave in arbitrary direction, Reflection and refraction at dielectric interface, Total internal reflection, wave polarization at media interface, Reflection from a conducting boundary.

Module-5: Wave propagation **[6 Hrs]**

Wave propagation in parallel plane waveguide, Analysis of waveguide general approach, Rectangular waveguide, Modal propagation in rectangular waveguide, Surface currents on the waveguide walls, Field visualization, Attenuation in waveguide

Module-6: Radiation **[6 Hrs]**

Solution for potential function, Radiation from the Hertz dipole, Power radiated by hertz dipole, Radiation Parameters of antenna, receiving antenna, Monopole and Dipole antenna

Text/Reference Books

1. R.K. Shevgaonkar, Electromagnetic Waves, Tata McGraw Hill India, 2005
2. E.C. Jordan & K.G. Balmain, Electromagnetic waves & Radiating Systems, Prentice Hall, India
3. Narayana Rao, N: Engineering Electromagnetics, 3rd ed., Prentice Hall, 1997.
4. David Cheng, "Electromagnetics", Prentice Hall.
5. Sadiku, "Elements of Electromagnetics", Oxford.
6. Krauss, "Electromagnetics", McGraw Hill, New York, 4th edition.
7. W. H. Hayt, "Engineering Electromagnetics", McGraw Hill, New Delhi, 1999.
8. Edminister, Schaum series, "Electromagnetics", McGraw Hill, New York, 1993, 2nd edition.
9. Sarvate, "Electromagnetism", Wiley Eastern.

ET4L003	Electrical Machines and Instruments Lab	1 Credit

Course Outcomes:

Students will be able to:

1. Remember basic principles & construction, of electrical instruments and ac & dc machines.
2. Understand the operation, performance and characteristics of electrical instruments and ac & dc machines.
3. To identify the different issues related to the electrical instruments, speed control and torque improvement in ac & dc machines.
4. Analyse the performance indices of electrical instruments and ac & dc machines.
5. Evaluate the operation of ac and dc machines along with the testing of electrical instruments.
6. Solve the different problems related to operation, & performance indices of electrical instruments ac and dc machines.

List of Experiments:

1. To study the construction of field and armature of DC Machine.
2. To determine external characteristics of DC Generator
3. To perform Load test on DC shunt motor.
4. To perform speed control of DC shunt motor using armature and field control method.
5. To perform Load test on DC shunt generator.
6. .To study and perform the voltage build up in the DC shunt Generator
7. To study the internal construction of three phase induction motor.
8. To perform no Load and block rotor tests on squirrel cage induction motor
9. To study various starting methods of three phase induction motor
10. To control speed of induction motor by V/F control
11. To control speed of slip ring induction motor by rotor resistance control
12. To study the internal construction of three phase synchronous machine.
13. Determination of sequence impedance of salient pole synchronous machine
14. To perform speed control of Stepper motor
15. To study various electrical instruments with their industrial applications.

ET4L004	Electronic Circuit and Devices-II Lab	1 Credit

Prerequisites: Basic knowledge of Semiconductor Physics and theoretical knowledge of respective practical.

Course Objectives:

1. To identify Basic electronic components and devices
2. To observe the characteristics of MOSFET, CMOS Inverter, UJT
3. To analyze different amplifier configurations and their Frequency response
4. To design and Simulate Electronic circuits

Course Outcomes:

At the end of the laboratory work, students will demonstrate the ability to:

1. Acquire the basic concepts of different semiconductor components and understand theuse of semiconductor devices in different electronic circuits.
2. Plot and study the characteristics of semiconductor devices like MOSFET, UJT
3. Simulate Electronic circuits using SPICE.
4. Calculate different performance parameters of transistor.
5. Design, build, and test the performance of various circuits.

List of Experiments:

1. To Plot Drain and Transfer characteristics of N- Channel E- MOSFET
2. To design NMOS Common source amplifier
3. To obtain the frequency response of MOSFET amplifier in common source configuration with given specifications
4. To Study MOSFET as a Switch
5. To assemble and characterize MOSFET current mirrors
6. To design and plot the static (VTC) and dynamic characteristics of a digital CMOS inverter using Virtual lab
7. To design and plot the dynamic characteristics of 2-input NAND and NOR logic gates using CMOS technology using Virtual lab
8. Implement 2:1 Multiplexer using transmission gate
9. Implementation of NAND and NOR gate
10. To Design and Simulate Wein Bridge oscillator using FET
11. To Design and Simulate RC Phase shift oscillator using FET
12. To Design and Simulate Hartley Oscillator using FET

13. To Design and Simulate Colpitts Oscillator using FET
14. To Study the operation of UJT as a Relaxation Oscillator
15. To Design adjustable Voltage Regulated Power Supply using LM317

ET4L005	Signal and System Lab	1 Credit

Course Objectives:

1. Develop a strong foundation of continuous and discrete time signal and system analysis using Scilab.
2. Understand the various continuous and discrete time signals generation methods.
3. Understand the basic operations on the signals.
4. Understand the Design and analysis of linear time-invariant (LTI) systems.
5. Understand the spectral characteristics of signals using Fourier analysis.
6. Develop a strong foundation of systems using Laplace transform and Z-transform

Course Outcomes:

Upon successful completion of this course the students will be able to:

1. Understand basics of Scilab syntax, functions and programming.
2. Familiar With characterization of various continuous and discrete time signals.
3. Solve the Problems on basic operations on the signals.
4. Apply Knowledge of linear time-invariant (LTI) systems for computing its response.
5. Analyze the spectral characteristics of signals using various transforms.
6. Design the Mathematical model of systems using various transforms.

List of Experiments:

1. Introduction to Scilab.
2. To create user defined functions for generating Continuous and Discontinues time sinusoidal signal.
3. To create user defined functions for generating Continuous and Discontinues time delta signal and unit step signal.
4. To create user defined functions for generating Continuous and Discontinues time Exponential and RAMP Signal.
5. To create user defined functions for signal operation: signal addition, subtraction, and multiplication.
6. To create user defined functions for signal operation: time shifting, time scaling and time inversion.
7. To compute convolution of two signals and verify its properties.
8. To compute auto-correlation of two signals and verify its properties.
9. To compute cross-correlation of two signals and verify its properties.
10. To obtain the response of LTI system defined by linear constant coefficient difference equations.
11. To synthesize the periodic signal using Fourier series.

12. To analyze the spectrum of the signal using Fourier transform and verify its properties.

13. To compute and plot the impulse response and pole-zero diagram of transfer function using Laplace transform

14. To compute and plot the impulse response and pole-zero diagram of transfer function using Z-transform.

15. Program for calculating Inverse z-transform of Given function.

16. Program for calculating Inverse Laplace-transform of Given function

17. To Analyze discrete-time signals with the (discrete) Fast Fourier transform

18. To find whether the system is linear or nonlinear for the given signal.

ET4T007	Universal Human Values	Audit

Course Objective:

The objective of the course is four fold:

1. Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
2. Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
3. Strengthening of self-reflection.
4. Development of commitment and courage to act.

Course Contents:

Module 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

1. Purpose and motivation for the course, recapitulation from Universal Human Values-I
2. Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration
3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
4. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority
5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
6. Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking

Module 2: Understanding Harmony in the Human Being - Harmony in Myself!

7. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
8. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility
9. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
10. Understanding the characteristics and activities of 'I' and harmony in 'I'
11. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail

12. Programs to ensure Sanyam and Health. Include practice sessions to discuss the role others have played in making material goods available to me.
Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease

Module 3: Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship

13. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship

14. Understanding the meaning of Trust; Difference between intention and competence

15. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship

16. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals

17. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives

Module 4: Understanding Harmony in the Nature and Existence - Whole existence as Coexistence

18. Understanding the harmony in the Nature

19. Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self regulation in nature

20. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space

21. Holistic perception of harmony at all levels of existence. Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

Module 5: Implications of the above Holistic Understanding of Harmony on Professional Ethics

22. Natural acceptance of human values

23. Definitiveness of Ethical Human Conduct

24. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order

25. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.

26. Case studies of typical holistic technologies, management models and production systems

27. Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations

28. Sum up. Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. to discuss the conduct as an engineer or scientist etc.

Text Books:

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010

Reference Books:

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj - PanditSunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

JAIDEV EDUCATION SOCIETY'S

JD COLLEGE OF ENGINEERING AND MANAGEMENT

KATOL ROAD, NAGPUR

Website:www.jdcoem.ac.in E-mail:info@jdcoem.ac.in

Education to Eternity

An Autonomous Institute, with NAAC "A" Grade

Department of Electrical Engineering

AY-2021-22

।। ज्ञानम् सर्वार्थ साधनम् ।।

VISION	MISSION
"To develop competent and committed Electrical Engineers to serve the society"	1. To impart quality education in the field of Electrical Engineering. 2. To be excellent learning centre through research and industry interaction.

Teaching Scheme

Branch code: EE

I Semester

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				Credit
				L	T	P	CA	MSE	ESE/Ext. Pra.	Total	
1	HSMC	HU2T001	Communication Skills	2	0	0	60	0	40	100	2
2	BSC	MA2T001	Engineering Mathematics- II	3	1	0	20	20	60	100	4
3	BSC	EE2T002	Engineering Chemistry	3	1	0	20	20	60	100	4
4	ESC	EE2T003	Engineering Graphics	1	0	0	20	20	60	100	1
5	HSMC	HU2L001	Communication Skills Lab.	0	0	4	60	0	40	100	2
6	BSC	EE2L002	Engineering Chemistry Lab	0	0	2	60	0	40	100	1
7	ESC	EE2L003	Engineering Graphics Lab	0	0	4	60	0	40	100	2
8			Induction Programme	3 Weeks							
9	ESC	EE2T004	Basic Civil and Mechanical Engineering	2	0	0	10	15	25	50	Audit
				11	**2**	**10**					**16**

II Semester

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				Credit
				L	T	P	CA	MSE	ESE/Ext. Pra.	Total	
1	HSMC	HU1T002	Introduction to Computer programming	2	0	0	20	20	60	100	2
2	BSC	MA1T001	Engineering Mathematics- I	3	1	0	20	20	60	100	4
3	BSC	EE1T005	Engineering Physics	3	1	0	20	20	60	100	4
4	ESC	EE1T006	Energy and Environment Engineering	3	0	0	20	20	60	100	3
5	HSMC	HU1L002	Introduction to Computer programming Lab	0	0	4	60	0	40	100	2
6	ESC	WS1L001	Workshop Practices	0	0	4	60	0	40	100	2
7	BSC	EE1L005	Engineering Physics Lab	0	0	2	60	0	40	100	1
8			Societal Internship/ Field Training	Report submission						50	1

9	ESC	EE1T007	Basic Electrical and Electronics Engineering	2	0	0	10	15	25	50	Audit
				13	**2**	**10**					**19**
				25							

III Semester

Sr. No.	Subject Category	Subject Code	Course Title	Teaching Scheme			Evaluation Scheme				Credits
				L	T	P	CA	MSE	ESE	TOTAL	
1	HSMC	EE3T001	Engineering Economics	2	0	0	20	20	60	100	2
2	BSC	EE3T002	Engineering Mathematics –III	3	1	0	20	20	60	100	4
3	ESC	EE3T003	Fundamentals of Electrical Engineering	3	1	0	20	20	60	100	4
4	PCC-EE	EE3T004	Network Analysis and synthesis	3	0	0	20	20	60	100	3
5	PCC-EE	EE3T005	Electrical Machine I	2	1	0	20	20	60	100	3
6	PCC-EE	EE3T006	Measurement and Instrumentation	2	1	0	20	20	60	100	3
7	PCC-EE	EE3L004	Network Analysis and synthesis Lab	0	0	2	60	0	40	100	1
8	PCC-EE	EE3L005	Electrical Machine I Lab	0	0	2	60	0	40	100	1
9	PCC-EE	EE3L006	Measurement and Instrumentation Lab	0	0	2	60	0	40	100	1
10	PROJ-EE	EE3P001	Field trainning/ Internship/ industrial visit	0	0	0	0	0	50	50	1
11	MC	EE3T007	Universal Human Values -II	2	0	0	10	15	25	50	Audit
				17	**4**	**6**	**310**	**135**	**555**	**1000**	
								Total Credits			**23**

IV Semester

Sr. No.	Subject Category	Subject Code	Course Title	Teaching Scheme			Evaluation Scheme				Credits
				L	T	P	CA	MSE	ESE	**TOTAL**	
1	HSMC	EE4T001	Advanced Physics	2	0	0	20	20	60	100	2
2	BSC	EE4T002	Numerical method and probability	2	1	0	20	20	60	100	3
3	ESC	EE4T003	Power Station Practice	4	0	0	20	20	60	100	4
4	PCC-EE	EE4T004	Electronic Devices and circuits	3	0	0	20	20	60	100	3
5	PCC-EE	EE4T005	Power System I	2	1	0	20	20	60	100	3
6	PCC-EE	EE4T006	Electrical Machine II	3	0	0	20	20	60	100	3
7	BSC	EE4L002	Numerical method and probability Lab	0	0	2	60	0	40	100	1
8	PCC-EE	EE4L005	Power System I Lab	0	0	2	60	0	40	100	1
9	PCC-EE	EE4L006	Electrical Machine II Lab	0	0	2	60	0	40	100	1
10	PROJ-EE	EE4P002	Field trainning/ Internship/ industrial visit	0	0	0	0	0	50	50	1
11	MC	EE4T007	Innovation and entrepreneurship Development	2	0	0	10	15	25	50	Audit
				18	**2**	**6**	**310**	**135**	**555**	**1000**	

Total Credits	22

V Semester

Sr. No.	Subject Category	Subject Code	Course Title	Teaching Scheme			Evaluation Scheme				Credits
				L	T	P	CA	MSE	ESE	TOTAL	
1	PCC-EE	EE5T001	Power Electronics	3	0	0	20	20	60	100	3
2	PCC-EE	EE5T002	Control System I	2	1	0	20	20	60	100	3
3	PCC-EE	EE5T003	Power System II	3	0	0	20	20	60	100	3
4	PEC-EE	EE5TE01	**Elective I**	3	0	0	20	20	60	100	3
5	PEC-EE	EE5TE02	**Elective II**	3	0	0	20	20	60	100	3
6	OEC-EE	EE5TO01	**Open Elective I**	4	0	0	20	20	60	100	4
7	PCC-EE	EE5L001	Power Electronics Lab	0	0	2	60	0	40	100	1
8	PCC-EE	EE5L002	Control System I Lab	0	0	2	60	0	40	100	1
9	PCC-EE	EE5L003	Power System II Lab	0	0	2	60	0	40	100	1
10	PROJ-EE	EE5P003	Mini Project (Phase I)	0	0	2	0	0	50	50	2
11	MC	EE5T004	Consumer Affairs	2	0	0	10	15	25	50	Audit
				20	**1**	**8**	**310**	**135**	**555**	**1000**	
							Total Credits				**24**

VI Semester

Sr. No.	Subject Category	Subject Code	Course Title	Teaching Scheme			Evaluation Scheme				Credits
				L	T	P	CA	MSE	ESE	TOTAL	
1	PCC-EE	EE6T001	Microprocessor and microcontroller	3	0	0	20	20	60	100	3
2	PCC-EE	EE6T002	Advanced Control System	3	0	0	20	20	60	100	3
3	PEC-EE	EE6TE03	**Elective III**	3	0	0	20	20	60	100	3
4	PEC-EE	EE6TE04	**Elective IV**	3	0	0	20	20	60	100	3
5	OEC-EE	EE6TO01	**Open Elective II**	4	0	0	20	20	60	100	4
6	PCC-EE	EE6L001	Microprocessor and microcontroller Lab	0	0	2	60	0	40	100	1
7	PCC-EE	EE6L003	Cad Lab	0	0	2	60	0	40	100	1
8	PROJ-EE	EE6P004	Mini Project phase II	0	0	2	0	0	50	50	2
9	MC	EE6T003	Research Methodology	2	0	0	10	15	25	50	Audit
				15	**0**	**6**	**210**	**95**	**395**	**700**	
								Total Credits			**20**

Prof. A. V.Joshi
Member Secretary
Board of Studies, EE Dept

Chairman
Board of Studies, EE Dept

JAIDEV EDUCATION SOCIETY'S

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An Autonomous Institute, with NAAC "A" Grade

At: Khandala, Post- Valni, Kalmeshwar Road, Nagpur

Department Of Electrical Engineering

"Igniting minds to illuminate the world"

Session: 2021-22

Course Structure and Syllabus (Autonomous)

For

B. Tech. Electrical Engineering Programme

VISION AND MISSION OF INSTITUTE

VISION

To be a centre of excellence imparting professional education satisfying societal and global needs.

MISSION

Transforming students into lifelong learners through quality teaching, training and exposure to concurrent technologies. Fostering conducive atmosphere for research and development through well-equipped laboratories and qualified personnel in collaboration with global organizations.

VISION AND MISSION OF THE DEPARTMENT

VISION

To be the eminent department known for producing globally proficient electrical graduates possessing finest human values, to achieve sustainable socio-economic development

MISSION

To transform students into academically and technically sound electrically sound engineers.
To enhance teaching learning process by dedicated qualified professionals.
To promote research and development with current techniques through well developed educational environment.

PROGRAM EDUCATIONAL OBJECTIVES (PEO's)

PEOs	ATTRIBUTES
PEO 1	To prepare the graduates for professional careers with strong fundamental knowledge in science, mathematics, English and Engineering sciences and capable to develop core competency in electrical engineering domain or enable to pursue higher education.
PEO 2	The graduates can comprehend, analyze, design and create novel ideas and provide solutions to electrical engineering problems that are technically sound, economically feasible and socially acceptable.
PEO 3	The graduates will be leaders with strong communication and interpersonal skills, capability to work efficiently in multidisciplinary teams, understanding of ethical and environmental concerns in engineering practices and deal with social and safety issues along with respect for intellectual property.

Dr.S.R.Vaishnav
Chairman
Board of Studies, EE Dept

PROGRAM OUTCOMES (PO's)

POs	ATTRIBUTES
1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3	**Design/ development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life -long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOS):

At the end of Electrical Engineering program the student will have following Program specific outcomes.

PSO1: Interpret, identify and analyze problems in electrical domain and demonstrate this knowledge to develop, control and assess electrical systems.

PSO2: Solve ethically and professionally various Electrical Engineering problems in societal and environmental context and communicate effectively.

PSO3: Apply modern software tools for design, simulation and analysis of electrical systems to engage in life-long learning and to successfully adapt in multi disciplinary environments

Recommendations for conducting one theory course of curriculum through online Teaching / Learning

1. Only Swayam / NPTEL platform is allowed.

2. One defined subject per semester in online mode and BOS should declare that one subject for online mode based on availability of NPTEL offering before commencement of the semester.

3. Student will be allowed to appear for NPTEL / Institute level / University Examination as applicable.

4. In order to ensure learning, NPTEL lectures to be telecast in the class by including it in regular time table if required.

5. 75% assignment submission is mandatory for these online classes also like regular lecture attendance.

6. One faculty to be allotted for this subject, who will discuss and solve student's doubts. Allot 3 hrs/week load to teacher who is allotted to work as facilitator of online course.

7. For Autonomy Students: For online mode the student should submit all assignment given by nptel then his/her score has weightage of 40% for CA & MSE. And if student clear the nptel final exam and producing certificate then 60% weghtage should be given as ESE, otherwise he/she has to appear for Makeup exam of Institute.

If student cannot enroll for NPTEL then he/she has to study online videos / material and these students should appear for Mid Semester, CA-I , CA-II and End sem exams of the Institute.

8. For DBATU students: For online mode he has to appear for CA-I, CA-II, Mid sem exam of the institute and End sem exam of University.

If student can't enroll for NPTEL then he/she has to study online videos / material and these students should appear for Mid Semester, CA-I , CA-II of the institute and End sem exams of the University.

10. If the credits of NPTEL/ SWAYAM courses do not match with the existing subject proper scaling will be done)

This system will ensure real learning; avoid any problem arising due to cancellation of NPTEL exam as it happened in this semester. At least for first year and in the unpredictable situation of covid pandemic these provisions will avoid any last moment chaos.

Course Structure and Syllabus

For

B. Tech. Electrical Engineering Programme

Curriculum for Semester- I [First Year]

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				Credit
				L	T	P	CA	MSE	ESE/Ext. Pra.	Total	
1	HSMC	HU1T002	Introduction to Computer programming	2	0	0	20	20	60	100	2
2	BSC	MA1T001	Engineering Mathematics- I	3	1	0	20	20	60	100	4
3	BSC	EE1T005	Engineering Physics	3	1	0	20	20	60	100	4
4	ESC	EE1T006	Energy and Environment Engineering	3	0	0	20	20	60	100	3
5	HSMC	HU1L002	Introduction to Computer programming Lab	0	0	4	60	0	40	100	2
6	ESC	WS1L001	Workshop Practices	0	0	4	60	0	40	100	2
7	BSC	EE1L005	Engineering Physics Lab	0	0	2	60	0	40	100	1
8			Induction Programme	3 Weeks							
9	ESC	EE1T007	Basic Electrical and Electronics Engineering	2	0	0	10	15	25	50	Audit
				13	**2**	**10**					**18**

HU1T002	Introduction to Computer Programming	4 Credit

COURSE OBJECTIVES:

1. To understand the importance of Programming
2. To understand the application of C Programming.
3. To investigate the key concepts of C Programming.
4. To enable students build a applications based on C programming

COURSE OUTCOME:

CO1: Define the algorithms, flowcharts, array, pointer, structure, function, and python.

CO2: Discuss and differentiate between variables, operators, statements, loops, array dimensions.

CO3: Demonstrate working programs using functions, loops, conditional statements, array, pointer, structure and files in C and python language.

CO4:Distinguish between different steps of programming and prioritize levels of programming.

CO5:Find errors and predict outcome in C and python programming.

CO6:Compose and develop any application using C and python programming.

Unit I: Basic of Programming Language **(6 Hrs)**

HLL, LLL, Language translator, Error checking, Debugging, Programming processes, Flowcharts, Algorithms along with asymptotic notation.

Unit II: Types, Operators and Expressions in C language **(6 Hrs)**

Variable names, Data types, sizes, constants, declarations, arithmetic operators, relational and logical operators, type conversions, increment and decrement operators, bitwise operators, assignment operators and expressions, conditional expressions precedence and order of evaluation.

Unit III: Control Flow: **(6 Hrs)**

Statements and Blocks. If-else, else-if, switch, Loops: while and for, do-while break and continue go to and Labels. Initializing arrays, Initializing character arrays, multidimensional arrays, Introduction to pointers.

Unit IV: Functions and Pointers in Python **(6 Hrs)**

Functions and Program Structure: Basic of functions, functions returning non-integers external variables scope rules.

Pointers in Python: Pointers to integers, characters, floats, arrays.

Unit V: **(6 Hrs)**

Structures in Python: Basics of structures, structures with functions, arrays of structures.

File handling in Python: Basics of file handling.

Text Books

1. Let Us C by Yashavant Kanetkar.
2. Let Us C Solutions by Yashavant Kanetkar
3. Data Structure through C by Yashavant Kanetkar.

Reference Books

1. C Programming: A Modern Approach (2nd Edition) - K. N. King (2008). A good book for learning C.
2. Programming in C (4th Edition) - Stephen Kochan (2014). A good general introduction and tutorial.
3. C Primer Plus (5th Edition) - Stephen Prata (2004)
4. A Book on C - Al Kelley/Ira Pohl (1998).
5. The C Book (Free Online) - Mike Banahan, Declan Brady, and Mark Doran (1991).

HU1L002	**Introduction to Computer Programming Lab**	**2 Credit**

List of Practical:-

1 A simple program to display a message “Hello World” on screen.
2 Write a Program to print addition, subtraction Multiplication and Division of a entered number.
3 Write a Program to LCM of the entered number..
4 Write a program to find GCD of the entered number.
5 Write a program to find the greatest among three number.
6 Write a any menu driven program using if…else statement.
7 Write a any menu driven program using Switch case statement.
8 Write a program to find count of even no ,count of odd number , sum of even no and sum of odd number between 1 to 50.
9 Write a Program to generate prime number up to inputted number.
10 Write a program to check entered no is Armstrong no or not.
11 Write a program to find transpose of a matrix.
12 Write a Program to find multiplication of a two matrix elements.
13 Write a Program to find length of a string.(with and without using a library function)
14 Write a Program to find addition of two numbers using pointer.
15 Open ended Program. (How to execute C program on Linuxoperating system)
16 Write a Python program to print “Hello World”.
17 Write a Python program to display the current date and time.
18 Write a Python program which accepts the radius of a circle from the user and compute the area.
19 Write a Python program to find reverse of the entered number.
20 Write a Python program to get the Python version you are using

MA1T001	Engineering Mathematics-1	4 Credit

COURSE OBJECTIVES

1. To understand the importance of Mathematics
2. To understand the application of Mathematics in engineering and in real life.
3. To investigate the key concepts of Mathematics.
4. To enable students to analyse a problem

COURSE OUTCOMES

At the end of the course students will be able to

1. Describe rank, Bernoulli's theorem, Taylor's and Maclaurin's theorems for functions of two variables, , Euler's Theorem for functions containing two and three variables, Lagrange's theorem
2. Illustrate the examples of ordinary differential equation, partial differential equation, matrices.
3. Solve questions related to ordinary differential equation, partial differential equation, matrices and their applications.
4. Apply the knowledge of matrices, ordinary differential equation, partial differential equation, and their applications to real world problems.
5. Interpret the results of matrices, ordinary differential equation, partial differential equation and their applications.
6. Design a method or modal on matrices, ordinary differential equation, and partial differential equation.

Unit 1: Linear Algebra- Matrices [09 Hours]

Determinants & Matrix, Inverse of Matrix by adjoint method, Inverse by partitioning method, solution of system of linear equations, Rank of Matrix, Consistency of linear system of equation.

Unit 2: Ordinary Differential Equations of First Order and First Degree and Their Applications [09 Hours]

Linear equations; Reducible to linear equations (Bernoulli's equation); Exact differential equations; Equations reducible to exact equations; Applications to orthogonal trajectories, mechanical systems and electrical systems.

Unit3: Linear Differential Equations with Constant Coefficients [09 Hours]

Introductory remarks - complementary function, particular integral; Rules for finding complementary functions and particular integrals; Method of variation of parameters; Cauchy's homogeneous and

Legendre’s linear equations.

Unit 4:Partial Differentiation **[09 Hours]**

Partial derivatives of first and higher orders; Homogeneous functions , Euler’s Theorem for functions containing two and three variables (with proofs); Total derivatives; Change of variables.

Unit 5:Applications of Partial differentiation **[09 Hours]**

Jacobians - properties; Taylor’s and Maclaurin’s theorems (without proofs) for functions of two variables; Maxima and minima of functions of two variables; Lagrange’s method of undetermined multipliers.

Text Books

1) Higher Engineering Mathematics by B. S. Grewal, Khanna Publishers, NewDelhi.

2) Advanced Engineering Mathematics by Erwin Kreyszig, John Wiley & Sons, NewYork.

3)A Course in Engineering Mathematics (Vol I) by Dr. B. B. Singh, Synergy Knowledgeware,Mumbai.

4) A Text Book of Applied Mathematics (Vol I & II) by P. N. Wartikar and J. N. Wartikar, Pune Vidyarthi Griha Prakashan, Pune.

5) Higher Engineering Mathematics by H. K. Das and Er. RajnishVerma, S. Chand & CO. Pvt.Ltd., New Delhi.

Reference Books

1) Higher Engineering Mathematics by B. V. Ramana, Tata McGraw-Hill Publications, New Delhi.

2) A Text Book of Engineering Mathematics by Peter O’ Neil, Thomson Asia Pte Ltd. , Singapore.

3) Advanced Engineering Mathematics by C. R. Wylie & L. C. Barrett, Tata Mcgraw-Hill Publishing Company Ltd., New Delhi.

ET1T005	Engineering Physics	4 Credit

COURSE OBJECTIVES:-

1. To provide a firm grounding in the basic physics principles and concept to resolve many Engineering and technological problems.
2. To understand and study the Physics principles behind the developments of Engineering materials.

COURSE OUTCOMES

At the end of the course students will be able to

1. Define the concept of laser, optical fiber, Hall effect, electron Ballistics, Bethe's law, Brewster law, polarization, electromagnetic wave.
2. Illustrate different types of laser, and optical fiber, Band-theory, Effect of electric and magnetic fields, Electric and Magnetic focusing, Interference in thin films, Interference in Wedge shape thin film and electromagnetic wave.
3. Apply the concept of Three and four level laser, pumping, population inversion, Numerical aperture, Attenuation and dispersion, V-I characteristics of PN-junction diode, CRO, Interference in thin films and electromagnetic waves.
4. Analyze the different types of laser and optical fiber, semiconductors, Motion of charged particles in uniform electric and magnetic fields, polarization, relation between electric and magnetic fields of an electromagnetic wave.
5. Interpret different types of laser, and optical fiber, PN- junction diode, Bipolar Transistor action, Velocity filter, polarization, wave plate.
6. Develop models based on laser, optical fiber.

Unit-I: Laser & Optical Fibre **[08 Hrs]**

Interaction of radiation with matter, Population Inversion and Optical resonance cavity , Three and four level laser, Ruby laser, He-Ne laser, Semiconductor laser , Properties and engineering applications of laser.

Optical fibers: Propagation by total internal reflection, structure and classification (based on material, refractive index and number of modes), Modes of propagation in fiber, Acceptance angle, Numerical aperture, Attenuation and dispersion.. Applications: I) As a Sensors - i) Temperature Sensor ii)

Pollution / Smoke detector iii) Liquid level sensor. II) As a Detectors- i) PIN detector ii) Avalanche Detector.

Unit-II: Semiconductor Physics **[09Hrs]**

Band-theory based classification of solids into insulators, semiconductors and conductors, Fermi-Dirac distribution Function, Intrinsic semiconductors: Germanium and silicon; Fermi- energy, Typical energy band diagram of an intrinsic semi-conductor, Extrinsic semiconductors, Current conduction in semiconductors.

PN- junction diode; Unbiased, Forward biased& Reverse biased mode with Energy band diagram , Diode rectifier equation, Bipolar Transistor action, Hall effect, Hall coefficient & Hall Angle

Unit-III: Electron Ballistics **[08 Hrs]**

Lorentz force, Motion of changed particles in uniform electric and magnetic fields (parallel, perpendicular and at an acute angle), Effect of electric and magnetic fields on kinetic energy of charged particle, Crossed electric and magnetic field configurations, Velocity filter, Electrostatic and magneto static deflection.

Bethe's law, Electric and Magnetic focusing, Construction & working of Electrostatic lens, Devices: CRT, CRO, Block Diagram, Function & working of each block.

Unit-IV: Wave Optics **[08 Hrs]**

Interference in thin films, Interference in Wedge shape thin film, Newton's rings, Anti-reflection coating, advanced applications of interference in thin film.

Polarization by reflection, Brewster's law, polarization by double refraction, Nicol prism, elliptically and circularly polarized light, Quarter wave plate and half wave plate.

Unit-V: Electromagnetic waves **[06 Hrs]**

The wave equation; Plane electromagnetic waves in vacuum, their transverse nature and polarization; relation between electric and magnetic fields of an electromagnetic wave; energy carried by electromagnetic waves and examples.

Text Books:

1. Fundamentals of Physics: David Halliday, Robert Resnick and Jerle Walker, John-WileyIndia (8e, extended)
2. A text book of Engineering Physics: M. N. Avadhanulu, S. Chand & Co.
3. Nano the Essentials: Understanding Nanoscience and Nanotechnology, T.Praddep; TMH Publications.

4. Introduction to Nanotechnology:Pooly& Owens; Willey Publication
5. Text Book of Optics: Brijlal and Subramanyam (S. Chand and Company)
6. Laser: M. N. Avadhanulu, S. Chand & Co.

Reference Books:

1. LASERS: Theory and Applications: Thyagarajan K and Ghatak A.K.
2. Nanomaterials& Nanotechnologies and Design:M.F.Ashby, Paulo Ferreira and Daniel L.Schodek, Elsevier Publications.
3. University Physics: Young and Freedman (Pearson Education).
4. Optics: Jenkins and White (Tata Mcgraw Hill)

ET1L005	Engineering Physics Lab	1 Credit

List of Experiment

2. Newton's rings - Determination of radius of curvature of Plano convex lens / wavelength of light
3. Wedge Shaped film - Determination of thickness of thin wire
4. Laser - Determination of wavelength of He-Ne laser light
5. Magnetron Tube - Determination of 'e/m' of electron
6. Hall Effect - Determination of Hall Coefficient
7. Measurement of Band gap energy of Semiconductors
8. Study of I-V characteristics of P-N junction diode
9. Experiment on fibre optics
10. Input, output and current transfer characteristics of PNP/NPN transistor in CB and CE mode
11. Study of Cathode Ray Oscilloscope

ET1T006	Energy and Environment Engineering	3 Credit

COURSE OBJECTIVES

1. To understand the importance of Energy and Environment
2. To understand the application of energy saving tool in real life.
3. To investigate the key concepts of Energy and Environment

COURSE OUTCOMES

At the end of the course students will be able to

1) Describe different kind of pollution eg. Water pollution, air pollution, soil pollution etc.
2) Understand the importance of ecosystem for human beings..
3) Discover innovative method of power generation.
4) Correlate the cost of various method of power generation.
5) Judge the quality of air.

Unit 1 **[4 hrs]**

Air Pollution: Environment and Human health - Air pollution, Particulate emission: sources- effects- control measures -, air quality standards, and measurement of air pollution. Disposal of solid wastes, Bio-medical wastes effects- control measures

Unit 2 **[4 hrs]**

Water Pollution and Conservation: Water pollution- types of pollutants, effects- control measures, Water conservation and its methods, rainwater harvesting,methods of rainwater harvesting Surface runoff harvesting, Rooftop rainwater harvesting, Noise pollution ,effects and control measures, -Thermal pollution , Soil pollution ,Nuclear hazard.

Unit 3 **[4 hrs]**

Conventional Power Generation: Steam power station, Nuclear power plant , Gas turbine power plant- Hydro power station: Schematic arrangement, advantages and disadvantages, Thermo electric and thermionic generators, Environmental aspects for selecting the sites and locations of power plants.

Unit 4 **[4 hrs]**

Renewable Power Generation: Solar, Wind, Biogas and Biomass, Ocean Thermal energy conversion (OTEC), Tidal, Geothermal energy, Magneto Hydro Dynamics (MHD): Schematic arrangement, advantages and disadvantages.

Unit 5 [**4 hrs]**

Energy conservation: Scope for energy conservation and its benefits Energy conservation Principle , Maximum energy efficiency, Maximum cost effectiveness, Methods and techniques of energy conservation in ventilation and air conditioners, refrigerator, compressors, pumps, fans and blowers, Energy conservation in electric furnaces, ovens and boilers, lighting techniques. Triffs and economic aspects in power generation.

Reference/Text Books:

1. A Chakrabarti, M. L Soni, P. V. Gupta, U. S. Bhatnagar, A Text book of Power System Engineering, DhanpatRai Publication.

2. Rai. G. D., Non-Conventional Energy Sources, Khanna Publishers, Delhi, 2006.

3. Rao S., Parulekar B.B., Energy Technology-Non conventional, Renewable and Conventional, Khanna Publishers, Delhi, 2005.

4. Glynn Henry J., Gary W. Heinke, Environmental Science and Engineering, Pearson Education, Inc, 2004.

5. J. M. Fowler, Energy and the Environment, McGraw-Hill, 2 nd Edition, 1984.

6. Gilbert M. Masters, Introduction to Environmental Engineering and Science, 2nd Edition, Prentice Hall, 2003.

WS1L001	Workshop Practices	2 Credit

Instructions to the student:

Each student is required to maintain a „workshop journal" consisting of drawing / sketches of the jobs and a brief description of tools, equipment, and procedure used for doing the job.

Contents:

a**) Carpentry:** Technical Terms related to wood working, Types of wood, Joining materials, Types of joints - Mortise and Tenon, Dovetail, Half Lap, etc., Methods of preparation and applications, Wood working lathe, safety precautions.

b) Welding: Arc welding - welding joints, edge preparation, welding tools and equipment, Gas welding - types of flames, tools and equipment, Resistance welding - Spot welding, joint preparation, tools and equipment, safety precautions.

c) Fitting: Fitting operation like chipping, filing, right angle, marking, drilling, tapping etc., Fitting hand tools like vices, cold chisel, etc. Drilling machine and its operation.

e) Machine shop: Lathe machine, types of lathes, major parts, cutting tool, turning operations (Demo), safety precautions

List of Practical:

1. Wood sizing exercises in planning, marking, sawing, chiselling and grooving to make half lap joint and cross lap joint.
2. A job involving cutting, filing to saw cut, filing all sides and faces, corner rounding, drilling and tapping on M. S. plates.
3. Exercise in Arc welding (MMAW) to make a square butt joint.
4. A demo job on turning of a Mild Steel cylindrical job using centre lathe.

Electrical workshop:-

1) To wire for a stair case arrangement using a two-way switch.

2) To measure electrical quantities-voltage current, power & power factor in RLC circuit.

ET1T007	Basics of Electrical and Electronics Engineering	Audit

COURSE OBJECTIVES

1. To provide a basic information and use of electrical and electronics components.
2. To understand and study the materials used for the preparation of electrical and electronics components.
3. To provide basic knowledge of operation and functionality of electrical and electronics components.

COURSE OUTCOMES:

CO1: Define fundamentals of electrical system and choose measuring instruments for measurement of electrical quantities & describe the concept PN junction diode and its characteristics.

CO2: Classify wiring system and compare energy resources for electrical energy generation & elaborate the transistor configuration in CE, CB & CC mode.

CO3: Plan and organize the utilization of energy resources of electrical system & apply transistor characteristics to construct Amplifier devices.

CO4: Compare different sources of electrical system & distinguish various logic gates and simplify the Boolean's equations.

CO5: Justify the utilization of various electrical and electronics components into electrical and electronics circuitries.

CO6: Construct various circuits using Resistors, capacitors, inductors, PN junction diode, Zener diode, transformers, transistors and logic gates.

Unit 1: Elementary Electrical Concepts and Circuit Components (8 Hrs)

Fundamental of Electrical system: Potential difference, Ohm's law, Effect of temperature onresister, resistance temperature coefficient, **Electrical wiring system**: Study of different wire gauges and their applications in domestic and industry.

Resistors: colour code, type of resistors, material used for resistors, resistance wires, resistance standards, frequency errors in resistors.

Capacitors: Capacitance standards, variable capacitors, frequency errors in capacitors. Loss angle and power factor of capacitors.

Inductors: standards of inductance, mutual inductance, self-inductance, variable inductance, inductors for high and low frequency work, frequency errors in inductors.

Unit 2: Measurement of Electrical Quantities, Measuring Instruments & Energy Resources (7 Hrs)

Measurement of Voltage, Current, and Power (1ph and 3ph), Introduction to PMMC instrument, Ohmmeter, galvanometer, potentiometers, power factor meter and frequency meters. Study of circuit breakers & Actuators (MCB & Fuse, Power Contactors & Aux contactors, Electro-Mechanical & Solid state Relays). **Energy Resources and Utilization**: Conventional and nonconventional energy resources; Introduction to electrical energy generation from different resources, transmission, distribution and utilization, Concept of Supply Demand, Power Factor, Need of unity factor.

Unit3: Introduction to diodes, diode circuit and Transducers (8 Hrs)

The P-N Junction Diode, V-I characteristics, Diode as Rectifier, specifications of Rectifier Diodes, Half Wave, Full wave, Bridge rectifiers, Equations for IDC VDC VRMS, IRMS, Efficiency and Ripple Factor for each configuration. Zener Diode, Characteristics, Specifications, Zener Voltage Regulator, Types of Diodes: LED, Photodiode. Introduction to transducer, Classification of transducers, characteristics and choice of transducers.

Unit 4: Semiconductor Devices and Applications: (7 Hrs)

Transistors: Introduction, Classification, CE, CB, and CC configurations, α, β, concept of gain and bandwidth. Operation of **BJT** in cut-off, saturation and active regions (DC analysis). BJT as an amplifier, biasing techniques of BJT, BJT as a switch.

Introduction to Digital Electronics: Number System, Basic logic Gates, Universal Gates, Boolean Postulates, De-Morgan Theorems

Reference/Text Books:

1. V. N. Mittal and Arvind Mittal, Basic Electrical Engineering, McGraw-Hill Publication.
2. Brijesh Iyer and S. L. Nalbalwar, A Text book of Basic Electronics, Synergy Knowledgeware Mumbai, 2017. ISBN:978-93-8335-246-3
3. Vincent DelToro, Electrical engineering Fundamentals, PHI Publication, 2nd Edition, 2011.
4. A Textbook of Basic Electrical and Electronics Engineering, J.B.Gupta, Katson Publication.
5. A Textbook of Basic Electrical Engineering by S.B. Bodkhe, N.M.Deskar, Professional Publishing House Pvt. Ltd
6. D. P. Kothari and Nagrath, Theory and Problems in Electrical Engineering, PHI Publication, 2011.

7. B. L. Theraja, Basic Electronics, S. Chand Limited, 2007.
8. Millman Halkias, Integrated Electronics-Analog and Digital Circuits and Systems, McGraw-Hill Publication, 2000.
9. Donald Neaman, Electronic Circuit Analysis and Design, McGraw-Hill Publication, 3rd Edition.
10. Donald Neaman, Electronic Circuit Analysis and Design, McGraw-Hill Publication, 3rd Edition.
11. Printed Circuit Boards Design & Technology, Walter C. Bosshart, McGraw-Hill Publication.

Note: Students are advised to use internet resources whenever required

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				Credit
				L	T	P	CA	MSE	ESE/Ext. Pra.	Total	
1	HSMC	HU2T001	Communication Skills	2	0	0	60	0	40	100	2
2	BSC	MA2T001	Engineering Mathematics-II	3	1	0	20	20	60	100	4
3	BSC	EE2T002	Engineering Chemistry	3	1	0	20	20	60	100	4
4	ESC	EE2T003	Engineering Graphics	1	0	0	20	20	60	100	1
5	HSMC	HU2L001	Communication Skills Lab.	0	0	4	60	0	40	100	2
6	BSC	EE2L002	Engineering Chemistry Lab	0	0	2	60	0	40	100	1
7	ESC	EE2L003	Engineering Graphics Lab	0	0	4	60	0	40	100	2
8			Societal Internship/ Field Training	Credit to be given in III Sem.							
9	ESC	EE2T004	Basic Civil and Mechanical Engineering	2	0	0	10	15	25	50	Audit
				11	**2**	**10**					**16**
				23							

Curriculum for Semester- II [First Year]

HU2T001	Communication Skills	2 Credit

COURSE OBJECTIVES:

The main objective of the subject is to enhance the employability skills of engineering studentsas well as communication skills at work place.

The sub-objectives are:

1) To develop students' reading skills and pronunciation.
2) To develop technical communication skills through drafting, letter writing, and précis writing.
3) To develop literary skills through essay writing.
4) To develop public speaking skills of the students.
5) To expose the students to the ethics of English language by teaching grammar

COURSE OUTCOMES:

At the end of the course students will be able to

1) Better reading comprehension, pronunciation, and functional English grammar.
2) Write letters and resumes
3) Organize their thoughts for effective presentation and writing.
4) Learn skills to present themselves well in an interview, and handle a Group Discussion

Unit 1: Communication and Communication Processes (06 hrs)

Introduction to Communication, Types and functions of Communication, Barriers to Communication and overcoming them, Role of Communication Skills in Society

Reading: Introduction to Reading, Barriers to Reading, Types of Reading: Skimming, Scanning, Intensive and Extensive, Strategies for Reading Comprehension.

Listening: Importance of Listening, Types of Listening, and Barriers to Listening.

Unit 2: Study of Sounds in English and Vocabulary Building (06 hrs)

Introduction to phonetics, Study of Speech Organs, Study of Phonemic Script, Articulation ofDifferent Sounds in English.

Vocabulary Building: The concept of Word Formation, Root words from foreign languages and their use in English, Use of prefixes and suffixes from foreign languages in English to form derivatives, Synonyms, antonyms, and standard abbreviations

Unit 3: English Grammar (06 hrs)

Grammar: Forms of Tenses, Articles, Prepositions, Use of Auxiliaries and Modal Auxiliaries, Sentence Structures, Use of phrases and clauses in sentences, Importance of proper punctuation,Common Errors. Misplaced modifiers

Unit 4: Professional Verbal Communication (06 hrs)

Components of an effective talk, Idea of space and time in public speaking, Tone of voice, Body language, Timing and duration of speech, Audio-Visual Aids in speech. Presentation Skills, Group Discussion and Job Interviews

Unit 5: Developing Business Writing Skills, Styles and Practice (06 hrs)

Writing Emails, Report Writing: Format, Structure and Types, Letter Writing**:** Types, Parts, Layouts, Writing Job Application Letter and Resume.

Nature and Style of sensible Writing and Practice: Describing, Defining, Classifying, Providing examples or evidence, writing introduction and conclusion, Writing Practices: Comprehension, Précis Writing, Essay Writing

Text book:

Mohd. Ashraf Rizvi, Communication Skills for Engineers, Tata McGraw Hill

Reference Books:

1) Sanjay Kumar, PushpLata, Communication Skills, Oxford University Press, 2016

2) Meenakshi Raman, Sangeeta Sharma, Communication Skills, Oxford University Press, 2017

3) Teri Kwal Gamble, Michael Gamble, Communication Works, Tata McGraw Hill Education, 2010

4) Anderson, Kenneth. Joan Maclean and Tossny Lynch. Study Speaking: A Course in Spoken English for Academic Purposes. Cambridge: CUP, 2004.

5) Aswalthapa, K. Organisational Behaviour, Himalayan Publication, Mumbai (1991).

6) Atreya N and Guha, Effective Credit Management, MMC School of Management, Mumbai (1994).

7) Balan,K.R. and Rayudu C.S., Effective Communication, Beacon New Delhi (1996).

8) Bellare, Nirmala. Reading Strategies. Vols. 1 and 2. New Delhi. Oxford University Press, 1998.

9) Bhasker, W. W. S &Prabhu, N. S.: English through Reading, Vols. 1 and 2. Macmillan, 1975.

10) Black, Sam. Practical Public Relations, E.L.B.S. London (1972).

11) Blass, Laurie, Kathy Block and Hannah Friesan. Creating Meaning. Oxford: OUP, 2007.

12) BoveeCourtland,L and Thrill, John V. Business Communication, Today McGraw Hill, New York, Taxman Publication (1989).

HU2L001	Communication Skills Lab	2 Credit

List of Practical Sessions (Any 10 PR sessions can be conducted):

1) Pronunciation, Intonation, Stress and Rhythm(02 hrs)
2) Introduction to Phonemic symbols (02 hrs)
3) Articulation of sounds in English with proper manner (02 hrs)
4) Practice and exercises on articulation of sounds (02 hrs)
5) Read Pronunciations/transcriptions from the dictionary (02 hrs)
6) Practice and exercises on pronunciations of words (02 hrs)
7) Introduce yourself (02 hrs)
8) Importance of Business Communication with the help of a case study.(02hrs)
9) Listening Skills/ Comprehension(02 hrs)
10) Common Everyday Situations: Conversations and Dialogues(02 hrs)
11) Communication at Workplace(02 hrs)
12) Rapid reading sessions (02 hrs)
13) Draft Email(02 hrs)
14) Resume Writing(02hrs)
15) Drafting Business Letter(02 hrs)
16) Preparing technical paper using IEEE format(02 hrs)
17) Extempore (02 hrs)
18) Elocution (02 hrs)
19) Group discussion (02 hrs)
20) Participating in a debate (02 hrs)
21) Presentation techniques (02 hrs)
22) Interview techniques , Job Interviews, Telephonic Interviews(02hrs)
23) Mock interviews and practice sessions(02 hrs)

MA2T001	Engineering Mathematics-II	4 Credit

COURSE OBJECTIVES

1. To understand the importance of Mathematics
2. To understand the application of Mathematics in engineering and in real life.
3. To investigate the key concepts of Mathematics.
4. To enable students to analyse a problem

COURSE OUTCOMES

At the end of the course students will be able to

1. Describe concept of complex numbers, integral calculus & multiple integrals, Fourier series & transform, vector differential calculus, vector integral calculus.
2. Illustrate the concept of complex numbers, integral calculus & multiple integrals, Fourier series & transform, vector differential calculus, vector integral calculus by using examples.
3. Apply the knowledge of complex numbers, integral calculus & multiple integrals, Fourier series & transform, vector differential calculus, vector integral calculus to solve the engineering problems.
4. Analyse the problems and results of complex numbers, integral calculus & multiple integrals, Fourier series & transform, vector differential calculus, vector integral calculus to solve the engineering problems.
5. Evaluate the problems by using complex numbers, integral calculus & multiple integrals, Fourier series & transform, vector differential calculus, vector integral calculus to solve the engineering problems.
6. Create the methods or model by using complex numbers, integral calculus & multiple integrals, Fourier series & transform, vector differential calculus, vector integral calculus to solve the engineering problems.

Unit 1: Complex Numbers [09 Hours]

Definition and geometrical representation; De-Moivre'stheorem (without proof); Roots of Complex numbers by using De-Moivre'stheorem; Circular functions of complex variable ,definition; Hyperbolic functions; Relations between circular and hyperbolic functions; Real and Imaginary parts of circular and hyperbolic functions; Logarithm of Complex quantities.

Unit 2: Integral calculus & Multiple Integrals [09 Hours]

Beta, Gamma functions; tracing of the curves given in Cartesian, parametric & polar forms. Double integration in Cartesian and polar co-ordinates; Evaluation of double integrals by changing the order of integration and changing to polar form; Triple integral

Unit3: Fourier Series & Transform[09 Hours]

Fourier Series , Definition and Properties (excluding FFT), Fourier Integral Theorem, Relation with Laplace Transform, Applications of Fourier Transform to Solve Integral Equations.

Unit4: Vector Differential Calculus [09 Hours]

General rules of vector Differentiation; Scalar and vector fields: Gradient, divergence and curl; Solenoidal and irrotational vector fields; Vector identities

Unit5: Vector Integral Calculus [09 Hours]

Vector Integration: line integral, surface integral and volume integral; Green's lemma, Gauss' divergence theorem and Stokes' theorem (without proofs).

Text Books

1) Higher Engineering Mathematics by B. S. Grewal, Khanna Publishers, NewDelhi.
2) Advanced Engineering Mathematics by Erwin Kreyszig, John Wiley & Sons, NewYork.
3)A Course in Engineering Mathematics (Vol I) by Dr. B. B. Singh, Synergy Knowledgeware, Mumbai.
4) A Text Book of Applied Mathematics (Vol I & II) by P. N. Wartikar and J. N. Wartikar, Pune Vidyarthi Griha Prakashan, Pune.
5) Higher Engineering Mathematics by H. K. Das and Er. RajnishVerma, S. Chand & CO. Pvt.Ltd., New Delhi.

Reference Books

1) Higher Engineering Mathematics by B. V. Ramana, Tata McGraw-Hill Publications, New Delhi.
2) A Text Book of Engineering Mathematics by Peter O' Neil, Thomson Asia Pte Ltd. , Singapore.
3) Advanced Engineering Mathematics by C. R. Wylie & L. C. Barrett, Tata Mcgraw-Hill Publishing Company Ltd., NewDelhi.

ET2T002	Engineering Chemistry	4 Credit

COURSE OBJECTIVES

1. To understand the importance of Chemistry
2. To understand the application of Chemistry in engineering and in real life.
3. To investigate the key concepts of Chemistry knowledge
4. To enable students to analyse a Chemistry problem so that appropriate problem solving techniques may be applied

COURSE OUTCOMES

At the end of the course students will be able to

1. Describe various properties of water, fuel, transition metal ions and their magnetic properties, Debye-Hückel theory, Quinonoid theory, various electrode, polymer and batteries
2. Illustrate the various types of water, Ostwald's theory of acid-base indicator, polymer, various batteries, and fuel cell.
3. Analyze the question on water characteristics, electrochemistry and various types of instrumental titration, various batteries and fuel cell.
4. Apply the Knowledge of zeolite process, Ion exchange process, Hot Lime ,Soda process, acid base concept, fuel cell and batteries..
5. Develop a Modal on softening of water, standardization of acid and base by various instruments, polymers, fuel cell and batteries..
6. Organize water as per quality, and fuel, types of electrodes, polymers and fuel cell and batteries.

Unit1: Water Treatment **6 Hrs**

Introduction, hard and soft water, softening of water , Zeolite process, Ion exchange process, Hot Lime ,Soda process, water characteristics- Hardness, Domestic water treatment

Unit2: Fuels **6 Hrs**

Introduction, classification of fuel, essential properties of fuel, characteristics of good fuel, solid fuel- Coal, Various types of Coal, Analysis of coal-Proximate and Ultimate analysis, liquid fuel- Refining of Petroleum.

Unit3: Electrochemistry **8 Hrs**

Introduction-basic concepts, Transport number and its determination by Moving Boundary method, Debye-Hückel theory, Conductometric titrations, Ostwald's theory of acid-base indicator, Quinonoid theory, Electrodes , Glass electrode, Quinhydrone electrode.

Unit4: Advanced Polymeric Materials: **8 Hrs**

Introduction to reactions involving substitution, addition, elimination, cyclization and ring opening. Liquid crystals and liquid crystal polymers (thermotropic and lyotropic), phases of thermotropic polymers: nematic, smectic, cholesteric; advantages, disadvantages and applications

Unit5: Battery Technology: **6 Hrs**

Classification of batteries: Primary, Secondary- Electricity storage density, power density, energy efficiency, cycle life, shelf life. Rechargeable alkaline storage batteries, Ni-metal hydride,
Lithium ion batteries and H2-O2 Fuel cell.

Text Books:

1. A Text book of Engineering Chemistry, Dr. S. S. Dara, Dr. S. S. Umre,S. Chand and Company Ltd., Twelfth/ 2011
2. Selected Topics in Inorganic Chemistry, Dr. Wahid U. Malik, Dr. G. D. Tuli and Dr. R. D. Madan, S. Chand and Company Ltd., Seventh/2001

Reference Books:

Engineering Chemistry, P. C. Jain and Monika Jain, Dhanpatrai Publishing Company Ltd., 15th Ed/ 2009

Principles of Physical Chemistry, B. R. Puri, L. R. Sharma and Madan S. Pathania, Vishal Publishing Company, First/2002

Chemistry, John E McMurry and Robert C Fay, Pearson, First/2008

EL2L002	Engineering Chemistry Lab	1 Credit

List of Experiments: (Perform any 8, 10 Experiments)

1. Determination of Hardness of water sample by EDTA method.
2. Determination of flash point by Pensky Martin Apparatus
3. Determination of Dissolve Oxygen by Iodometric method.
4. Determination of percent purity of Bleaching Powder.
5. pH , metric Titration (any one type of Acid Base titration)
6. Conductometric Titration (any one type of Acid Base titration)
7. Surface tension: Determination of relative surface tension of liquid with respect to water using drop number method.
8. Viscosity:Determination of relative viscosity of liquid with respect to water using Ostwald's viscometer method.
9. To determine the normality in Normal term and Strength in gms/lit of HCl solution by titrating with Na_2CO_3 solution.
10. To find out Morality, Normality and Strength of the given $KMnO_4$ solution by titrating against N/10 Mohr's solution.
11. Determination of Acid value of an oil sample.
12. Determination of Saponification value of an oil sample.

Reference Books:

1. Systematic experiments in Chemistry, A. Sethi, New Age International Publication, New Delhi.
2. Practical Inorganic Chemistry, A. I. Vogel, ELBS Pub.
3. Practical in Engineering Chemistry, S. S. Dara.

ET2T003	Engineering Graphics	1 Credit

COURSE OBJECTIVES

1. To understand the concepts like dimensioning, conventions and standards related to engineering graphics in order to become professionally efficient
2. To understand theory of projection and simple machine parts in first and third angle of projection systems.
3. To understand the key concepts CAD software.
4. To enable students to analyze a 2-dimensional & 3-dimensional problem.

COURSE OUTCOMES:

1. Define various concepts like dimensioning, conventions and standards related to engineering graphics in order to become professionally efficient.
2. Interpret drawings of simple machine component in first and third angle of projection systems
3. Apply theory of projections in projection of lines, projection of planes and projection of solid.
4. Classify solid geometry in different positions.
5. Assess the two dimensional and three dimensional drawing in CAD software.
6. Create the three dimensional engineering objects into two dimensional drawings and vice versa using CAD software

Unit I Introduction to Computer Aided Drawing [03 hrs]

Theory of CAD software, Demonstration knowledge, layout of the software, standard tool bar/menus and description of most commonly used tools bars, Navigational tools. Creation of 2D/3D environment. Commands and creation of co-ordinate points, lines, axes, polyline, square, rectangle, polygons, splines, circles, ellipse, text, move, copy, offset, mirror, rotate, trim, extend, break, chamfer, fillet, zoom, pan, curves, constraints viz. tangency, parallelism, inclination and perpendicularity. Dimensioning, line conventions, lettering. Line properties, 3D modeling& topology of engineering component.

Unit II Drawing standards & Orthographic Projections: [03 hrs]

Drawing standard SP: 46, type of lines, lettering, dimensioning. Basic geometrical construction, drawing of regular polygon, Theory of projection, introduction to orthographic projection, drawing of orthographic views of objects from their isometric views by using first angle method of projection.

Unit III Projections of Points & Projections of Straight Lines: [03 hrs]

Projection of point lying in four quadrants. Projections of lines parallel and perpendicular to one or both planes, projections of lines inclined to one or both reference planes.

Unit IV Projections of Planes & Projections of Solids: [03 hrs]

Projections of planes parallel and perpendicular to one or both planes, projection of planes inclined to one or both planes.

Types of solids, Projection of solid when axis is perpendicular to one of the reference planes, when axis is inclined to one and parallel to other reference plane, when axis is inclined to both the reference planes

Unit V Isometric Projections [03 hrs]

Isometric projections: Isometric scale, drawing of isometric projections from given orthographic views.

Text Books:

1. N. D. Bhatt, Engineering Drawing, Charotar Publishing House, 46th Edition, 2003.
2. Dhananjay A. Jolhe, Engineering Drawing with an Introduction to AutoCAD, McGraw Hill Education, 2017

Reference Books:

1. K. V. Nataraajan, A text book of Engineering Graphic, Dhanalakshmi Publishers, Chennai, 2006.
2. K. Venugopal and V. Prabhu Raja, Engineering Graphics, New Age International (P) Ltd, 2008.
3. Engineering Drawing, R. K. Dhawan, S. Chand Publication, 1998.
4. Engineering Graphics, A. R. Bapat, Allied Publishers, 2004.
5. Fundamentals of Engineering Drawing, Luzadder& Duff, Eastern Economy, 11th Edition.

ET2L003	Engineering Graphics Lab	2 Credit

COURSE OBJECTIVES:

The objective of the course is to enable students to

1. Provide basic foundation in CAD software.
2. Understand the fundamentals used to create and manipulate geometric models.
3. Get acquainted with the basic CAD software for to design geometric modeling.

COURSE OUTCOMES:

1. Define basic structure of CAD workstation, CAD commands, Memory types, input/output devices and display devices to become professionally efficient to operate CAD software.
2. Explain drawing of simple machine component in CAD software.
3. Acquire the knowledge of geometric modeling in CAD software.
4. Analyze the steps required in CAD software for 2-dimensional and 3-dimensional models.
5. Assess the two dimensional and three dimensional drawing in CAD software.
6. Create the three dimensional engineering objects into two dimensional drawings and vice versa using CAD software.

List of Practical:

1. Introduction of CAD software and to study and practice basic draw commands exists in the CAD software.
2. Lines, lettering and dimensioning. (Drafting work)
   Identify the different types of Lines in the given object, draw lettering and give the Required dimensions in the given object.
3. Geometric Construction. (Drafting work)
4. Orthographic projections first sheet. (Using CAD software)
5. Orthographic projections second sheet. (Using CAD software)
6. Projections of straight lines. (Drafting work)

7. Projections of planes & solids. (Drafting work)
8. Isometric Projections first sheet. (Using CAD software)
9. Isometric Projections second sheet. (Using CAD software)
10. Design of basic hardware components using CAD Software.
11. Design of advance hardware components using CAD Software.
12. Design of assembly drawing using CAD Software.
13. Design of assembly drawing with animation and rendering using CAD Software.

ET2T004	Basic Civil and Mechanical Engineering	Audit

COURSE OBJECTIVES

1. To understand the basic stream of Mechanical engineering and Civil Engineering.
2. To understand the concepts of product manufacturing, Energy engineering, design engineering, Automobile engineering, construction technique and civil surveying.
3. To have basic knowledge of Casting, Machining, Designing, Manufacturing, different materials for building construction and surveying.

COURSE OUTCOMES:

Students would be able to

1. Define basic stream of Mechanical & Civil Engineering.
2. Explain the concepts of product manufacturing, Energy engineering, design engineering, Automobile engineering, construction technique and civil surveying.
3. Apply Basic knowledge of Casting, Machining, Designing, Manufacturing & Civil Construction technique.
4. Analyzed the different mechanical system and properties of construction & surveying material.
5. Interpret the problem in mechanical system and civil structure.
6. Solve the problem in mechanical system and civil structure.

Part I Basic Civil Engineering

Unit 1: Introduction to civil engineering

Various branches introduction to civil engineer in various construction activities basic engineer properties and various materials: earth bricks timber, stone, sand Aggregate cement motor steel bituminous glass FRP composite material.

Unit 2: Building component and planning material

Foundation and superstructure function of foundation type of shallow and deep foundation suitability in different situation plinth wall lintels beam column slab roof staircase floor door window and study of building plans ventilation and basic plumbing and sanitation

Unit 3: Surveying

Principal of surveying element of distance angular measurement plotting of area base line and off set introduction of plane table survey introduction to levelling concept of bench mark reduce level and counting

Part II Basic Mechanical Engineering

Unit 1: Introduction to Mechanical Engineering, Introduction to Laws of Thermodynamics with simple examples pertaining to respective branches, IC Engines: Classification, Applications, Basic terminology, 2 and 4 stroke IC engine working principle, Power Plant: Types of Power plant; Gas power plant, Thermal power plant, Nuclear power plant, Automobiles: Basic definitions and objectives

Unit 2: Design Basics, Machine and Mechanisms, Factor of safety, Engineering Materials: types and applications, basics of fasteners, machining and machinability. Introduction to lathe machine, drilling machine, milling machine, basics of machining processes such as turning, drilling and milling. Introduction to casting

Text Books:

1. AnuragKandya, “Elements of Civil Engineering”, Charotar Publishing, Anand
2. M. S. Palani Gamy, “Basic Civil Engineering”, Tata Mc-Graw Hill Publication
3. G. K. Hiraskar, “Basic Civil Engineering”, DhanpatRai Publications
4. GopiSatheesh, “Basic Civil Engineering”, Pearson Education

Reference Books:

1. M. G. Shah, C. M. Kale, and S. Y. Patki, “Building Drawing”, Tata McGraw Hill
2. Sushil Kumar, “Building Construction”, Standard Publishers Distributors
3. Kanetkar T. P. and Kulkarni S. V., “Surveying and Levelling”, Vols. I, II and III, Vidyarthi
4. GruhPrakashan, Pune
5. B. C. Punmia, “Surveying”, Vol.- I, Vol.-II, Vol.-III, Laxmi Publications
6. P. K. Nag “Engineering Thermodynamics”, Tata McGraw Hill, New Delhi 3rd ed. 2005
7. A. Ghosh, A K Malik, “Theory of Mechanisms and Machines”, Affiliated East West Press Pvt. Ltd. New Delhi.

8. SeropeKalpakaji and Steven R Schimd “A manufacturing Engineering and Technology” Addison WsleyLaongman India 6th Edition 200
9. V. B. Bhandari, “Design of Machine Elements”, Tata McGraw Hill Publications, New Delhi.

Curriculum for Semester- III [Second Year]

Sr. No.	**Subject Category**	**Subject Code**	**Course Title**	**Teaching Scheme**			**Evaluation Scheme**				**Credits**
				L	T	P	CA	MSE	ESE	TOTAL	
1	HSMC	EE3T001	Engineering Economics	2	0	0	20	20	60	100	2
2	BSC	EE3T002	Engineering Mathematics –III	3	1	0	20	20	60	100	4
3	ESC	EE3T003	Theory of electrical engineering	3	1	0	20	20	60	100	4
4	PCC-EE	EE3T004	Network Analysis	3	0	0	20	20	60	100	3
5	PCC-EE	EE3T005	Electrical Machine I	2	1	0	20	20	60	100	3
6	PCC-EE	EE3T006	Measurement and Instrumentation	2	1	0	20	20	60	100	3
7	PCC-EE	EE3L004	Network Analysis Lab	0	0	2	60	0	40	100	1
8	PCC-EE	EE3L005	Electrical Machine I Lab	0	0	2	60	0	40	100	1
9	PCC-EE	EE3L006	Measurement and Instrumentation Lab	0	0	2	60	0	40	100	1
10	PROJ-EE	EE3P001	Field trainning/ Internship/ industrial visit	0	0	0	0	0	50	50	1
11	MC	EE3T007	Innovation and entrepreneurship Development	2	0	0	10	15	25	50	Audit
				17	**4**	**6**	**310**	**135**	**555**	**1000**	
								Total Credits			**23**

EE3T001	Engineering Economics	2 Credit

COURSE OBJECTIVE

1. To learn the basics of Economics.
2. Ability to take Economically Sound Decision.
3. Ability To understand the interaction of World Economy.
4. To be able to work in an Industrial atmosphere.

COURSE OUTCOME

1. Remember and define basics of the Economics
2. Understand Mechanism of Price Fixation
3. Identify Time value of Money.
4. Analyze and classify basic Factors of Production
5. Interpret Indian Economy and Globalization .
6. Plan To become Self Employed

COURSE CONTENTS:

UNIT 1: [05 hrs]

Introduction, Micro And Macro Economics .Economics and its relation with other subjects, Nature of Economic laws. Basic Economic problems, Basic Economic terms, Engineering and Economics

UNIT 2: [05 hrs]

Meaning of demand ,Factors affecting demand, Law of Elasticity ,Types of elasticity, Practical applications of Laws of Elasticity ,Demand Forecasting, Techniques of Demand forecasting. Law of supply, Role of demand and Supply in Price Fixation.

UNIT 3: [04 hrs]

Time value of Money ,Capital Budgeting ,Traditional and modern methods of Payback, IRR, ANR, Case studies

UNIT 4: **[05 hrs]**

Factors of Production, Concepts of cost, Break even Analysis, Law of variable Proportions ,Internal and External Economies of scale, Depreciation.

UNIT 5: **[05 hrs]**

ENTERPRISE Meaning and definition, factors required for growth of Enterprise, Institutions to support the growth of MSME's, Sources of finance for MSME's and scope for self Employment Opportunities.

UNIT 6: **[04 hrs]**

Features of Indian Economy, Fiscal and Monetary policy, LPG, Inflation, Banking,
World Economic bodies

Text Books:

1. Chopra P. N., Principle of Economics, Kalyani Publishers
2. Dewett K. K., Modern economic theory, S. Chand
3. H. L. Ahuja., Modern economic theory, S. Chand
4. Dutt Rudar & Sundhram K. P. M., Indian Economy
5. SMALL-SCALE INDUSTRIES AND ENTREPRENEURSHIP by Vasant DEASAI,

Reference Books:

1. Dewett K.K. Elemntary Economic Theory.
2. Entrepreneurial Development By S.S.Khanka.
3. Financial Management: Theory and Practice: Author: Prasanna Chandra, Mc Graw Hill India .

EE3T002	Engineering Mathematics –III	4 Credit

COURSE OBJECTIVES:

1. The basic concept of Laplace Transform , Fourier Transform, Function of Complex variable.
2. Ability to solve the problem on Laplace transform Fourier integral , Parseval's identity.
3. Apply the knowledge of the Laplace Transform ,Fourier Transform , Partial differential equation, function of complex variable to real life problem.

COURSE OUTCOMES:

At the end of this course students will demonstrate the ability to

1.Remember properties of Laplace transform , Convolution Theorem, Fourier integral theorem , Parseval‟s identity , Cauchy's integral theorem , Cauchy's residue theorem

2.Describe properties of Laplace transform , Convolution Theorem, Fourier integral theorem , Parseval‟s identity , Cauchy's integral theorem , Cauchy's residue theorem .

3.Illustrate the examples using Laplace transform, Fourier Transform, Partial differential equation, Function of Complex Variables, Matrices.

4.Apply the knowledge of Laplace transform ,Z-transform, function of complex variable, Advance partial differential equation.

5.Analyze the question on Laplace transform, Fourier Transform, Partial differential equation , Function of Complex Variables

6.Create a modal using Laplace transform, Fourier Transform, Partial differential equation, Function of Complex Variables, Matrices.

COURSE CONTENTS

UNIT 1 : Matrices **[07 hrs]**

Characteristics equation, Eigen values and Eigen vectors, Statement and Verification of Cayley Hamilton Theorem [without proof], Reduction to Diagonal form, Sylvester's theorem [without proof.]

UNIT 2: Laplace Transform **[07 hrs]**

Definition , conditions for existence; Properties of Laplace transforms; Transforms of some special functions- periodic function, Heaviside-unit step function.

UNIT 3: Inverse Laplace Transform **[07 hrs]**

Introductory remarks ; Inverse transforms of some elementary functions ; Partial fraction method and Convolution Theorem for finding inverse Laplace transforms ; Applications to find the solutions of differential equations

UNIT 4: Z- Transform **[07 hrs]**

Defination, Convergence of Z-transform and Properties, Inverse Z-transform by Partial Fraction Method, Residue Method (Inversion Integral Method), Solutions of Difference Equations with Constant Coefficients by Z- transform.

UNIT 5: Advance Partial Differential equations **[07 hrs]**

Introduction Partial differential equation, method of separation of variables, Application of partial differential equations .(Heat equation ,wave equation , Laplace Equation)

UNIT 6: Functions of Complex Variables **[07 hrs]**

Analytic functions; Conjugate functions; Cauchy- Riemann equations in Cartesian and polar forms; Harmonic functions in Cartesian form, Cauchy's integral theorem; Bilinear transform Cauchy's integral formula; Residues; Cauchy's residue theorem (All theorem without proofs)

Text Books:

1. Higher Engineering Mathematics by B. S. Grewal, Khanna Publishers, New Delhi.
2. Advanced Engineering Mathematics by Erwin Kreyszig, John Wiley & Sons, New York.
3. A Course in Engineering Mathematics (Vol III) by Dr. B. B. Singh, Synergy Knowledge ware, Mumbai.
4. A Text Book of Applied Mathematics (Vol I & II) by P. N. Wartikar and J. N. Wartikar, Pune Vidyarthi Griha Prakashan, Pune.
5. Higher Engineering Mathematics by H. K. Das and Er. Rajnish Verma, S. Chand & CO. Pvt. Ltd., New Delhi.

Reference Books:

1. Higher Engineering Mathematics by B. V. Ramana, Tata McGraw-Hill Publications, New Delhi.
2. A Text Book of Engineering Mathematics by Peter O' Neil, Thomson Asia Pte Ltd., Singapore.

3. Advanced Engineering Mathematics by C. R. Wylie & L. C. Barrett, Tata Mcgraw-Hill Publishing Company Ltd., New Delhi.
4. Integral Transforms and Their Engineering Applications by Dr. B. B. Singh, Synergy . Knowledge ware, Mumbai.
5. Integral Transforms by I. N. Sneddon, Tata McGraw-Hill, New York.

EET3003	Theory of Electrical Engineering	4 Credit

COURSE OBJECTIVE

Students will learn:

1 Remember fundamental principles of electrical and magnetic circuit

2 Understand simplified methods such as series parallel reductions, voltage and current dividers, and the mesh - node method.

3 To apply laws of electric and magnetic system.

4 To analyze electrical circuit, magnetic circuit and illumination system

5 To utilize various lighting system and electric system and evaluation of same.

6 Design parameters of electrical circuit, magnetic circuit and illumination system.

COURSE OUTCOMES

Upon completion of this course, the students shall be able to,

1. Remember the basic laws of electric and magnetic circuits also Define various A.C. and D.C Quantities
2. Understand and interpret the sinusoidal electrical quantities mathematically as well as graphically in the form of waveforms/phasors and illustrate the 1-phase/3-phase AC circuits.
3. Apply knowledge to calculate the power loss, voltage drop of electric and magnetic circuit also identify illumination required and the knowledge related with its need.
4. Analyze various electric, magnetic circuit and distinguish between properties.
5. Evaluate lighting system, recommend various lighting as per requirement also able to Explain A.C. fundamentals.
6. Design lighting system and also able to give solutions on single phase, poly phase and magnetic circuit unknown quantities.

Course Contents:

Unit 1: D. C. Circuits (Only Independent sources) **[08 hrs]**

Ohm's law, resistances in series and parallel, current and voltage division rules, Kirchhoff's law, ideal and practical voltage and current sources. Mesh and Nodal analysis (Super node and super Mesh excluded). Source transformation. Star delta transformation. Superposition theorem.

Unit 2: Electromagnetism **[10 hrs]**

Magnetic effect of electrical current cross and dot convention, right hand thumb rule and cork screw rule, nature of magnetic field of long straight conductor, concepts of solenoid and torrid. Concepts of m.m.f, flux, flux density, reluctance, permeability and field strength, their units and relationship. Simple series and parallel magnetic circuits. , comparison between electrical and magnetic circuits , force on current carrying conductor placed in magnetic field, Fleming's left hand rule.

Faraday's law of electromagnetic induction, Fleming's right hand rule, statically and dynamically induced EMF's self and mutual inductance coefficient of coupling, energy stored in magnetic field.

Unit 3: A.C. Fundamentals **[12 hrs]**

Sinusoidal voltage and currents, their mathematical and graphical representation, concept of cycle period, frequency, instantaneous, peak, average, r.m.s. values, peak factor , and form factor, phase difference, lagging, leading and in phase quantities and phasor representation. Rectangular and polar representation of phasors. Study of A.C circuits of pure resistance, inductance and capacitance and corresponding voltage- current phasor diagrams, voltage , current and power waveforms.

Unit 4: Single phase and poly phase A. C. circuits **[12 hrs]**

Single phase AC Circuits: Study of series and parallel R-L, R-C, R-L-C circuits, concept of impedance and admittance for different combinations, wave form and relevant voltage current phasor diagrams. Concept of active, reactive, apparent, complex power and power factor, resonance in series and parallel RLC circuit. Q- factor and bandwidth.

Polyphase AC circuits: Concept of three phase supply and phase sequence. Balanced and unbalanced loads voltage current and power relations in three phase balance star and delta loads and their phasor diagrams.

Unit 5: Electrostatics **[07 hrs]**

Electrostatics: electrostatic field, electric flux density, electric field strength, absolute permittivity, relative permittivity and capacitance, composite dielectric capacitors, capacitors in series and parallel, energy stored in capacitors, charging and discharging of capacitors and concept of time constant.

Unit 6 : Illumination and Electrical Energy Tariff **[07Hrs]**

Definitions of luminous flux, luminous intensity, candle power, illumination, luminance, luminous efficiency (lumens/watt) of different types of lamps, working principle of Fluorescent/ Sodium Vapour/ Mercury vapour & CFL Lamps. Simple numerical to determine number of lamps to attain a given average lux level in an area.

Types of Tariff, One part (KWH based) tariff with simple numerical: (Students should be able to calculate the domestic electricity charges.)

Text Books:

1. Elements of Electrical sciences: P. Mukhopadhyay, N. Chand & Bros Roorkee (1989).
2. Electrical Technology: B. L. Thareja, S. Chand Publications.
3. Basic Electrical Engineering: S. B. Bodkhe, N. M. Deshkar, P. P. H. Pvt. Ltd.

Reference Books:

1. V. N. Mittal and Arvind Mittal;, " Basic Electrical Engineering" McGraw Hill
2. Vincent DelToro, " Electrical engineering Fundamentals", PHI second edition 2011
3. Bolestaad, :"Electronics Devices and Circuits Theory", Pearson Education India
4. Edward Hughes, " Electrical Technology,", Pearson Education
5. D.P. Kothari and Nagrath " Theory and Problems in electrical Engineering", PHI edition 2011.

EE3T004	Network Analysis	3 Credit

COURSE OBJECTIVE

Students will learn:

1. The fundamental principles of electrical circuit analysis
2. To become adept at using various methods of circuit analysis, including simplified methods such as series parallel reductions, voltage and current dividers, and the mesh - node method.
3. To appreciate the consequences of linearity, in particular the principle of superposition and Thevenin - Norton equivalent circuits.
4. To analyze energy storage elements.
5. To utilize Laplace transforms for circuit analysis.
6. To analyze four terminal networks using two-port parameters.

Course Outcomes:

Students should be able to:

1. Define basic concepts and principles related to Circuit Analysis
2. Identify the super mesh & super nodal problems.
3. Apply a variety of circuit analysis methods including theorems and Laplace transform
4. Solve two port network problems.
5. To design and develop network equations and their solutions.
6. Select best possible method of circuit analysis for a given situation

COURSE CONTENTS

Unit 1: Terminal Element Relationships **[06 Hrs]**

V-I relationship for Inductance and Capacitance - Constant Flux Linkage Theorem and Constant Charge Theorem. Dependent and Independent Sources, Active & Passive Elements, Source Transformation, Duality.

Unit 2: Mesh And Nodal analysis **[08 Hrs]**

Mesh analysis of circuits containing resistors, inductors, capacitors, transformers, and both independent and dependent sources to determine current, voltage, power, and energy. Concept of super mesh, mutual inductance, coefficient of coupling, Dot convention, dot marking in coupled coils. Nodal analysis of circuits containing resistors, inductors, capacitors, transformers, and both independent and dependent sources to determine current, voltage, power, and energy. Concept of super node.

Unit 3: Network Theorems **[07 Hrs]**

Linearity theorem, Thevinin's theorem, Norton's theorem, Maximum power transfer theorem, Reciprocity theorem, Compensation theorem, Tellegen's theorems (Both AC & DC)

Unit 4: Time Domain Analysis of Circuits **[07 Hrs]**

Linear Differential Equations for Series RC, Parallel RC, Series RL, Parallel RL, Series RLC, Parallel RLC and Coupled Circuits- Complete Solution for step/impulse/sinusoid voltage/current inputs. Natural Response-Transient Response-Time Constant-Rise and Fall times-Concept of D.C. steady state and sinusoidal steady state-Frequency Response of simple circuits from steady state solution-Solution of two mesh circuits by differential equation method Determination of initial conditions

Unit 5: Laplace Transform & Properties **[07 Hrs]**

Review of Laplace Transform & Properties Partial fractions, Concept of initial and final condition, Singularity functions, Waveforms synthesis, Steady state and transient state analysis of RL, RC, RLC network with and without initial conditions with Laplace transforms. Network Functions: Driving points and transfer functions, poles, zeros of transfer function, their properties.

Unit 6: Two Port Networks **[07 Hrs]**

Two port networks, characterizations in terms of impedance, admittance, hybrid and transmission parameters, Conditions for symmetry and Reciprocal, inter relationships among parameter sets Reciprocity Theorem-Interconnection of Two port networks: Series, Parallel and Cascade connection.

Ref Books:

1. Mac.E Van Valkenburg, "Network Analysis"
2. Franklin Fa-Kun. Kuo, "Network Analysis & Synthesis", John Wiley & Sons.
3. M. L. Soni, J. C. Gupta, "A Course in Electrical Circuits and Analysis"
4. Mac.E Van Valkenburg, "Network Synthesiss"

5. Joseph A. Edminister, Mahmood Maqvi, “Theory and Problems of Electric Circuits”, Schaum's Outline Series
7. Sudhakar Shyammohan Tata Mc Graw Hill 2005, “Circuit and Network Analysis”\

EE3L004	Network Analysis Lab	1 Credit

COURSE OBJECTIVE

Students will learn:

8. The fundamental principles of electrical circuit analysis
9. To become adept at using various methods of circuit analysis, including simplified methods such as series parallel reductions, voltage and current dividers, and the mesh - node method.
10. To appreciate the consequences of linearity, in particular the principle of superposition and Thevenin - Norton equivalent circuits.
11. To analyze energy storage elements.
12. To utilize Laplace transforms for circuit analysis.
13. To analyze four terminal networks using two-port parameters.

COURSE OUTCOMES

Students should be able to:

1. Define basic concepts and principles related to Circuit Analysis
2. Identify the super mesh & super nodal problems.
3. Verifies principles of network
4. Solve two port network problems.
5. To Analyze RLC Circuit

List of Practical

1 To Study & Verify Superpostion theorem
2 To Study & Verify Thevinion’s theorem
3 To Study & Verify Norton’s theorem
4 To Study & Verify maximum power transfer theorem
5 To Study & Verify reciprocating theorem
6 Determination of transient response of current in RL & RC circuits with step voltage input
7 Analysis of RL/ RC and RLC circuits

8 Determination of driving point and transfer functions of a two port ladder network and verify with theoretical values

9 Determination of z and h parameters (dc only) for a network and computation of Y and ABCD parameters.

EE3T005	Electrical Machine-I	3 Credit

COURSE OBJECTIVE

The course objective is to impart knowledge of,

1. The basic principle of transfer of electrical power, operation, construction of Single phase and Three phase transformers, their classification, connections and phasor diagrams.
2. The basic principle, construction, operation, Performance characteristics, steady state analysis and applications of DC generators and motors.
3. The basic principle, construction, operation, Performance characteristics, steady state analysis, Speed control and applications of Single Phase and Three phase Induction motors.

COURSE OUTCOMES

Upon completion of this course, the students shall be able to,

1. Recall the basic laws and rules of electromagnetic induction, electric and magnetic circuits.
2. Understand constructional features, working principles of electrical machines and explain different types of starting & speed control methods of electric motors.
3. Apply knowledge to calculate the power loss, voltage regulation, efficiency of transformer and operating speed of electric motor and choose type of motor, its starting and speed control methods with respect to applications.
4. Analyse performance indices, vector diagrams of electrical machines and examine the need of parallel operation, O.C. & S.C. test, Polarity test on transformer, and blocked rotor test on induction motors.
5. Evaluate braking methods of DC, and induction motor.
6. Design motoring system able to give solutions for single phase, three phase and DC supply with respect to supply available and load requirements.

COURSE CONTENTS

Unit 1: Single Phase Transformer [05 Hrs]

Transformer construction, classification, principle and operation of single phase transformer, Excitation phenomenon in transformers, Ideal and practical transformer, equivalent circuits, NO load and ON load operation, Phasor diagrams, Power and Energy Efficiency, Voltage regulation, Polarity test, Parallel operation, O.C. & S.C. test on single phase transformer, Effect of load on power factor, Applications-Auto transformers, Variable frequency transformer, Voltage and Current transformers, Welding transformers, Pulse transformer and applications.

Unit 2: Three Phase Transformer [05 Hrs]

Constructional features, principle and operation of three phase transformer, Regulation, Efficiency, Three winding transformers and its equivalent circuit, Magnetizing current and harmonics, Winding identifications, Various connections with vector group, On load tap changing of transformers, O.C. & S.C. test on three phase transformer, Determination of equivalent circuit parameters calculation using O.C. & S.C. test, Parallel operation of three phase transformer, Scott Connection, Back to Back test, Type and routine tests.

Unit 3: DC Generator [05 Hrs]

Construction, Magnetic structure, Principle and operation, Field and Armature systems, Field and Armature windings (Both Lap and Wave Types), EMF Equation,Armature reaction - Demagnetizing and Cross magnetizing mmfs and their estimation; Remedies to overcome the armature reaction, commutation, straight line commutation, inter-poles, compensating winding, Causes of bad commutation and remedies, Building of Emf in D.C. Shunt generator, Characteristics and Applications of Different types of D.C. Generators.

Unit 4: DC Motor [05 Hrs]

Principles of working, Significance of back emf, Torque Equation, Types, Characteristics and Applications of various types of D.C. Motors, Starting of DC Motors, Speed control of Series, Shunt and Compound motors, Power flow in DC machines, Losses and Efficiency, Condition for Maximum Efficiency, Braking of DC Motors, Effect of saturation and armature reaction on losses &Applications

Unit 5: Three Phase Induction Motor [04Hrs]

Types of 3-∅ induction motor and production of torque. Torque-slip characteristics, Torque-speed characteristics & Applications, NO load blocked rotor test, Losses & efficiency, Double cage motor, Operating characteristics & Influence of machine parameter on the performance of motor, Various methods of starting of 3 phase I.M, Methods of speed control of I.M., Braking Methods-Braking regenerative braking, Plugging, Dynamic braking, Crawling & cogging.

Unit 6: Single Phase Induction Motor **[04Hrs]**

Construction, Double Field revolving theory of Single phase induction motor, Types of IM on the basis of self-starting methods: Split phase induction motor: Capacitor start inductor motor, Capacitor start capacitor run induction motor (two value capacitor method), Permanent split capacitor (PSC) motor; Shaded pole induction motor; Phasor diagrams, Losses and Efficiency, Load characteristics & Applications.

Text Books:

1. Electrical Machines: Dr. P.S. Bimbhra
2. Electrical Machines: Ashfaq Hussain; Dhanpat Rai Publication
3. A Text Book of Electrical Technology: B. L. Theraja (Vol. II)
4. Electrical Machines 2nd -1993 :Dr. P. K. Mukherjee and S. Chakravarti, Dhanpat Rai Publications (P) Ltd
5. Electrical Machines 3rd -2010: J.Nagrath and Dr. D.P.Kothari; Tata McGraw Hill

Reference Books:

1. Performance & Design of A.C. Machine: M. G. Say
2. Laboratory Courses in Electrical Engineering: Tarnekar, Kharbanda, Bodkhe& Naik
3. D.C. Machines: Langsdorf
4. Electrical Machines and Transformers: Nasser Syed
5. Laboratory manual for Electrical machines: Dr. D.P. Kothari and Prof. Umre; S. S.CHAND publications.

EE3L005	Electrical Machine-I Lab	1 Credit

COURSE OBJECTIVE

The course objective is to impart knowledge of,

1. The basic principle of transfer of electrical power, operation, construction of Single phase and Three phase transformers, their classification, connections and phasor diagrams.
2. The basic principle, construction, operation, Performance characteristics, steady state analysis and applications of DC generators and motors.
3. The basic principle, construction, operation, Performance characteristics, steady state analysis, Speed control and applications of Single Phase and Three phase Induction motors.

COURSE OUTCOMES

Upon completion of this course, the students shall be able to,

1. Define the basic laws and rules of Transformer and Electric machines.
2. Demonstrate the constructional features of Transformer and Electrical Machines and illustrate the different machine parameters for transformer and Electrical Machines.
3. Identify the parameters like power loss, voltage regulation, efficiency of transformer and operating speed of electric motor and select the type of motor, its starting and speed control methods with respect to applications.
4. Examine the performance indices, vector diagrams of different electrical machines and inspect the need of parallel operation, O.C. & S.C. test, Polarity test on transformer, and blocked rotor test on induction motors.
5. Interpret different methods of braking for different electrical motors.
6. Develop the motoring system able to give solutions for single phase, three phase and DC supply with respect to supply available and load requirements.

List of Experiments:

1 To verify turns ratio of Transformer.

2 To perform polarity test on Single Phase Transformer.

3 To determine equivalent circuit diagram of transformer through O.C & S.C Test.

4 To determine efficiency by direct loading test on Single Phase Transformer.

5 To verify V-I relationship & draw Phasor diagram of 1.Star-Star 2.Star-delta 3.delta-star 4.Delta-Delta connection of single phase transformer.

6 To study the construction of field and armature of DC Machine.

7 To determine external characteristics of DC Generator.

8 To perform Load test on DC shunt motor.

9 To perform speed control of DC shunt motor using armature and field control method.

EE3T006	Measurement And Instrumentation	3 Credit

COURSE OBJECTIVE

Students will learn:

1. Remembering the fundamental principles of electrical instruments and measurements
2. Classification of various electrical measuring instruments
3. Make a use of operating principles of various electrical measuring instruments.
4. To distinguish between variety of measuring instruments available.
5. To utilize various electrical measuring instruments for different measurements.
6. Estimate various parameters of electrical measuring instruments.

COURSE OUTCOMES

Upon completion of this course, the students shall be able to,

1. Remember the different types of instruments used in electrical measurements.
2. Understand the operating principles of various electrical measuring instruments.
3. Apply knowledge of variety of instruments available for required parameter and identify the appropriate one.
4. Analyze and classify different electrical measuring instruments on basis of type of electrical/ physical quantity to be measured.
5. Evaluate different electrical measuring instruments
6. Test and solve various problems on electrical measuring instruments

UNIT 1: General principles of measurements **[05 hrs]**

Measurement system measurement standards , characteristics - errors in measurement. Calibration of meters- significance of IS standards of Instruments. Classification of meters - operating forces - essentials of indicating instruments - deflecting, damping, controlling torques. Ammeters and voltmeters - moving coil, moving iron, constructional details and operating, principles shunts and multipliers , extension of range.

UNIT 2: Measurement of resistance **[05 hrs]**

Classification of resistance. Measurement of medium resistances , ammeter and voltmeter method, substitution method, Wheatstone bridge method.

Measurement of low resistances , Potentiometer method and Kelvin's double bridge method. Measurement of high resistance: Loss of Charge Method, Direct Deflection Method, Price's Guard wire method. Measurement of earth resistance.

UNIT 3: AC bridges **[05 hrs]**

Generalized treatment of four-arm AC bridges. Sources and detectors. Maxwell's bridge, Hay's bridge Anderson bridge, Owens Bridge for self inductance measurement. Heaviside's bridge for mutual inductance measurement. De Sauty Bridge, Schering bridge for capacitance measurement. Wien's bridge frequency measurements. Sources of error in bridge measurements and precautions. Screening of bridge components.

UNIT 4: Introduction to high voltage and high current measurements **[04 hrs]**

Measurement of high DC voltages - measurement of high AC voltages - electrostatic voltmeters , sphere gaps - DC Hall effect sensors - high current measurements. Study of Phasor Measurement Units (PMU). Current transformers and potential transformers , principle working, ratio and phase angle errors , numerical problems, Clamp on meters

UNIT 5: Measurement of Power & Energy **[05 hrs]**

Principle of Measurement of active, reactive and apparent power single and in polyphase circuits. Measurement of Energy in single and polyphase circuits. Electrodynamometer Wattmeters, Construction, Working, Errors in wattmeter, Single phase Energy meter, Theory and operation , compensation and adjustment. Testing and calibration of single-phase energy meter by phantom loading

UNIT 6: Transducers **[04 hrs]**

Definition and classification - common transducers for measurement of displacement, velocity, flow, liquid level, force, pressure, strain and temperature - basic principles and working of LVDT, electromagnetic and ultrasonic flow meters, piezoelectric transducer, load cell, strain gauge, RTD, Thermistors, thermocouple, Need for instrumentation system, data acquisition system.

Text Book:

1. Sawhney A.K., A course in Electrical and Electronic Measurements & instrumentation, DhanpatRai .
2. J. B. Gupta, A course in Electrical & Electronic Measurement & Instrumentation., S K Kataria& Sons
3. Kalsi H. S., Electronic Instrumentation, 3/e, Tata McGraw Hill, New Delhi, 2012

References:

1. Golding E.W., Electrical Measurements & Measuring Instruments, Wheeler Pub.
2. Cooper W.D., Modern Electronics Instrumentation, Prentice Hall of India
3. Stout M.B., Basic Electrical Measurements, Prentice Hall
4. Oliver & Cage, Electronic Measurements & Instrumentation, McGraw Hill
5. E.O Doebelin and D.N Manik, Doebelin's Measurements Systems, sixth edition, McGraw Hill Education (India) Pvt. Ltd.
6. P.Purkait, B.Biswas, S.Das and C. Koley, Electrical and Electronics Measurements and Instrumentation, McGraw Hill Education (India) Pvt. Ltd.,2013

EE3L006	**Measurement and Instrumentation Lab**	**1 Credit**

COURSE OBJECTIVE

Students will learn:

1. Remembering the fundamental principles of electrical instruments and measurements
2. Classification of various electrical measuring instruments
3. Make a use of operating principles of various electrical measuring instruments.
4. To distinguish between variety of measuring instruments available.
5. To utilize various electrical measuring instruments for different measurements.
6. Estimate various parameters of electrical measuring instruments.

COURSE OUTCOMES

Upon completion of this course, the students shall be able to,

1. Choose correct instrument for measuring given electrical/ physical quantity.
2. Compare various methods and instruments available for measurement of single quantity.
3. Apply understanding about instrumentation concepts which can be applied to electrical measurements.
4. Analyse the testing and measuring set up for electrical systems
5. Evaluate efficiency of different instruments
6. Design circuit for measuring given quantity.

List of Practical:-

1. To measure low resistance by Kelvin's double bridge
2. To measure medium resistance by Wheatstone bridge
3. To measure self inductance by Hay's bridge
4. To measure capacitance by De Sauty Bridge
5. To calibrate a given single phase induction type energy meter.
6. To Study and Calibrate Three Phase Wattmeter.
7. To measure active and reactive power in three phase balanced load by one wattmeter method

8. To find the effect of various parameters on output of given LVDT
9. To Study the change in resistance of RTD probe depending on the process temperature and to Study the dynamic response of RTD probe.
10. To Study the change in EMF of a thermocouple in response to the process temperature.
11. To study impulse voltage generator
12. To study impulse current generator

Note : Some practicals will be conducted through simulations tools.

EE3T007	Innovation and Entrepreneurship Development	Audit

Course Outcomes:

At the end of the Course, Student will be able to:

1. Discover the creative / innovative side within her/him.
2. Hone entrepreneurial and leadership skills within his/her personality.
3. Develop new ways of thinking and Learn the entire innovation cycle from Ideation to GoToMarket.
4. Study frameworks, strategies, techniques and business models for conceived ideas.
5. Develop skills for evaluating, articulating, refining, and pitching a new product or service.

Course Contents:

Introduction to Innovation, Personal thinking preferences, 'Innovation' mind set, Everyday creativity and eliminating mental blocks, Introduction to Innovation, Creative thinking techniques, Innovation types, Idea management and approaches, Teaming techniques for creativity, Idea Conception, Idea Scoping, Self-Evaluation, Idea Brainstorming sessions, Idea Verification, Market Evaluation, Concept Evaluation, Idea Verification, Prototype Evaluation, Protection/Patent review, Innovation Case Study, Idea Presentations, Idea Incubation, Product and Market Plan, Product and Market Development, Innovation Case Studies, Idea Incubation and Product Launch, Marketing and selling, Post Launch Review

Reference Books:

1. Jeff Dyer, Hal Gregersen, Clayton M. Christensen, " The Innovator's DNA: Mastering the Five Skills of Disruptive Innovators, Harvard Business Review Press, 2011.
2. Paddy Miller, Thomas Wedell-Wedellsborg, "Innovation as Usual: How to Help Your People Bring Great Ideas to Life, Harvard Business Review Press, Kindle Edition.

Sr. No.	Subject Category	Subject Code	Course Title	Teaching Scheme			Evaluation Scheme				Credits
				L	T	P	CA	MSE	ESE	**TOTAL**	
1	HSMC	EE4T001	Constitution of India	2	0	0	20	20	60	100	2
2	BSC	EE4T002	Numerical method and probability	2	1	0	20	20	60	100	3
3	ESC	EE4T003	Power Station Practice	4	0	0	20	20	60	100	4
4	PCC-EE	EE4T004	Electronic Devices and circuits	3	0	0	20	20	60	100	3
5	PCC-EE	EE4T005	Power System I	2	1	0	20	20	60	100	3
6	PCC-EE	EE4T006	Electrical Machine II	3	0	0	20	20	60	100	3
7	BSC	EE4L002	Numerical method and probability Lab	0	0	2	60	0	40	100	1
8	PCC-EE	EE4L005	Power System I Lab	0	0	2	60	0	40	100	1
9	PCC-EE	EE4L006	Electrical Machine II Lab	0	0	2	60	0	40	100	1
10	PROJ-EE	EE4P002	Field training/ Internship/ industrial visit	0	0	0	0	0	50	50	1
11	MC	EE4T007	Universal Human Values	2	0	0	10	15	25	50	Audit
				18	**2**	**6**	**310**	**135**	**555**	**1000**	

Total Credits	22

Curriculum for Semester- IV [Second Year]

EE4T001	Constitution of India	Credit 2

COURSE OBJECTIVES

1. Understand the concept of Constitution and its importance.
2. Know the need and importance of protecting Constitution.
3. Familiarize students (Prospective engineers) with elementary knowledge of laws that would be of utility in their profession.
4. To be supplemented by the historical development of laws wherever required.

COURSE OUTCOME

1. To define Constitution and basic knowledge about Indian Constitution.
2. To demonstrate Constitution and its importance.
3. To identify constitution law and constitutionalism

4. Classify Responsibilities, Fundamental Duties and its legal status values of an engineer.
5. To evaluate the Parliamentary Form of Government in India.
6. To create awareness on Constitutional Scheme in India

COURSE CONTENTS:

COURSE CONTENT

Unit 1: Introduction to constitution law and constitutionalism [06 hrs]

Meaning of the constitution law and constitutionalism. Historical perspective of the Constitution of India. Salient features and characteristics of the Constitution of India. Scheme of the fundamental rights.

Unit 2: The Fundamental Duties and its legal status [06 hrs]

The scheme of the Fundamental Duties and its legal status. The Directive Principles of State Policy – Its importance and implementation. Federal structure and distribution of legislative and financial powers between the Union and the States.

Unit 3: The constitution powers [06 hrs]

Parliamentary Form of Government in India – The constitution powers and status of the President of India. Amendment of the Constitutional Powers and Procedure. The historical perspectives of the constitutional amendments in India. Emergency Provisions : National Emergency, President Rule, Financial Emergency

Unit 4: Constitutional Scheme in India [06 hrs]

Local Self Government – Constitutional Scheme in India. Scheme of the Fundamental Right to Equality. Scheme of the Fundamental Right to certain Freedom under Article 19. Scope of the Right to Life and Personal Liberty under Article 21

Text Books:

1. The Constitutional Law Of India 9th Edition, by Pandey. J. N.
2. The Constitution of India by P.M.Bakshi
3. Constitution Law of India by Narender Kumar
4. Bare Act by P. M. Bakshi

EE4T002	Numerical method and probability	Credit 3

Course Outcome

1. Define approximation and errors in numerical differentiation and Integration.
2. Evaluate the roots of the equation using Bracketing methods: Bisection methods, Open methods: Newton Raphson method
3. Apply the Cramer's rule, Gauss- Elimination Method, pivoting, scaling, Heun's method, Runge–Kutta Method,to engineering problem.
4. Analyze the question Newton's Cotes Integration Formulas: Trapezoidal Rule, Simpson's rule, engineering applications Numerical differentiation using Finite divide Difference method.
5. Compute the linear and non linear equation, regression, Interpolation and ordinary differential equation using MATLAB programming
6. Develop computer program for linear and non linear equation.

Course Contents:

Unit 1: Error Analysis [08 Hours]
Significant figures, round-off, precision and accuracy, approximate and true error, truncation error and Taylor series, machine epsilon, data uncertainties, error propagation, importance of errors in computer programming.

Unit 2: Roots of Equations [06 Hours]
Motivation, Bracketing methods: Bisection methods, Open methods: Newton Raphson method, Engineering applications.

Unit 3: Numerical Solution of Algebraic Equations [07 Hours] :
Cramer's rule, Gauss- Elimination Method, pivoting, scaling, engineering applications, Heun's method, Runge–Kutta Method, engineering applications.

Unit 4: Numerical Integration and Differentiation [06 Hours]
Motivation, Newton's Cotes Integration Formulas: Trapezoidal Rule, Simpson's rule, engineering applications Numerical differentiation using Finite divide Difference method

Unit 5: Curve Fitting and Interpolation [08 Hours]
Motivation, Least Square Regression: Linear Regression, Polynomial regression. Interpolation: Newton's Divide Difference interpolation, engineering applications.Motivation, Euler's and Modified Euler's Method.

Unit 6: Introduction to MATLAB Programming : [07 Hours]
Array operations ,Loops and execution control lecture ,working with file: Scripts and function ,Plotting and program output. Overview of programming language, Algorithms and Flowchart of method based on each unit,Development of at least one computer program based on each unit.

Texts:
1. Steven C Chapra, Reymond P. Canale, "Numerical Methods for Engineers", TataMcGraw Hill Publications, 2010.
2. E.Balagurusamy, "Numerical Methods", TataMcGraw Hill Publications,1999.

References:
1. V. Rajaraman, "Fundamental of Computers", Prentice Hall of India,NewDelhi,2003.
2. S. S. Sastri,"IntroductoryMethodsofNumericalMethods",PrenticeHallofIndia,NewDelhi, 3 rdedition,2003. 3. K. E. Atkinson, "An Introduction to Numerical Analysis",Wiley,1978.
4. M.J. Maron, "Numerical Analysis: A Practical Approach", Macmillan, New York, 1982

EE4L002	Numerical method and probability	Credit 1

Course Outcome

1. Define approximation and errors in numerical differentiation and Integration.

2. Evaluate the roots of the equation using Bracketing methods: Bisection methods, Open methods: Newton Raphson method
3. Apply the Cramer's rule, Gauss- Elimination Method, pivoting, scaling, Heun's method, Runge–Kutta Method,to engineering problem.
4. Analyze the question Newton's Cotes Integration Formulas: Trapezoidal Rule, Simpson's rule, engineering applications Numerical differentiation using Finite divide Difference method.
5. Compute the linear and non linear equation, regression, Interpolation and ordinary differential equation using MATLAB programming

Develop computer program for linear and non linear equation.

List of Experiments

1. Program for plotting a circle centre at the point (4,3) with a radius=2 and also 3D circle.
2. Program to plot filled in black circle at x=50, y=55 and with radius =1.
3. Program to plot a sphere
4. Program to plot a straight line
5. Program to plot an ellipsoid
6. Program to plot a cylinder
7. Program for finding roots of f(x)=0 by bisection method.
8. Program for finding roots of equation by newton raphson method.
9. Program for solving numerical integration by simpson's 1/3 rule.
10. Program for solving ordinary differential equation by runge kutta method.

EE4T003	Power Station Practice	Credit 4

COURSE OBJECTIVE

Students will learn:

1 Remember fundamental principles of power plant system

2 Understand various power plant and its practices

3 To apply Economic Operation of Power Systems.

4 To analyze Economic Operation of Power Systems

5 To utilize concept of power plant operations and demand also evaluation of same.

6 Design parameters of basics of power plant operation and its economy.

COURSE OUTCOMES

Upon completion of this course, the students shall be able to,

1. Remember the basic operations of various power plants.
2. Understand and interpret the requirements and basics of power plant installation and site selection.
3. Apply knowledge to Economic Operation of Power Systems and the knowledge related with its need.
4. Analyze various electric power plants operations and distinguish between properties.
5. Evaluate thermal, hydro, nuclear, gas power plant also able to Explain its fundamentals.
6. Design Economic Operation of Power Systems and also able to give solutions implementation of power plant on its basics.

Course Contents:

Unit 1: Introduction

Electric energy demand and growth in India, electric energy sources. Thermal Power Plant: Site selection, general layout and operation of plant, detailed description and use of different parts. Hydro Electric Plants: Classifications, location and site selection, detailed description of various components, general layout and operation of Plants, brief description of impulse, reaction, Kaplan and Francis turbines, advantages & disadvantages, hydro-potential in India

Unit 2: Nuclear Power Plant

Location, site selection, general layout and operation of plant. Brief description of different types of reactors Moderator material, fissile materials, control of nuclear reactors, disposal of nuclear waste material, shielding. Gas Turbine Plant: Operational principle of gas turbine plant & its efficiency, fuels, open and closed-cycle plants, regeneration, inter-cooling and reheating, role and applications. Diesel Plants: Diesel plant layout, components & their functions, its performance, role and applications

Unit 3: Sub-stations Layout

Types of substations, bus-bar arrangements, typical layout of substation. Power Plant Economics and Tariffs: Load curve, load duration curve, different factors related to plants and consumers, Cost of electrical energy, depreciation, generation cost, effect of Load factor on unit cost. Fixed and operating cost of different plants, role of load diversity in power system economy. Objectives and forms of Tariff; Causes and effects of low power factor, advantages of power factor improvement, different methods for power factor improvements.

Unit 4: Economic Operation of Power Systems

Characteristics of steam and hydro-plants, Constraints in operation, Economic load scheduling of thermal plants Neglecting and considering transmission Losses, Penalty factor, loss coefficients, Incremental transmission loss. Hydrothermal Scheduling

Unit 5: Non Conventional Energy Sources

Power Crisis, future energy demand, role of Private sectors in energy management, concepts & principals of MHD generation, Solar power plant, Wind Energy, Geothermal Energy, Tidal energy, Ocean Thermal Energy.

Text Books:

1. B.R. Gupta, "Generation of Electrical Energy", S. Chand Publication.
2. Soni, Gupta & Bhatnagar, "A text book on Power System Engg.", Dhanpat Rai & Co.
3. P.S.R. Murthy, "Operation and control of Power System" BS Publications, Hyderabad. Reference Books:
4. W. D. Stevenson, "Elements of Power System Analysis", McGraw Hill.
5. S. L. Uppal, "Electrical Power", Khanna Publishers

EE4T004	Electronics Devices and Circuits	3 Credit

COURSE OBJECTIVE

Students will learn:

1 To understand operation of semiconductor devices

2 To be exposed to the characteristics of basic electronic devices

3 To apply concepts for the design of Regulators and Amplifiers

4 To verify the theoretical concepts through laboratory and simulation experiments.

5 To implement mini projects based on concept of electronics circuit concepts.

COURSE OUTCOMES

Upon completion of this course, the students shall be able to:

1. Understand the characteristics of the p-n junction, the diode and some special function diodes and these diodes' application in electronic circuits
2. Familiarize the operation and applications of transistor like BJT
3. Develop design competence in power amplifiers using BJT.
4. Apply the knowledge of amplifier in order to Design various differential amplifier
5. Design Various Oscillator Circuits and Understand the concept of FETs as well as MOSFETs
6. Apply the knowledge of Digital Electronics in order to develop the truth tables for various logic Gates

Unit 1: Diode theory and Diode Circuits **[07 Hrs]**

Theory of PN-junction diodes, operation and characteristics, Zener diodes and voltage regulators, Half and Full Wave Rectifiers, Filters, Ripple factor, Voltage doublers.

Unit 2: Bipolar Junction Transistor **[07 Hrs]**

BJT, Theory of operation, characteristics, Biasing arrangements, Stability factor, Small signal analysis of CE, CB, CC amplifiers and their comparison, Power Transistors, Transistor as a switch

Unit 3: Power Amplifiers **[07 Hrs]**

Power amplifiers- classification as A,B, AB, C, Push pull amplifiers, Cross over distortion, Positive and Negative amplifiers- classification, feedback amplifiers, advantages and applications

Unit 4: Differential Amplifiers **[07 Hrs]**

Differential amplifier circuits and their stages, current source, biasing, level Shifting techniques, Common mode and differential mode gain, Impedance of different stages**.**

Unit 5: Oscillators **[07 Hrs]**

Oscillators- Barkhausen‟s criterion, RC and Crystal oscillators. Field effect transistors and MOSFETs- Principle of operation and characteristics, biasing arrangements.

Unit 6: Digital Electronics **[07 Hrs]**

Boolean Identities, Binary, Gray, Octal, Hex & ASCII, Codes, Logic gates and their truth tables, De Morgan‟s Laws, Concept of Sum of Products and Product of Sums.

Text Books:

1. Sanjeev Gupta, "Electronic Devices and Circuits" Dhanpat Rai Publication
2. P. Godse, U. A. Bakshi, "Electronic Devices and Circuits" Technical Publication

3. R P Jain, “Modern Digital Electronics” Tata McGraw-Hill Education

Reference Books:

1. Millman and Halkias;, “Electronic Devices and Circuits” McGraw Hill
2. Millman and Halkias, “Integrated Electronics”, McGraw Hill
3. H. Taub,“ Digital Integrated Electronics”, McGraw Hill
4. Wait, “Introduction to Operation Amplifiers”, Tata McGraw Hill

EE4T005	Power System-I	3 Credit

COURSE OBJECTIVE

Students will develop the ability

1 To calculate the basic parameters of transmission line of power systems.

2 To know the power flow through transmission lines under different circumstances.

3 To model and represent the system components used in power system

4 To represent and understand the transmission line

COURSE OUTCOMES

Upon completion of this course, the students shall be able to,

1. To define basic components of power system and remember the structure of power system.
2. To understand the working of transmission and distribution system and relate the different parameters of transmission and distribution system
3. To do Modeling and representation of the system component used in power system

4. To Analyze the per unit system of power system
5. To select the proper parameter of power system and determine the value of inductance, capacitance, voltage regulation and efficiency of transmission line and explain the effect of sag and corona on transmission line.
6. To create the structure of power system with suitable components and improve the efficiency of power system

COURSE CONTENTS

UNIT 1: General Structure of Electrical Power System [04 hrs]

Introduction to Power System, Generation, Transmission, Distribution and Utilization- Overview Single Line Diagram (SLD) Representation, Use of high voltage, idea about substation (indoor and outdoor), concept of real, reactive and complex power unit system, load and their characteristics, voltage and frequency dependence of loads, overhead v/s underground transmission

UNIT 2: Inductance [05 hrs]

Definition, Inductance due to internal flux of two wire single phase line of composite conductor line, Concept of GMD, Inductance of three phase line with equal & unequal spacing, vertical spacing.

Capacitance: Concept of electric field, Potential difference between two points in space, Effect of earth's surface on electric field, Computation of capacitance of single phase, three phase transmission lines with & without symmetrical spacing for solid & composite conductors.

UNIT 3: Representation of power system elements [05 hrs]

Representation of power system elements, models and parameters of generator, transformer and transmission lines, Transmission line parameters calculation (R,L,C), per unit system representation. Elementary distribution scheme: Feeders and distributors. Introduction to distribution automation.

UNIT 4: Transmission [06 hrs]

Transmission: Types of conductors, Choice of conductor materials, Stranded copper & ACSR conductor, Current and Voltage relation: Representation of short, medium & long transmission lines, voltage regulation and efficiency of power transmission lines using equivalent pi and T representation. Representation using circle diagram with generalized constants. Ferrant effect, Skin Effect, Proximity Effect.

Unit 5: Insulators and Cables Types [03 hrs]

Insulators and Cables Types: Classification of Insulators, Potential distribution over suspension insulator string, String efficiency, Numericals on string efficiency. CABLES: Construction, classification, insulation resistance, capacitance, Dielectric stress, economical size, Grading of cables, Numericals.

Unit 6:Mechanical Design of Transmission Line [04 hrs]

Mechanical Design of Transmission Line: Effect of wind & ice coating on transmission line, sag due to equal & unequal supports, with their derivation, Numericals. Corona: Phenomenon of corona, factors affecting the corona, Power loss & disadvantages of corona.

Textbook:

1. J. B. Gupta, "Power System Analysis",(Katson Books)
2. Kothari Nagrath, "Electric Power System", (Tata McGraw Hill Publications)
3. Wadhva C. L.,"Electric Power System",(Tata McGraw Hill Publications)
4. Asfaque Hussain, "Power System Analysis" CBS

Reference:

1. W.D. Stevenson Jr., Elements of power system analysis, McGraw-Hill publications
2. John J Grainger, W.D. Stevenson, Power System Analysis, McGraw-Hill (India) Pub. , 2003

EE4T006	Electrical Machine II	3 Credit

COURSE OBJECTIVES

This course provides the fundamental knowledge to the students to

1. Understand the concept of MMFs and rotating magnetic fields in synchronous motor.
2. Understand basic principle, construction and operation of synchronous machines.
3. Understand transient and steady state analysis of synchronous machines.
4. Analyse performance characteristics of synchronous machines.

COURSE OUTCOMES

Upon completion of this course, the students shall be able to,

1. Define voltage regulation, load torque angle and MMF of windings.
2. Classify reactances under transient conditions and effects of variable excitation.
3. Apply the method of synchronous impedance and Potier triangle to find voltage regulation.

4. Develop phasor diagram of three phase synchronous machine.
5. Analyze the V curves and effects of excitation and load on motor operation.
6. Compare various methods of cooling in synchronous machine.

Unit 1: Synchronous Machines **[08hrs]**

Construction, types, armature reaction, introduction to armature winding and field windings MMF of armature and field windings induced EMF, circuit model of synchronous machine, power angle characteristics, two axis theory, synchronous motor operation, characteristic curves, synchronous condenser, dynamics, Single phase synchronous motors.

Unit 2: Steady State Operation of Three Phase Synchronous Machine **[06hrs]**

Phasor diagram, voltage regulation using synchronous impedance and Potier triangle method, steady state performance of three phase synchronous machines, circle diagrams

Unit 3: Synchronization **[08hrs]**

Parallel operation, experimental determination of parameters (positive sequence reactance, negative sequence reactance, Zero sequence reactance), short circuit ratio, losses and efficiency

Unit 4: Synchronous Machines On Infinite Bus **[06hrs]**

Phasor diagram, expression for torque, load torque angle, V curve and inverted V curve, effectsof variable excitation and power input on generator operation and effect of variable excitation and load on motor operation, asynchronous generator.

Unit 5: Transient Behaviour **[07hrs]**

Sudden 3, phase short circuit. Transient and sub- transient reactances and their measurement. Time constant and equivalent circuit diagram, hunting & damper windings.

Unit 6: Methods Of Cooling In Synchronous Machines **[07Hrs]**

Cooling system classification, Open ventilated, Air-to-water cooler, Air-to-air cooler, Radial flow ventilation system, Axial flow ventilation system, Circumferential Ventilation, Direct water cooling, Hydrogen cooling, their advantages and disadvantages.

Text Books:

1. Electrical Machine : Dr.P.K.Mukherjee and S. Chakravarti , DhanpatRai
2. Electrical Machinery : Nagrath and Kothari, 3rd , Tata Mcgraw Hill
3. Generalised Theory of Electrical Machinery: P.S. Bhimbra, Tata Mcgraw Hill

Reference Books:

1. Fitzgerald and Kingsley and Kusco , “Electrical Machinery” McGraw Hill
2. P. S. Bhimbra, “Electrical Machinary”

EE4L006	Electrical Machine II Lab	1 Credit

COURSE OBJECTIVES

This course provides the fundamental knowledge to the students

1. To study the performance characteristics of synchronous machine.
2. To study the predetermination of voltage regulation of synchronous generator.
3. To study the variation in reluctance in salient pole machine.
4. To predetermine the characteristics of three phase synchronous motors.

COURSE OUTCOMES

Upon completion of this course, the students shall be able to correlate the theory and practice of the study of

1. Performance characteristics of synchronous machines using direct and indirect methods
2. Regulation of three phase alternator using the predetermination methods
3. Saliency nature of synchronous machine
4. Starting and Speed control of ac machines
5. Synchronization of two three phase alternators
6. Measurement of impedances and short circuit ratio of alternator

List of Experiments

1. Predetermination of regulation of three phase alternator using emf, mmf and Potier triangle method
2. To determine Xd and Xq of the salient pole type synchronous machine
3. To plot V curves and inverted V curves for three phase synchronous machine.
4. Study of prime mover and damper windings in synchronous motor
5. To measure the synchronous reactance of a synchronous generator by measured values of open circuit voltage and short circuit current
7. To study and measure positive, negative and zero sequence impedance of alternator.
8. To measure short circuit ratio of synchronous generator
9. To perform synchronization of two three phase alternators by
   a) Synchroscope method
   b) Three dark lamp method

c) Two bright one dark lamp method

10. To perform OC test on synchronous generator and determine full load regulation of a three phase synchronous generator by synchronous impedance method
11. To study synchronization of the alternator with infinite bus bar

EE4T007	**Universal Human Values**	**Audit**

COURSE OBJECTIVES

1. Sensitization of student towards self, family (relationship), society and nature.

2. Understanding (or developing clarity) of nature, society and larger systems, on the basis of human relationships and resolved individuals.

3. Strengthening of self reflection.

4. Development of commitment and courage to act.

COURSE OUTCOMES

1. Students are expected to become more aware of their surroundings, society, social problems and their sustainable solutions, while keeping human relationships and human nature in mind.
2. They would have better critical ability.

3. They would also become sensitive to their commitment towards what they believe in (humane values. Humane relationships and humane society).
4. they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.

UNIT 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education [10 hrs]

Purpose and motivation for the course, recapitulation from Universal Human Values-I . Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration. Continuous Happiness and Prosperity- A look at basic Human Aspirations . Right understanding, Relationship and Physical Facility- the basic requirements for fulfillment of aspirations of every human being with their correct priority. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario. Method to fulfil the above human aspirations: understanding and living in harmony at various levels. Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking.

Unit 2: Understanding Harmony in the Human Being - Harmony in Myself! [12 hrs]

Understanding human being as a co-existence of the sentient 'I' and the material 'Body'. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer). Understanding the characteristics and activities of 'I' and harmony in 'I'. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail. Programs to ensureSanyam and Health. Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease

UNIT 3: Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship [12 hrs]

Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship. Understanding the meaning of Trust; Difference between intention and competence. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive

Human Goals. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family. Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives

Module 4: Understanding Harmony in the Nature and Existence - Whole existence as Coexistence

[10 hrs]

Understanding the harmony in the Nature. Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self- regulation in nature. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space.Holistic perception of harmony at all levels of existence.

Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

Module 5: Implications of the above Holistic Understanding of Harmony on Professional Ethics

[12 hrs]

Natural acceptance of human values. Definitiveness of Ethical Human Conduct. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people- friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems. Case studies of typical holistic technologies, management models and production systems. Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations.

Text Books:

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010

Reference Books :

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.

2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.

3. The Story of Stuff (Book).

4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi

5. Small is Beautiful - E. F Schumacher.

6. Slow is Beautiful - Cecile Andrews

7. Economy of Permanence - J C Kumarappa

8. Bharat Mein Angreji Raj - PanditSunderlal

9. Rediscovering India - by Dharampal

10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi

11. India Wins Freedom - Maulana Abdul Kalam Azad

12. Vivekananda - Romain Rolland (English)

13. Gandhi - Romain Rolland (English)

Recommendations for specialization B.Tech. with Honor (Major) and B. Tech. with Minor Engineering Degree

1. The concept of Honour and Minors at B. Tech. level is introduced, to enhance learning skills of students, acquisition of additional knowledge in domains and other than the discipline being pursued by the student through online mode, to make the students better employable with additional knowledge and encourage students to pursue cross-discipline research.

2. Eligibility Criteria and rules to award Honours

i) The Student should have Minimum CGPA of 7.5 up to 2nd Semester.

ii) Student willing to opt for honors has to register in 2nd year.

iii) The Student has to complete 6 to 7 additional advanced courses from the same discipline specified in the curriculum. Total credits of these courses should be between 18 to 20. The students should complete these credits before the end of last semester.

iv) Student to opt for the courses from NPTEL/SWAYAM platform as recommend by concern BOS.

v) If the credits of NPTEL/ SWAYAM courses do not match then proper scaling will be done).

Student complying with above criteria will be awarded B. Tech. with Honour Degree.

3. Eligibility Criteria and rules to award Minor Degree

i) The Student should have Minimum CGPA of 7.5 up to 2nd Semester.

ii) Student willing to opt for honors has to register in 2nd year.

iii) The Student has to complete 6-7 additional courses from other discipline of their interest, which are specified in the respective discipline. These courses are of total 18-20 credits.

iv) Student to opt for the courses from NPTEL/SWAYAM platform as recommended by concern BOS.

v) If the credits of NPTEL / SWAYAM courses do not match then proper scaling will be done).

Student complying with above criteria will be awarded B. Tech. with Minor Degree.

4. Availability of course from MOOC platform will be reviewed by the Major and Minor committee before beginning of semester.

Dr.S.R.Vaishnav
Chairman
Board of Studies, EE Dept

VISION	MISSION
"To develop competent and committed Electrical Engineers to serve the society"	1. To impart quality education in the field of Electrical Engineering. 2. To be excellent learning centre through research and industry interaction.

SYLLABUS of V Semester

EE5T001	Power Electronics	3 Credit

PRE REQUISITES: Electronic Devices And Circuits

COURSE OBJECTIVES:

1 .To review principle of construction, operation and characteristics of basic Semiconductor devices.
2. To understand and analyze performance of controlled and uncontrolled converters.
3. To understand and analyze performance of DC to DC converters. Dc to AC converters.
4 .To understand and analyze performance of AC voltage controllers.

COURSE OUTCOME:

CO1: To remember the principle of operation of various basic semiconductor devices
CO2: To understand the characteristics of various types of semiconductor device and its working as converters.
CO3: To make use of various semiconductor device for the converters operation under various load types.
CO4: Examine the performance of various types of converters.
CO5: Compare various types of converters based on performance parameter.
CO6:Todesign the converters based on real time industrial applications.

Unit I :Power semiconductor devices & their characteristics (6 Hrs)
SCR, triac, diac-construction, characteristics & applications, two transistor analogy for turning ON-OFF SCR, turn ON mechanism, different methods of turning ON-OFF SCR, turn OFF mechanism, series and parallel connections of SCRs, Protection of SCR gate circuit protection, over voltage and over current protection, snubber circuit design

Unit II : Turn on and Turn off circuits for power semiconductor devices (6Hrs)
Introduction to GTO, power transistor, power MOSFET & IGBT & their construction &characteristics.Uni-junction transistors, Triggering circuits and optocouplers and Pulse transformer
Introduction to types of power electronic circuits: diode rectifiers, AC-DC converters, AC-AC converters, DC-DC converters, DC-AC converters

Unit III:Diode Rectifiers and AC-DC converters (6Hrs)

Diode Rectifiers: Single phase half wave, full wave rectifiers with R and RL load, Threephase bridge rectifier with R and RL load, Effect of source inductance.

Controlled Rectifiers : Principle of phase controlled rectification, single phase semi andfull converter with R and RL load, power factor improvement in controlled rectifiers, threephase semi and full converter with R and RL load. (only descriptive approach)

Unit IV : DC-AC converters(6 Hrs)

Classification , series inverter, improved series inverter, parallel inverter, out put voltageand waveform control, principle of operation for three phase bridge inverter in 120 deg. and 180 deg. mode, single phase bridge inverter.

Unit V :DC-DC converters (6 Hrs)

Basic principles of chopper, time ratio control and current limit control techniques, voltage commutated chopper ckt., Jones chopper, step-up chopper, step-down chopper and AC chopper.

Unit VI : AC voltage controllers (AC-AC converters) (6 Hrs)

Principle of on-off control, principle of phase control in single phase and three phase circuits, Cycloconverters: single phase cycloconverter operation, three phase cycloconverter operation.

Text Books

1. Rashid M. H – Power Electronics circuits, devices and applications-(New Delhi Pearson Education).

Reference Books

1. Murthi.V. R- Power Electonics Devices, circuits and Industrial Applications.(Oxford).
2. Bimbhra.P. S- Power Electronics.(Khanna Publication).

EE5T002	**Control System-I**	**3 Credit**

PRE REQUISITES: Network Anlysis

COURSE OBJECTIVES:

1. To introduce about fundamental concepts of control system.
2. To understand the concept of stability analysis.

COURSE OUTCOME:

After completion of syllabus, students must be able:

CO1: To remember the basic concept of control system and methods of stability analysis.

CO2: To understand the basic concept of control system and its types

CO3: To apply knowledge of control system analysis to find stability of any system using various methods such as root locus, Bode plot, Nyquist plot etc.

CO4: To analyze any system to find its stability using various methods such as root locus, Bode plot, Nyquist plot etc.

CO5: To evaluate various parameters of system for its stability analysis.

CO6: To design the linear control system in time and frequency domains using various approaches.

EE5T002: CONTROL SYSTEM-I

Unit I: Introduction to Control System **[08 Hrs]**

Introduction to Control Problem : Industrial Control examples, Mathematical models of physical systems, Control hardware and their models, Transfer function models of linear time invariant systems, Feedback control, Open loop and closed loop systems, Benefits of feedback, Block dig and signal flow graph algebra

Unit II: Characteristics of Feedback Control Systems : **[08 Hrs]**

Effect of negative feedback compared to open loop system such as – sensitivity to parameter variation, speed of time response, bandwidth, disturbance rejection and linearizing effect, Effect of positive feedback

Unit III: Time domain analysis **[08 Hrs]**

Concept of transient response, Steady state response and time response, standard test signals, Time response of first order systems, Transfer function of second order system, Time response of second order system, Time response specifications of second order system, steady state error (ess) analysis, static error constants and system type, dominant poles, Relation between roots of characteristic equation, damping ratio and transient response, effect of proportional(P), Integral (I) and derivative (D) controllers on the time response concept of transportation lag.

Unit IV: Stability **[08 Hrs]**
Concept of stability, Effect of pole zero location on stability, Routh- Hurwitz criterian. Root Locus Techniques: Concept and use of root locus, Magnitude and angle criteria, Construction of root loci, effect of addition and poles and zeros on root loci

Unit V: Frequency domain analysis of control systems **[08 Hrs]**
Concept of frequency response and sinusoidal transfer function, resonant frequency, resonant peak, cut off frequency, bandwidth, correlation between time and frequency response.
Frequency Response Analysis: Relationship between time and frequency response, Polar plots, Bode plots. Nyquist stability criterion, Relative stability using Nyquist criterion gain and phase margin, Closed-loop frequency response.

Unit VI: State Space Approach **[08 Hrs]**
State Variable Analysis : Concept of state, state variables and state model, state model of linear systems, state model using physical variables, phase variables and canonical variables, state model from differential equations, block diagram and signal flow graph, transfer function from state model, stability of systems modeled in state variable form.

Text Book:

1. Benjamin C Kuo, “Automatic Control Systems”, Prentice Hall of India.
2. M. Gopal, “Control Systems- Principle of Design”, Fourth Edition, 2012, McGraw Hill.
3. I.J. Nagrath, “Control Systems Engineering” ,New Age International Ltd. , 2000

Reference Books:

1. D’AzzoHoupis, Logakusha, Huelsoman, “Linear System Analysis”, McGraw Hill.
2. Richard C. Dorf and Robert H. Bishop, “Modern Control Systems”, Pearson Education Inc.
3. Norman S Nise, “Control System Engineering”, John Wiley & Sons.
4. Katsuhiko Ogata, “Modern Control Engineering”, Prentice Hall of India

EE5T003	Power Systems-II	3 Credit

PRE REQUISITES: Power Systems-I

COURSE OBJECTIVES:

1. To understand the different parameters of power system operation.
2. To understand the different parameters of power system control.
3. To study different issues related to power systems.
4. After learning, students will be able to analyze different solution methods related to power system
5. Understand amongst the different analytical & numerical methods for power flow solutions
6. Understand different problems related to cost load flow, fault, reactive power and Stability constraints in the power systems

COURSE OUTCOMES:

After completion of syllabus, students must be able:
CO1. **Define** the different parameters of power system operation.
CO2. **Illustrate** the different parameters of power system operation and control.
CO3.To **identify** the different issues related to power systems
CO4. **Analyze** the different solution methods related to power system ..
CO5. **Choose** amongst the different analytical & numerical methods for power flow solutions.
CO6. **Solve** the different problems related to cost load flow, fault, reactive power and Stability constraints in the power systems

Unit I: Economic Operation of Power System (7 Hrs)
Introduction, Distribution of Load between Units & within the Plant.Optimum Generation Scheduling considering Transmission Losses, Representation of Transmission Loss Using Loss Formula Co-Efficient, Derivation of Loss Formula Co-Efficient.

Unit II: Load Flow Studies (6 Hrs)
Per Unit System, Ybus formation Simple example of a loadflowsolution ,Network model formulation, (Applications of iterative techniques like Gauss-Siedal method, and Newton-Raphson method, etc.).

Unit III: Reactive Power Control (6 Hrs)
System voltage and reactive power, Reactive power generation by synchronous machine, Excitation control, Automatic voltage regulator for alternator, Reactive power generation by turbo-generator, Synchronous compensators, Reactors, Capacitors, Static compensators. Introduction to power flow control, HVDC and FACTS.

Unit IV: Symmetrical and unsymmetrical fault analysis: (8 Hrs)

Unbalanced System Analysis using Sequence Components, Symmetrical Fault Analysis Without & With Pre-Fault Load Currents. Symmetrical Component Transformation, Three Phase Power in Unbalanced Circuit in Terms of Symmetrical Component Sequence Impedance of Generator Transformer & Transmission Line ,Unsymmetrical Fault Analysis: L-G, L-L-G-, L-L-L, LL-L-G, Open Conductors Fault Using Symmetrical Components.

Unit V: Stability of Power System : (7 Hrs)

Steady State Dynamic and Transient Stability Definition and Comparison Dynamics of Synchronous Machine Swing Equation Swing Equation for Single Machine Connected To Infinite Bus, Power Angle Equation. Steady State Stability Studies Transient Stability Studies: Swing Curve, Equal Area Criterion for Transient Stability Application of Equal Area Criterion for Different Disturbances. Solution of Swing Equation by Point by Point Method, Methods of Improving Transient Stability.

Unit VI: Load dispatch center functions (6 Hrs)

Contingency analysis, preventive, emergency and restorative Control. power quality def., causes, affects, slandered and mitigation methods

Text Books

1. Nagrath& Kothari – Modern Power System Analysis.(Tata Mcgraw Hill).
2. Prof A M Kulkarni IIT "Bombay Web Course on Power System Operation and Control".

Reference Books

1. Stevension .W. D– Power System Analysis. (Tata Mcgraw Hill).
2. AshfaqHussian - Power System Analysis.(Tata Mcgraw Hill).
3. Hadi Sadat- Power System Analysis (Tata Mcgraw Hill).

EE5TE02(A) Elective I- Renewable Energy System 3 Credit

COURSE OBJECTIVES:

1. To give sufficient knowledge about the promising new and renewable sources of energy
2. Understanding basic characteristics of renewable sources of energy and technologies
3. To give review on utilization trends of renewable sources of energy

COURSE OUTCOMES:

CO1	To define basic properties of different renewable sources of energy and technologies for their utilization.
CO2	Describe main elements of technical systems designed for utilization of renewable sources of energy
CO3	Interpret advantages and disadvantages of different renewable sources of energy
CO4	Undertake simple analysis of energy potential of renewable sources of energy
CO5	Interpret the knowledge of fuel cells, wave power, tidal power and geothermal principles and applications.
CO6	Discuss the economics of harnessing energy from renewable energy sources.

UNIT I :(05 Hrs)

Overview of conventional &renewable energy sources, need , potential & development of renewable energy sources, types of renewable energy sources ,types of renewable energy system, future of energy use, Global and Indian Energy Scenario, Energy for sustainable development, Physical principle of conversion of solar radiation into heat, Global climate change, CO2 reduction potential of renewable energy.

UNIT II: (05 Hrs)

Solar Radiation & its Measurement: Solar constant, solar radiation on earth's surface, solar radiation geometry, solar radiation measurement, estimation of average solar radiation, solar radiation on tilted surface. Introduction to solar collectors.

Applications of Solar Energy: Solar water heating, Space cooling, Solar thermal heat conversion, Solar photovoltaic energy conversion, Solar pumping, Solar cooking , Online grid connected solar photovoltaic generation system.

UNIT III: (05 Hrs)

Wind Energy: Basic principles of wind energy conversion, Wind energy conversion system, Wind data& energy estimation, Site selection consideration, Basic component of wind energy conversion system (WECS), Classification of WEC system, Energy storage, Advantages and Disadvantages of (WECS), Application of wind energy.

UNIT IV:(04 Hrs)

Geothermal Energy: Geothermal fields, Estimates of geothermal power, Basic geothermal steam power plant, Binary fluid geothermal plant , Geothermal preheat hybrid power plant. Advantages and disadvantages of geothermal energy.Applications of geothermal energy in India.

UNIT V :(05 Hrs)

Energy from Oceans : Oceans thermal electric conversion (OTEC) , Claude & Anderson cycle, Evaporators,Bio-fueling,Hybrid cycle,Site selection, Component of OTEC for power generation.Energy from Tides: Introduction, Basic principles of Tidal power, Component of Tidal Power Plant, Operation methods of utilization of Tidal Energy,Estimation of Energy & Power in simple single basin Tidal system,Estimation of Energy & Power in double basin Tidal system , Advantages & limitations of Tidal Power Generation.

UNIT VI:(04 Hrs)

Other nonconventional Energy Sources: Brief intriduction to operating principles of small scale hydro electric power generation,Energy from Bio-Mass, Ethanol production, MHD power generation, Fuel cell, Energy from waste.

Text Books:

1. Non Conventional Energy Sources : G.D. Rai , Khanna publishers
2. Non Conventional Energy Resources : B. H. Khan, 2 nd , The McGraw Hill Companies
3. Energy Technology : Nonconventional, Renewable and Conventional : S. Rao& B. B. Parulekar, 1 st, Khanna Publisher
4. Solar Energy: Principles of thermal collection and storage : S. P. Sukhatme, 2 nd edition, Tata McGraw Hill Publishing Company Ltd.
5. Solar Photovoltaics : Fundamental, Technologies and Applications : Chetan Singh Solanki, PHI Learning Pvt. Ltd.

Reference Books:

1. A. N. Mathur: Non-Conventional Resources of Energy. 2010
2. V. V. N. Kishore: Renewable Energy Engineering and Technology, TERI. 2006

EE5TE01 (B)	Elective I- Electromagnetic Field	3 Credit

COURSE OBJECTIVES:

1. Static electric and magnetic fields.
2. Laws of electromagnetic & electrostatic fields.
3. The nature of dielectric materials like in parallel plate capacitance

COURSE OUTCOMES:

CO1	Remember, Understand Scalars & vector analysis, vector and scalars conversion for different coordinate system.
CO2	Apply Gauss law, Divergence theorem to electric field intensity.
CO3	Apply Faradays law of electromagnetic induction (as a component of Maxwell's equations) to solve and analyze problems of Performance and behavior of electromechanical devices such as Motors, Generators and Transformers.
CO4	Apply effective analysis tool like Poisson's and Laplace equations to current, current density, dielectrics and capacitances.
CO5	Analyze& Apply Biot-Savorts law.
CO6	Solve & Analyze problems of Capacitance of parallel plate capacitor, Capacitance of two wire line, Poissons.

Unit I: Review of Mathematics (05 Hrs)
Scalar and vector fields, calculus of scalar and vector fields (Vector Algebra, Vector addition, vector subtraction, Dot product, Scalar product) in Cartesian and curvilinear coordinates, conversion of variables from Cartesian to cylindrical of Cartesian to spherical.

Unit II: Electrostatics (06 Hrs)
Electric field, divergence & curl of electric field, Coulombs' law, the principle of superposition, point charges, field due to continuous volume charge distribution, field of line charge, field of sheet charges concept of flux density.

Unit III: Gauss's law, Energy and Potential of charge system (05 Hrs)
Gauss's law, Application of Gauss's law, divergence theorem, definition of potential difference and potential, potential of a point charges, potential field of system of charge, potential gradient, Energy density in Electrostatic field.

Unit IV: Conductors, Dielectric and Capacitance and Poisson's and Laplace's Equations (06 Hrs)
Current and current density, continuity of current, metallic conductors, conductor properties and Boundary conditions, Nature of Dielectric materials capacitance and capacitances, Capacitance of parallel plate capacitor, Capacitance of two wire line, Poissons and Laplace equations.

Unit V: Magneto Statics (08 Hrs)
Magnetic force between two small moving charges and the concept of magnetic field. Bio Savart's law, Magnetic flux density vector B and Magnetic flux .The law of conversation of

magnetic flux, Ampere's law, magnetic scalar potential, application to various configurations. Magnetic fields of currents in presence of magnetic materials— current loop in a magnetic field (torque and behavior), elementary current loop and aggregates of current loops.Magnetization vector.Generalization of Ampere's law. Magnetic fields intensity and its interpretation. Boundary conditions, effect of applied magnetic field on materials substances, magnetic characteristics of ferromagnetic materials, B-H curve of iron and hysteresis loops, magnetic circuit, magnetic field problems.

Unit VI: Maxwell Equations **(06 Hrs)**

The equation of continuity and displacement current, Maxwell's equations in different forms and the constitutive relations consequence of Maxwell's equations, plane electromagnetic waves in free space, boundary conditions with generalizations.

Text Books:

1. Matthew N. O. Sadiku, "Elements of Electromagnetics", Oxford University publication, 6 th Edition, 2014.
2. A.Pramanik, "Electromagnetism - Theory and applications", PHI Learning Pvt. Ltd, New Delhi, 2nd Edition, 2009.
3. A.Pramanik,"Electromagnetism-Problems with solution", Prentice Hall of India, Pvt. Ltd., 2nd Edition, 2012.

Reference Books:

1. G.W.Carter,"The electromagnetic field in its engineering aspects", Longmans, 1st Edition, 1954.
2. W.J.Duffin,"Electricity and Magnetism", McGraw Hill Publication, 3rd Edition (Rev), 1980.
3. W.J.Duffin,"Advanced Electricity and Magnetism", McGraw Inc. US, 1968.
4. E.G.Cullwick,"The Fundamentals of Electromagnetism", Cambridge University Press, 3rd Edition, 1966.
5. B.D.Popovic,"Introductory Engineering Electromagnetics", Addison-Wesely, Educational Publishers Inc, International Edition, 1971.
6. WiilaimHayt, " Engineering Electromagnetics", Tata McGraw Hill Education Pvt. Ltd., 7th Edition, 2012.

E-notes:

- nptel.ac.in/downloads/

EE5TE01 (C)Elective I-Introduction to Special Machines	3 Credit

PRE REQUISITES: Electrical Machines -I

COURSE OBJECTIVES:

1. To develop a basic foundation of some special electrical machines.
2. Understand the basic principle, construction &operation, of special electrical machines.
3. Understand & evaluate the performance & operational characteristics of special electrical machines
4. Have the detailed knowledge regarding applications of special electrical machines in day today life.

COURSE OUTCOME:

CO1. **Remember** basic principles of some special electrical machines.
CO2. **Understand** the basics of construction & principle of operation of special electrical machines.
CO3. To **identify** the different operational characteristics related to the special electrical machines.
CO4. **Analyze** the performance indices of special electrical machines.
CO5. **Evaluate** the operation & characteristics of special electrical machines.
CO6. **Solve** the different problems related to operation, supply conversion & performance indices of special electrical machines.

UNIT-I: SPECIAL AC MACHINES (07 Hrs)
Inverted Induction Machine, Synchronous Induction motor, Linear induction Motors (LIM), High efficiency Induction motors, Repulsion motors, Schrage motors. (Only Elementary Aspects).

UNIT-II: FRACTIONAL KILOWATT MACHINES (07 Hrs)
Reluctance motors, AC tachometers, AC Series Motor-Universal Motor, Stepper Motor & its types, Hysteresis Motor, (Only Elementary Aspects).

UNIT-III: SPECIAL D.C. MACHINES (06 Hrs)
PMDC motors: Construction, Working, Characteristics & applications,
BLDC Motors: Construction, Working, Characteristics & applications.

UNIT-IV: PERMANENT MAGNET SYNCHRONOUS MOTORS (07 Hrs)
Introduction, Construction, Working, Ideal PMSM, EMF and Torque equations, Armature MMF, Phasor diagram, Torque/speed characteristics, Applications.

UNIT-V: SERVOMOTORS (07 Hrs)

DC servomotors: Construction, working, torque speed characteristics, applications.
AC servomotors: Construction, working, torque speed characteristics, applications, Comparison of servomotors with conventional motors.

UNIT-VI: SOFTWARE APPLICATIONS (03 Hrs)
NPTEL, (Swayam) courses, Software Applications in Electrical Machines.

Text Books

1. I.J Nagrath, D. P. Kothari,“Electric Machines”, Fourth Edition, Tata McGraw-Hill Publishing Company Ltd.
2. AshfaqHussain ,“Electric Machines”,SecondEdition,DhanpatRai& Co. Ltd.
3. P.S. Bhimbra, “Electrical Machinery”, Seventh Edition,1995,Khanna Publishers
4. Miller, T. J. E., Brushless Permanent Magnet and Reluctance Motor Drives, Oxford Science Publications, 1989.
5. Venkataratnam K., Special Electrical Machines, CRC Press, 2009.

Reference Books

1. Krishnan, R., “Permanent Magnet and BLDC Motor Drives”, CRC Press, 2009.
2. Chang-liang, X., "Permanent Magnet Brushless DC Motor Drives and Controls", Jun 2012.

EE5TE01 (D) Elective I-Electrical Power Utilization & Practice	3 Credit

COURSE OBJECTIVES:

1. Introduce various methods of effectively and efficiently utilizing Electrical Energy for different and desired applications.
2. Teach the various Electrical Lighting principles and their applications.
3. Impart knowledge on effective utilization of Electro Mechanical process.

COURSE OUTCOMES:

CO1: The students should be able to understand the process and application of different types of Electric Heating equipments.
CO2: The students should be able to understand the process and application of different types of Welding equipments.
CO3: Students should be able to understand basics of illumination and working principles of different light sources.
CO4: The students shall be able to apply the fundamentals of illumination systems for lighting design for indoor/ outdoor installations for residential/ commercial and industrial applications.
CO5: The students should be able to understand the working principles and applications for various electrolytic processes for industrial applications.
CO6: The students should be able to understand the Refrigeration cycle process and electrical circuit used in different cooling system.

Unit I: Electric Heating (7 Hrs)
Heating transfer methods, construction, working and applications Resistance heating,Induction heating; principle of core type and coreless induction furnace, Electric arc heating; direct and indirect arc heating, Dielectric heating, Infra-red heating and its applications, Microwave heating

Unit II: Electric Welding (7 Hrs)
Principles of resistance welding, types, Principle of arc production, electric arc welding, characteristics of arc; Power supply required. Advantages of using coated electrodes, comparison between AC and DC arc welding, welding control circuits, welding of aluminium and copper, Introduction to TIG, MIG Welding

Unit III: Illumination Fundamental (7 Hrs)
Nature of light, visibility spectrum curve of relative sensitivity of human eye andwave length of light, Basic terms in lighting systems ,laws of illumination, polar curves, construction & operation of light sources (Incandescent, Fluorescent Tube, Sodium Vapor Lamp, Mercury Vapor Lamp, Neon tube).

Unit IV: Design of Lightning System (7 Hrs)
Lux level requirements for various applications, classification of light fittings and luminaires, factors affecting the design of indoor lighting installations, total lumen method of calculation,

Illumination schemes; indoor and outdoor. Illumination levels General ideas bout street lighting, flood lighting, monument lighting and decorativelighting, light characteristics etc.

Unit V: Electrolytic Processes (6 Hrs)

Need of electro-deposition, Laws of electrolysis, process of electro-deposition, Equipment and accessories for electroplating, Factors affecting electro-deposition, Principle of galvanizing, anodizing and its applications, Electroplating on non-conducting materials, Manufacture of chemicals by electrolytic process, Manufacturing of chemicals by electrolysis process.

Unit VI: Other Applications of Electrical Energy (6 Hrs)

Terminology, Refrigeration cycle, Vapor compression type, vapor absorption type, Electrical circuit of a Refrigerator, Room Air conditioner window type & split type.
Description of Electrical circuit used in
a) refrigerator,
b) air-conditioner, and
c) water cooler

Text Books

1. Art and Science of utilization of electrical energy by H. Partab, DhanpatRai and Sons, Delhi.
2. Uppal S.L, "Electric Power", Khanna Publishers, 1988
3. Open Shaw Taylor, "Utilization of Electrical Energy", Oriented Longmans Limited (Revised in SI Units), 1971.
4. Soni A. Chakrabarti, M.L.Soni, P.V.Gupta, U.S.Bhatnagar, “A text book on Power System Enggineering”, Khanna Publishers, 2000.
5. A.I.Starr, “Generation, Transmission and Utilization of Electric Power”, ELBS, 1978.

Reference Books

Guide book for National Certification Examination for Energy Managers and Energy Auditors, Bureau of Energy Efficiency.

EE5TE02(A) ElectiveII-Advance Renewable Energy System	4 Credit

PRE REQUISITES: Introduction to Non-Conventional energy sources

COURSE OBJECTIVES:

1. Study working principles of various renewable energy sources and their utilities.
2. Study economics of harnessing energy from renewable energy sources.
3. Study of various features of Ecosystem.

COURSE OUTCOME:
CO1: To Define the principle of energy conversion technique from biomass, geothermal and hybrid energy systems.
CO2: To Summarize the effects of air pollution and ecosystems Unit Contents Contact
CO3: To Identify the essential characteristics and technical requirements of photovoltaic and biomass energy systems.
CO4: To Analyze the need of various forms of non conventional energy sources, historical and latest developments
CO5 : Illustrate design of biogas, geothermal and hybrid power plant.
CO6 : Discuss about the environmental aspects of renewable energy resources.

Unit I: Biomass Energy (8 Hrs)
Introduction, Biomass conversion technologies, Biogas generation, classification of biogas plants and their Operating system.Biomass as a source of energy, methods of obtaining energy from biomass, thermal gasification of biomass, Applications.

Unit II: Geothermal Energy (6 Hrs)
Introduction, Geothermal sources , hydrothermal resources, Vapor dominated systems, Liquid dominated systems, hot water fields, Geo pressure resources, hot dry rocks, magma resources, volcanoes. Interconnection of geothermal fossil systems, geothermal energy conversion and applications.

Unit III: Hybrid energy systems (6 Hrs)
Need for hybrid systems, types of hybrid systems site specific examples; PV–Diesel and battery systems, PV– Gas Hybrid system, Biomass gasifier based thermal back up for Solar systems, natural convection solar driers in combination with biomass back up heater. Biogas and solar energy hybrid system, typical applications.

Unit IV: Air pollution (6 Hrs)

Primary, secondary, chemical and photochemical reactions, effects of CO, NO, CH and particulates, acid rain, global warming and Ozone depletion; monitoring and control of pollutants; noise pollution-sources and control measures; thermal-, heavy metals- and nuclear pollutions; industrial pollution from paper, pharmacy, distillery, tannery, fertilizer, food processing and small scale industries.

Unit V: Environment and Social Structure (6 Hrs)
Environment impact assessment policies and auditing, conflicting world views and environmentally sustainable economic growth, introduction to Design For Environment (DFE), product lifecycle assessment for environment and ISO 14000; triple bottom line of economic, environment and social performance.

Unit VI :Ecosystem(7 Hrs)
Ecosystem definition, concepts, structure, realm of ecology, lithosphere, hydrosphere, biosphere, atmosphere-troposphere-stratosphere; Nonrandom high quality solar energy flow/ balance to earth, greenhouse effect, matter and nutrient recycling in ecosystems; nitrogen, oxygen, carbon and water cycles, food producers, consumers and decomposers, food chains; biodiversity, threat and conservation of biodiversity

Text Books/Reference Books

1. Non-conventional energy sources by G.D. Rai, Khanna Publishers
2. Solar Energy: Principles of Thermal Collection and Storage by S,P Sukhatme, Tata McGraw Hill

EE5TE02 (B)	ElectiveII- Analog Digital Electronics	3 Credit

COURSE OBJECTIVES:

1. Understand the diode Circuits
2. Understand the MOSFET Circuits
3. Understand the sequential Circuits

COURSE OUTCOMES:

CO1	Understand the operation and analyze the characteristics of semiconductor diodes, MOSFET, and BJT
CO2	Examine and design electronic circuits containing non-linear elements such as diodes, MOSFET, & BJT using the concepts of biasing, load lines, operating point and incremental analysis
CO3	Apply feedback techniques in amplifier and examine its effect on parameters of amplifiers (ex. Gain, bandwidth, i/p and o/p impedance, etc) and the stability of amplifier
CO4	Design different combinational circuits for various applications
CO5	Design various sequential circuits for different applications
CO6	Design and verify digital systems using combinational and sequential circuits

Unit I: Diode Circuits: (7 Hrs)

P-N junction diode, V-I characteristics of a diode; half-wave and full-wave rectifiers, Zener diodes, clamping and clipping circuit.

Unit II: BJT Circuits (7 Hrs)

Structure and V-I characteristics of a BJT; BJT as a switch. BJT as an amplifier: small-signal model, biasing circuits; common-emitter, common-base and common-collector amplifiers; Small signal equivalent circuit, high-frequency equivalent circuits.

Unit III: MOSFET Circuits: (7 Hrs)

MOSFET structure and V-I characteristics.MOSFET as a switch. MOSFET as an amplifier: small-signal model and biasing circuits, common-source, common-gate and common-drain amplifiers; small signal equivalent circuit - gain, input and output impedances, trans-conductance, high frequency equivalent circuit

Unit IV:Number Systems(7 Hrs)

Logic Simplification Binary/Hexa/octal/BCD Number system, Binary Arithmetic, Boolean Algebra and De Morgan's Theorem, Logic Gates, SOP & POS forms, Logic Optimization

Technique, Karnaugh maps. Introduction to logic families, TTL and CMOS logic, Tri-state logic, Memory- classification, organization, operation and interfacing.

Unit V: Combinational logic Design: (6 Hrs)
Comparators, Multiplexers, Demultiplexer, Encoder, Decoder, Arithmetic Circuit Design, Barrel Shifter, ALU.

Unit VI: Sequential logic Design: (6 Hrs)
Sequential Logic Design Latches, Flip flop – S-R, J-K, D, T and Master-Slave JK FF, counters, Shift registers.

Text books:-

1. Digital Electronic Principles, By Malvino PHI, 3 Edition.
2. Modern Digital Electronics, R. P. Jain, McGraw Hill Education, 2009.
3. Sergio Franco,"Design with Operational Amplifiers and Analog Integrated Circuits," Fourth Edition, McGraw-Hill Education, 2014.

Reference books: -

1. Digital logic and Computer design, M. M. Mano, Pearson Education India, 2016.
2. Fundamentals of Digital Circuits, A. Kumar, Prentice Hall India, 2016.
3.DonaldNeamen, "Electronic Circuits: Analysis and Design," Third Edition, McGraw-Hill Publication, 2006.
4. Donald Neamen, "Semiconductor Physics and Devices: Basic Principles," Fourth edition, McGraw-Hill, 2011.
5. Jacob Millman, Christos Halkias, Chetan Parikh, "Millman's Integrated Electronics," Second edition, McGraw Hill Education, 2017.
6. J. V. Wait, L.P. Huelsman and G. A. Korn, Introduction to Operational Amplifier theory and applications, 2nd Edition, McGraw Hill, New York, 1992.
7. P. R. Gray, R. G. Meyer and S. Lewis, "Analysis and Design of Analog Integrated Circuits", John Wiley & Sons, 2001.

EE5TE02 (C)ElectiveII-Electrical Machine Design	**3 Credit**

COURSE OBJECTIVES:

1. To study mmf calculation and thermal rating of various types of electrical machines.
2. To design armature and field systems for D.C. machines.
3. To design core, yoke, windings and cooling systems of transformers.
4. To design stator and rotor of induction machines.

COURSE OUTCOMES:

CO1. **Remember** appropriate ratings, material, heating and cooling time constants.
CO2. **Understand** magnetic, electric materials, windings and transformers.
CO3. **Apply** concepts in design of electrical apparatus, devices and computer aided designing of transformer.
CO4. **Analyze** different materials, windings and modes of heat generation and heat dissipation in electrical machines.
CO5. **Evaluate** fault parameters in windings, voltage regulation and efficiency in transformer.
CO6. **Design** different types of transformers, heating coils and field coils.

Unit I: Review of material used in construction of electrical machines(7 Hrs)
Classification of magnetic, electric and insulating materials, Design of Electrical machines along with their parts and special features, rating, Specifications, Standards, Performance and other criteria to be considered

Unit II: Design of Induction Motor (7 Hrs)
Construction, Output equation of Induction motor, Main dimensions, choice of specific loadings,Design of squirrel cage rotor and wound rotor,Operating characteristics, Magnetizing current,Short circuit current, Circle diagram

Unit III: Design of synchronous machines (7 Hrs)
Output equations, choice of specific loadings, Design of salient pole machines, Short circuit ratio, Armature design, Estimation of air gap length, Design of rotor,Design of damper winding, Determination of full load field mmf, Design of field winding, Design of turboalternators

Unit IV: Design of transformer (7 Hrs)
Design of distribution and power transformers, Types,Classification and specifications, Design and main dimensions of core, yoke, winding,tank (with or without cooling tubes) and cooling tubes, Estimation of leakage reactance,resistance of winding, No load current, Losses, Voltage regulation and efficiency,Mechanical force developed during short circuits, Their estimation and measures tocounteract them, Testing of transformers as per I.S.S., Numerical examples.

Unit V: Heating, Cooling and Ventilation (6 Hrs)

Study of different modes of heat generation,Temperature rise and heat dissipation, Heating and Cooling cycles, heating and coolingtime constants, their estimation, dependence and applications, Methods of cooling /ventilation of electrical apparatus, Thermal resistance, radiated heat quantity of cooling medium (Coolant) Numerical.

Unit VI: Computer aided Design of Electrical machine(6 Hrs)

Introduction, advantages various approaches of Computer Aided Designing, Computer Aided Designing of transformer, Winding of rotating Electrical Machines. Optimization of Design.

Text Books

1. Sawhney, A.K., 'A Course in Electrical Machine Design', DhanpatRai& Sons, New Delhi, Fifth Edition, 1984.
2. M V Deshpande 'Design and Testing of Electrical Machines' PHI learning Pvt Ltd, 2011
3. Sen, S.K., 'Principles of Electrical Machine Designs with Computer Programmes', Oxford andIBH Publishing Co. Pvt. Ltd., New Delhi, Second Edition, 2009.

Reference Books

1. J Pyrhonen,T. Jokinen and V.Hrabovcova, " Design of Rotating Electrical Machines" , Wiley,2009.
2. K.M.Vishnumurthy 'Computer aided design of electrical machines' B S Publications,2008

EE5TE02(D) Electrical Installation & Design		**3 Credit**

PRE REQUISITES: Electrical Installation & Design

COURSE OBJECTIVES:

1. To explain how the Regulations and Codes are intended to be applied in practice, with the emphasis on design and specification of electrical installation.
2. Acquire knowledge of standard clearances, design and estimation methods of service connections and its safety aspects.

COURSE OUTCOME:

CO1: To Define various terms related to electrical installation system.
CO2: To Illustrate methods of installation, testing and commissioning of electrical apparatus and conductors.
CO3: To Apply knowledge to design the distribution system for residential, commercial, industrial applications and utility distribution networks and illumination design.
CO4: To Examine fault level at various locations in radial networks and be able to find rating and location of series reactors.
CO5 : Design single line diagrams with specifications for distribution networks, motor and power control centers for industrial installations and design reactive power compensation.
CO6 : Understand the fundamental principles for the design and installation of associated protective systems relating to electrical installations and understand the fundamental transformer testing and recognizes the limits of acceptance of each test.

Unit 1: **(7 Hrs)**
Electrical load assessment:
Concept of electrical load, categories of load, types of loads, connected load, demand factor, Maximum demand, diversity factor, load factor, power factor, TOD Tariff, Industrial Electric Bills.
Cables, conductors & bus-bars:
Construction, selection, installation, testing of LT/ HT cables, overload & short circuit ratings, rating factors; Overhead line conductors, copper and aluminiumbusbars.

Unit 2:
Switching & protection devices: **(7 Hrs)**
Types, specifications; selections of isolators, switches, switch fuse units, MCB, ELCB, MCCB,ACB, VCB, SF6 breakers, dropout/ horn gap fuses, AB switches, contactors for voltages upto 33 kV.
Symmetrical Short Circuit Calculations: **(7 Hrs)**

Determining symmetrical short circuit currents at various locations for selecting proper circuit breaker rating & determining value of series reactors for limiting short circuit current.

Unit 3:

Electric supply to Induction Motors in industries:**(7 Hrs)**

Types of motors, SLD and working of DOL/ Star-Delta/ Autotransformer starters; types, specifications, selection of power contactors, Overload relays, short circuit protective devices.

Reactive power management in industries:

Reactive power compensation in industries using static capacitors, use of Power Triangle, Calculating payback period for capacitor investment due to reduced system currents.

Unit 4

Transformers: **(6 Hrs)**

Specifications, ratings, selection, installation, testing & commissioning of transformers, protective device for transformers.

Substations: Types of Substation, Substation scheme and components, 11kV & 33 kV, indoor/ outdoor substations, plan/ elevations, Earthing Arrangements.

Unit 5:Earthing: (7 Hrs)

Necessity of earthing, concept of system & equipment earthing, Dimension & drawings of typical earth electrodes 1) Pipe Earthing 2) Plate Earthing , Earth tester & measurement of earth resistance , Megger. Definition of various terms – Referene earth, earth electrode, earth grid, earth electrode resistance, earth leakage current, earthing conductor, earth mat.

Unit 6: (6 Hrs)

General awareness of IS codes (IS 3043,IS 732,IS 2675, IS 5216,IS 2309), The India Electricity act 1910, The Indian Electricity supply Act 1948, Indian Electricity rule 1956, The electricity regulation commission act 1998, Electricity act 2003, National Electric Code (NEC), scope and safety aspects applicable to residential, commercial & Industrial installation.

Text Books

1. Electric Power Distribution system by A.S.Pabla, Tata Mcgraw Hill.
2. Electrical Engineering Handbook, C. L. Wadhwa.
3. Design of Electrical Installations, V.K.Jain,Amitab Bajaj, Laxmi Publications Pvt Limited, 01-Jan-1993.

EE5TO01	OpenElective-I	Electrical Safety & Management	4 Credit

COURSE OUTCOMES
CO1: Explain the objectives and precautions of Electrical Safety, effects of Shocks and their Prevention.
CO2: Summarize the Safety aspects during Installation of Plant and Equipment.
CO3: Describe the electrical safety in residential, commercial and agricultural installations.
CO4: Describe the various Electrical Safety in Hazardous Areas, Equipment Earthing and System Neutral Earthing.
CO5: State the electrical systems safety management and IE rules.

UNIT-I (7Hr)
INTRODUCTION TO ELECTRICAL SAFETY, SHOCKS AND THEIR PREVENTION:
Terms and definitions, objectives of safety and security measures, Hazards associated with electric current, and voltage, who is exposed, principles of electrical safety, Approaches to prevent Accidents, scope of subject electrical safety. Primary and secondary electrical shocks, possibilities of getting electrical shock and its severity, medical analysis of electric shocks and its effects, shocks due to flash/ Spark over's, prevention of shocks, safety precautions against contact shocks, flash shocks, burns, residential buildings and shops.

UNIT-II (7Hr)
SAFETY DURING INSTALLATION OF PLANT AND EQUIPMENT:
Introduction, preliminary preparations, preconditions for start of installation work, during, risks during installation of electrical plant and equipment, safety aspects during installation, field quality and safety during erection, personal protective equipment for erection personnel, installation of a large oil immersed power transformer, installation of outdoor switchyard equipment, safety during installation of electrical rotating machines, drying out and insulation resistance measurement of rotating machines.

UNIT-III (7Hr)
ELECTRICAL SAFETY IN RESIDENTIAL, COMMERCIAL AND AGRICULTURAL INSTALLATIONS:
Wiring and fitting – Domestic appliances – water tap giving shock – shock from wet wall – fan firing shock – multi-storied building – Temporary installations – Agricultural pump installation – Do's and Don'ts for safety in the use of domestic electrical appliances.

UNIT-IV (7Hr)
ELECTRICAL SAFETY IN HAZARDOUS AREAS:
Hazardous zones – class 0,1 and 2 – spark, flashovers and corona discharge and functional requirements – Specifications of electrical plants, equipments for hazardous locations – Classification of equipment enclosure for

various hazardous gases and vapours – classification of equipment/enclosure for hazardous locations. SF6 Breaker, Vaccum Circuit Breaker, AB Switches, HRC Fuses,etc.

UNIT – V

EQUIPMENT EARTHING AND SYSTEM NEUTRAL EARTHING: (7Hr)

Introduction, Distinction between system grounding and Equipment Grounding, Equipment Earthing, Functional Requirement of earthing system, description of a earthing system, , neutral grounding(System Grounding), Types of Grounding, Methods of Earthing Generators Neutrals.

UNIT-VI

SAFETY MANAGEMENT OF ELECTRICAL SYSTEMS: (5Hr)

Principles of Safety Management, Management Safety Policy, Safety organization, safety auditing, Motivation to managers, supervisors, employees.Review of IE rules and acts and their significance:

Objective and scope – ground clearances and section clearances – standards on electrical safety - safe limits of current, voltage –Rules regarding first aid and fire fighting facility. The Electricity Act, 2003, (Part1, 2, 3,4& 5)

Text books:

1. S. Rao, Prof. H.L.Saluja, "Electrical safety, fire safety Engineering and safety management", Khanna Publishers. New Delhi, 1988.(units-I to V)
2. www.apeasternpower.com/downloads/elecact2003.pdf (Part of unit-V)

Reference Books:

1. PradeepChaturvedi, "Energy management policy, planning and utilization", Concept Publishing company, New Delhi, 1997.

EE5L001	**Power Electronics Lab**	**1 Credit**

List of Practical:-

SrNo	Title of Experiment
1	To study Gate drive circuit
2	To study Reverse recovery time of diode
3	To study Single phase half wave controlled converter
4	To study Characteristics of junction gate fet
5	To study Unsymmetrical half wave bridge rectifier
6	To study SCR parallel inverter
7	To study Lamp dimmer using DIAC and TRIAC
8	To study Simulation of 3 phase full wave controlled rectifier
9	To study Simulation of 3 phase inverter
10	To study Simulation of buck converter

EE5L002	**Control Systems Lab**	**1 Credit**

List of Practical:-

Sr No	Title of Experiment
1	Potentiometer error detector
2	Time response of second order systems
3	Characteristics of synchros
4	A.C. position control system
5	D.C. position control system
6	Determination of step & impulse response for a first order unity feedback system
7	Lag and lead compensation - magnitude and phase plot
8	Stability analysis (Bode, Root locus, Nyquist) of linear time invariant system using MATLAB
9	State space model for classical transfer function using MATLAB
10	Study the effect of addition of poles to the forward path transfer function of a closed loop system
11	Effect of P, PD, PI, PID controller on second order systems

EE5L003	Power Systems-II Lab	1 Credit

List of Practical:-

Expt No	Title of Expt
1	Formation of Bus Admittance Matrix Y-BUS
2	Load flow study using Newton Raphsonmethod .
3	Load flow study using Gauss Seidal Iteration Method .
4	Study of AC network analyzer
5	Measurement of sequence reactance of salient pole synchronous machine
6	Measurement of sub transient reactance of salient pole synchronous machine
7	Steady state stability of synchronous motor
8	Steady sate power limit of transmission line
9	Fault study on AC network analyzer
10	Load flow study on AC network analyzer

EE5P003	Mini Project (Phase I)	**2 Credit**

Mini project should consist of Circuit design, PCB fabrication, & software testing of small digital or analog application circuit. Mini Project work should be carried out by a group of maximum three students. Student should use standard software available for drawing circuit schematic, simulating the design and PCB (single/double sided) layout of circuit.

SYLLABUS of VI Semester

EE6T001	Microprocessor and microcontroller	3 Credit

COURSE OBJECTIVES:

1.To know the architecture of 8085 and 8051.
2.To understand interfacing and interrupt features of 8085 and 8051.
3.To develop program for basic applications.

COURSE OUTCOMES:

CO1: To remember the architecture of 8085 and 8051.
CO2: To understand interfacing and interrupt features of 8085 and 8051.
CO3: To develop program for basic applications
CO4: To distinguish and analyze the properties of Microprocessors & Microcontrollers
CO5:To explain programming logic and concepts of 8085 microprocessors and 8051 micro-controller.
CO6:To build strong foundation for designing real world applications using microprocessors and microcontrollers.

Unit 1 : 8085architecture:(6 Hrs)
Architecture, register structure, addressing modes, instruction set of 8085, timing diagrams,Assembly Language Programming of 8085

Unit 2 : Interfacing: (7 Hrs)
Memory Interfacing: Interface requirements, Address space partitioning,Buffering of Buses, timing constraints, Memory control signals, Read and write cycles,interfacing SRAM, EPROM and DRAM sections. I/O Interfacing: Memory mapped I/OScheme, I/O mapped I/O scheme, Input and Output cycles, Simple I/O ports,Programmable peripheral interface (8255). Data transfer schemes: Programmable datatransfer, DMA data transfer, Synchronous, Asynchronous and interrupt driven datatransfer schemes, Interfacing, Simple keyboards and LED displays.

Unit 3 : Interrupts and DMA:(6 Hrs)
Interrupt feature, Need for interrupts, Characteristics of Interrupts,Types of Interrupts, Interrupt structure, Methods of servicing interrupts, Developmentof Interrupt service subroutines, Multiple interrupt request and their handling, need fordirect memory access, Devices for Handling DMA, Programmable DMA controller8237.

Unit 4 : Applications: (7 Hrs)

Interfacing of A/D converters (ADC 0800/ADC 0808/ADC 0809),Interfacing of D/A converters (DAC 0800), Waveform generators, Multiplexed seven segment LED display systems, Measurement of frequency, phase angle and powerfactor-Traffic light controller, Stepper motor control

Unit 5 : Introduction to microcontroller:(6 Hrs)
8051 architectures, 8051 Internal resources, pin diagram, I/O pins, ports and their internal logic circuits, counters, serial ports, interrupt structure, SFRs and their addressing, watch-dog timer, internal code memory, data memory, stack pointer, flags, bit addressable memory, study of instruction set of 8051.

Unit 6 : 8051 Peripheral Functions :(6 Hrs)
8051 interrupt structures, Timer and serial functions, parallelport features : Modes of operation, Power control, features, Interfacing of 8051, Typicalapplications, MCS 51 family features

Text Books

1. Goankar, R.S., "Microprocessor Architecture Programming and Applications with the 8085/8080A", 3rd Edition, Penram International Publishing House, 1997.
2. Singh. I.P., "Microprocessor Systems", Module 9: Microcontrollers and their Applications", IMPACT Learning Material Series IIT, New Delhi, 1997.

Reference Books

1. Douglas, V.Hall. "Microprocessor and Interfacing Programming and Hardware", 2ndEdition, McGraw Hill Inc., 1992.
2. Kenneth, L.Short., "Microprocessors and Programmed Logic", Prentice Hall of India, 2nd Edition, 1987

EE6T001	**Advanced Control Systems**	**3 Credit**

PRE REQUISITES: Control System-I
COURSE OBJECTIVES:

1. To introduce students about state variable approach and feedback design problems and also to introduce concept of Optimal Control theory, digital control system, Non Linear Control System
2. To Impart the knowledge of stability analysisforOptimal Control theory, digital control system, Non Linear Control System

COURSE OUTCOME:
After completion of syllabus, students must be able:

CO1: To remember the basic concepts of compensation, State variable analysis, Non linear Control System, Digital Control system.
CO2: To understand the basic concepts of compensation, State variable analysis, Nonlinear Control System, Digital Control system.
CO3: To apply different concepts to find controllability, observability and stability of non-linear control system, sampled data control system.
CO4: To analyze continuous time system using state space technique and investigate Controllability and Observability of the system, digital systems using the Z-transformation, and nonlinear system using the describing function technique and phase plane analysis
CO5: To evaluate various parameters of continuous time system, digital systems using the Z-transformation, and nonlinear system using various methods.
CO6: To design controllers to achieve desired specification

UNIT I: COMPENSATION [07 Hrs]
Need for compensation. Performance Analysis of Lead, Lag and Lag-lead Compensators in time & frequency domain, Bode Plots of Lead, Lag and Lag-lead Compensators.
UNIT II: DESIGN BY STATE VARIABLE FEEDBACK [07 Hrs]
Review of state variable representation. Eigen Values, Eigen Vectors, State Transition Matrix (STM), Model Matrix, Solution of state equation.Controllability and Observability. Design of SVF

UNIT III: OPTIMAL CONTROL SYSTEM [07 Hrs]

Performance Index (PI), Desirability of single P.I., Integral square error.Parameter Optimization with & without constraints. Optimal control problem with T.F. approach for continuous time system only.

UNIT IV: CONTROLLER TUNING [07 Hrs]

Review of analog PID controller, PID tuning methods in process control (Ziegler-Nichols tuning method), digital PID controllers.

UNIT V: NON LINEAR CONTROL SYSTEM (NLCS) [07 Hrs]

Non Linear Control System: Types of non-linearities, characteristics of NLCS. Inherent & intentional non- linearities. Describing function method for Analysis Describing functions of some common non-linearities. Stability analysis. Limit cycles & stability of limit cycles. Phase - Plane Method: Singular points stability from nature of singular points Construction of trajectory by Isocline and Delta Method Computation oftime.

UNIT VI: DIGITAL CONTROL SYSTEM [07 Hrs]

Representation of SDCS.Sample & Hold Circuit. Z – Transform. Inverse Z- Transform & solution of difference equation.Z & S domain relationship.Stability by bilinear transformation & Jury's test.Comparison of time response of continuous and digital control system, Effect of sampling period on transient response characteristic Discretization of continuous time state equation.Solution of Discrete time state equations. Controllability &Observability of Discrete time systems.

Text Book:

4. Benjamin C Kuo, “Automatic Control Systems”, Prentice Hall of India.
5. M. Gopal, “Control Systems- Principle of Design”, Fourth Edition, 2012, McGraw Hill.
6. I.J. Nagrath, “Control Systems Engineering” ,New Age International Ltd. , 2000

Reference Books:

5. D’AzzoHoupis, Logakusha, Huelsoman, “Linear System Analysis”, McGraw Hill.
6. Richard C. Dorf and Robert H. Bishop, “Modern Control Systems”, Pearson Education Inc.
7. Norman S Nise, “Control System Engineering”, John Wiley & Sons.
8. Katsuhiko Ogata, “Modern Control Engineering”, Prentice Hall of India

EE6TE03(A)	Elective III- Electrical Energy Conservation &Audit	4 Credit

COURSE OBJECTIVES:

To understand the need of energy audit and the mechanism through which it should be carry out and also to manage the electric and thermal energy.

COURSE OUTCOME:

CO1: Know Present energy scenario with need of energy audit and energy conservation.
CO2: Classify and Manage electric and thermal energy in the industry.
CO3: Identify various aspects of energy audit such as planning, monitoring and implementation
CO4: Analyze the energy flow diagram of an industry and identify the energy wasted or a waste stream.
CO5: Evaluate the techno economic feasibility of the energy conservation technique adopted.
CO6 : Choose appropriate energy conservation method to reduce the wastage of energy

Unit 1: Basics of Energy Management and Conservation (10 Hrs)

Global and Indian energy scenario. Global environmental concerns, Climate Change, Concept of energy management, energy demand and supply, economic analysis; Carbon Trading & Carbon foot prints. Energy Conservation: Basic concepts, Energy conservation in household, transportation, agricultural, service and industrial sectors; Lighting & HVAC systems in buildings.

Unit 2: Energy Audit (8 Hrs)

Definition, need, and types of energy audit; Energy management (audit) approach: Understanding energy costs, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements; Fuel & energy substitution; Energy audit instruments; Energy Conservation Act; Duties and responsibilities of energy managers and auditors.

Unit 3: Material & Energy balance and Waste Heat Recovery (8 Hrs)

Facility as an energy system; Methods for preparing process flow; material and energy balance diagrams. Cogeneration and waste heat recovery;

Unit 4: Energy Action Planning, Monitoring and Targeting: (8 Hrs)

Energy Action Planning : Key elements; Force field analysis; Energy policy purpose, perspective, contents, formulation, ratification; Organizing the management: location of energy

management, top management support, managerial function, roles and responsibilities of energy manager, accountability; Motivation of employees: Information system-designing barriers, strategies; Marketing and communicating: Training and planning.
Monitoring and Targeting : Defining monitoring & targeting; Elements of monitoring & targeting; Data and information analysis; Techniques: energy consumption, production, cumulative sum of differences (CUSUM); Energy Service Companies; Energy management information systems; SCADA systems.

Unit 5: Electrical Energy Management: (8 Hrs)
Supply side: Methods to minimize supply-demand gap, renovation and modernization of power plants, reactive power management, Demand side management: conservation in motors, pumps and fan systems; energy efficient motors.

Unit 6: Thermal energy Management : (8 Hrs)
Energy conservation in boilers, steam turbines and Furnaces; Application of FBC, Heat exchangers and heat pumps.

Text Books/Reference books :

1) Principles of Energy Conservation, Archie, W Culp, Published by McGraw Hill, 1991.
2) Energy Management, P. O'Callaghan, McGraw - Hill Book Company, 1993.
3) Energy Management Handbook, Wayne C. Turner, Wiley Inter Science Publication

EE6TE04 (B)	Linear Electronic Circuits	3 Credit

COURSE OBJECTIVES:

CO1 To understand characteristics of IC and Op-Amp and identify the internal structure.
CO2 To introduce various manufacturing techniques.
CO3 To study various op-amp parameters and their significance for Op-Amp.
CO4 To learn frequency response, transient response and frequency compensation techniques for Op-Amp.
CO5 To analyze and identify linear and nonlinear applications of Op-Amp.
CO6 To understand functionalities of PLL.

COURSE OUTCOME:

On completion of the course, students will be able to:

CO1 Understand the characteristics of IC and Op-Amp and identify the internal structure.
CO2 Derive and determine various performances based parameters and their significance for Op-Amp.
CO3 Comply and verify parameters after exciting IC by any stated method.
CO4 Analyze and identify the closed loop stability considerations and I/O limitations.
CO5 Analyze and identify linear and nonlinear applications of Op-Amp.
CO6 Understand and verify results (levels of V & I) with hardware implementation
CO7 Implement hardwired circuit to test performance and application for what it is being designed.
CO8 Understand and apply the functionalities of PLL.

Unit I: OP-AMP Basics(7 Hrs)

Block diagram of OP-AMP, Differential Amplifier configurations, Differential amplifieranalysis for dual-input balanced-output configurations, Need and types of level shifter,current mirror circuits. Feedback topologies: Voltage series and voltage shunt feedbackamplifier and its effect on Ri, Ro, bandwidth and voltage gain.

Unit II: Linear Applications of OP-AMP(7 Hrs)

Inverting and non-inverting amplifier configurations, voltage follower, summing, averagingscaling amplifier, difference amplifier, integrator, differentiator, and instrumentationamplifiers.

Unit III: Non-linear Applications of OP-AMP(7 Hrs)
Introduction to comparator, characteristics and applications of comparator, Schmitt trigger,clippers and clampers, voltage limiters, square wave generator, triangular wave generator,Need of precision rectifiers, Half wave and Full wave precision rectifiers.

Unit IV: Converters using OP-AMP(7 Hrs)
V-F, I-V and V-I converter, Digital-to-analog converters (DAC): Weighted resistor, R-2Rladder, resistor string etc. Analog-to-digital converters (ADC): Single slope, dual slope,Successive approximation, flash type.

Unit V: Oscillators(6 Hrs)
Principle of Oscillators, Barkhausen criterion, Oscillator types: RC oscillators (design ofphase shift, Wien bridge etc.), LC oscillators (design of Hartley, Colpitts, Clapp etc.), nonsinusoidaloscillators, and voltage controlled oscillators.

Unit VI: Active filters and PLL(6 Hrs)
Design guidelines of Active filters: Low pass, high pass, band pass and band stop filters, block diagram of PLL and its function.

Text Books

1. Ramakant A. Gaikwad, "Op Amps and Linear Integrated Circuits", Pearson Education 2000.
2. Salivahanan and KanchanaBhaskaran, "Linear Integrated Circuits", Tata McGraw Hill, India 2008.
3. George Clayton and Steve Winder, "Operational Amplifiers", 5th Edition Newnes.
4. Sergio Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", Tata McGraw Hill.

Reference Book

1. Bali, "Linear Integrated Circuits", McGraw Hill 2008.
2. Gray, Hurst, Lewise, Meyer, "Analysis & Design of Analog Integrated Circuits", Wiley Publications on Education.

EE6TE03(C)	**Elective III- Introduction to AC and DC Drive**	**3 Credit**

COURSE OBJECTIVES:
1. Understanding the operation of various drives
2. Learning about selection and control of motors.
3. Idea about AC/DC Contactors/Relays, Traction system and PLC programming & its application in electrical drives.

COURSE OUTCOMES
Students are able to
1. Examine factors governing selection of Electric Motors like speed torque characteristics under starting, running, and braking for particular application in a common electric drive system.
2. Select motor rating, Flywheel of common drive motors for continuous and intermittent periodic duties.
3. Analyze control circuit of ac/dc contactors and relays for automatic starting and braking of ac/dc motors.
4. Analyze the performance and suitability of motors used in ac/dc traction, their performance characteristic, and control and braking.
5. Apply digital control of electric motor, plc programming in electrical drives.

Unit I: Introduction to Drives **(6 Hrs)**
Basics of electrical drives and control ,Factors Governing Selection of Electric Motors, Types of Drives and Types of Load, Starting of electric motors, Speed control of Electric motors. Definition classification and speed torque characteristics of common drive motors and their characteristics under starting, running, Electric Braking. Types of enclosures.

Unit II: Rating **(6 Hrs)**
Rating & Service Capacity: Selection of Motor, Insulating materials, its classification, Temperature rise in Electrical machines, Power Capacity for Continuous and Intermittent Periodic Duties, Load Equalization: Flywheel Effect, Speed-Time Relations. Brief idea about drives commonly used in industries.

Unit III:AC and DC contactors and relays **(6 Hrs)**

Control devices for industrial motors, AC and DC contactors and relays: Lock out contactors, magnetic structure, operation, arc interruption, contactor rating, and H.V. contactors. Control circuits for automatic starting and braking of DC motor and three phase induction motor. Control panel design for MCC.

Unit IV: Electrical Traction **(6 Hrs)**

Electrical Traction: Electric Traction system, Speed time curve. Mechanics of Train movement. Traction motor: Motor Used in AC/DC Traction, Their Performance and Desirable Characteristics, Requirements and Suitability of Motor for Traction Duty. Control of D.C. Traction Motor, Series Parallel Control Starting and Braking of Traction Motor

Unit V:Traction motor control **(6 Hrs)**

Traction motor control – Starting and speed control traction motors. Series parallel control with numerical. Starting and speed control of 3-phase induction motors. Braking of traction motor.

Unit VI: **(6 Hrs)**

PLC, its programming and its applications in electrical drives.Digital control of Electric motor, Block diagram arrangement, comparison with other methods of control.

Text Books

1. G. K. Dubey, "Fundamentals of electrical drives", Second edition, (sixth reprint), Narosa Publishing house, 2001.
2. G.K Dubey, "Electrical Drives", Second Edition, 2002, PHI.
3. M.L. Soni, P.V. Gupta, U.S.Bhatnagar, "A course in Electrical Power", 1999, DhanpatRai& Sons.

Reference Books

1. VedamSubrahamanyam, "Electric Drives –Concepts & Applications", 1997, Tata McGraw-Hill.
2. H.Partab, "Art & Science of Utilization of Electrical Energy", 1999, DhanpatRai& Sons.
3. H.Partab, "Modern Electrical Traction", 1973, PritamSurat& Brothers.

EE6TE03 (D) Elective III-Electrical Power Distribution System	Credit 3

COURSE OBJECTIVES:

1.To calculate different distribution factors
2.Understand classification of load, types of load curves.
3.Control of voltage and reactive power in distribution system
4.Understanddistribution automation

COURSE OUTCOME:

CO1. **Remember** basic principles of distribution systems and reliability indices.
CO2. **Understand** the principle of operation of feeder, substation and data acquisition system.
CO3. To **identify** the different factors related to distribution systems.
CO4. **Analyze** the effect of various equipments on voltage control and substation protection requirements.
CO5. **Evaluate** voltage drop, power loss and line drop in distribution system
CO6. **Solve** different problems related to radial networks, reactive power requirements and substation protection

UNIT-1: Distribution systems (6 hrs)
Introduction to Distribution systems, Explanation of basic terms like demand factor, utilization factor, load factor, plant factor, diversity factor, coincidence factor, contribution factor and loss factor, Relationship between the load factor and loss factor, Classification of loads , Changes in load curve due to loads, use of captive generation & cogeneration in distribution network, Electricity Act 2003, Energy conservation act-2001, electricity rules-2005

UNIT-2: **Feeders** **(6 hrs)**
Radial and loop types, engineering considerations for voltage levels and loading, causes of unbalance and unequal drops.

System analysis : Voltage drop and power loss calculations, manual methods of solution of radial networks, three-phase & non-three-phase primary lines load flow and symmetrical component applications.

UNIT-3 :**Distribution System Reliability** **(6 hrs)**
Basic definition, appropriate levels of distribution reliability, Series & Parallel System, Markov Processes, Distribution reliability Indices, System and customer based indices, load and energy based indices, usage of reliability indices.

UNIT-4: **Voltage control** **(6 hrs)**
Equipment for voltage control, effect of series capacitors, effect of AVB/AVR, line drop calculations and compensations, Reactive power requirements, economic consideration & best location.

UNIT-5: DistributionAutomation(6 hrs)
Introduction to Distribution Automation, Data acquisition system and decentralized control, data acquisition and protection considerations of control panel, circuit breakers, fuses, relays, earthing.

UNIT-6: Substation **(6 hrs)**
Substation layout, selection criteria, voltage and spacing load, space and location, distribution substation protection needs, distribution substation construction methods, trends in distribution substation, insulation coordination, voltage regulation, theoretical consideration for fault calculations.

Text Books

1. A. S. Pabla,“Electric Power Distribution”, Fourth Edition, 1997, Tata McGraw-Hill Publishing Company.

2. Kamaraju ,“Electrical Power Distribution System”,Tata-McGraw Hill Publications.

3. TuranGonen, “Electric Power Distribution SystemEngineering”, 2ndEdition,2008,CRC Press

Reference Books

1.M. K. Khedkar& G. M. Dhole., “Electric Power Distribution Automation”, University Science Press.

EE6TE04(A)	Elective IV- Solar Photovoltaic Devices	3 Credit

COURSE OBJECTIVES:

1. To make the student aware about potential of solar photovoltaic energy source,
2. Introduce modeling of PV cell,
3. Understand the maximum PV power harnessing
4. familiarize with PV power conversion devices.

COURSE OUTCOME:
CO1: Calculate and analyse solar insolation on a collecting surface by locating the sun position at anygiven location and time, interpret sun path diagrams.
CO2. Interpret I-V curves from the circuit model of a PV cell, understand the impact of temperature andsolar insolation on I-V curves.
CO3. Evaluate the algorithms used for the maximum power point tracking of PV array.
CO4. Understand the principle of DC-AC power conversion in Grid connected PV system
CO5. Design standalone PV system by estimating the load, sizing and selecting the batteries, sizing and
selecting the PV modules and other components
CO6. Understand the various issues in PV systems.

Unit I:Introduction : (6 Hrs)

Fossil fuel energy usage and global warming; role of renewable energy in sustainable development; renewable energy sources; global potential for solar electrical energy systems.

Unit II Solar Radiation :(6 Hrs)

Extra-terrestrial and terrestrial solar spectrum; clear sky direct-beam radiation; total clear sky Insolation on a collecting surface; radiation on the collector in tracking systems; calculation of average monthly insolation from measured data.

Unit III: PV Cells and Modules :(6 Hrs)

Photovoltaic cell and its simple model; i-v and p-v characteristics; PV modules and arrays ; effect of shading, use of bypass and blocking diodes; influence of temperature; types of solar cells and their performance; Charge controller, Introduction of maximum power point tracking algorithms

Unit IV: PV Inverters: (7 Hrs)

Principle of DC-AC conversion, Working of Grid-connected PV inverter, schemes and basic control; Introduction to Grid Interfacing standards.

Unit V: PV Systems with Battery Energy Storage: (7 Hrs)

Power processing schemes and control for stand-alone applications; batteries for energy storage – types, charging, battery sizing and turn-around efficiency; other types of energy storage for PV systems; grid connected schemes with standby energy storage.

Unit VI :System Level Issues: (6 Hrs)

Design related issues; grounding, dc arcing and other safety related issues; islanding; harmonics; electro-magnetic interference; energy yield and economics of a PV installation.

Text Books

1. Solar Photovoltaic: Fundamentals, Technologies and Applications: Solanki, PHI Learning Pvt Ltd, 2009

Reference Books

1. Photovoltaic Systems Engineering: Roger A. Messenger & Jerry Ventre, CRC Press, 2004, 2nd edition.
2. Renewable and Efficient Electric Power Systems: Gilbert M. Masters, John Wiley & Sons, 2004

EE6TE04(B)	High Power Semiconductor Devices	3 Credit

COURSE OBJECTIVES:

1. To review principle of construction, operation and characteristics of Power switching devices
2. To understand and analyse performance of Power switching devices.
3.To understand various types of Firing and Protecting Circuits.
4. To understand various types of Thermal Protection.

COURSE OUTCOME:

CO1: To remember the principle of operation of various Power switching devices
CO2: To Understand the characteristics of various types of Power switching devices
CO3: To make use of steady state and dynamic models of Power switching devices
CO4: To analyse various types of Thermal Protection required for protection of Power switching devices
CO5: To compare various Thermal Protections and firing protection Circuits of Power switching devices
CO6: To design the Firing and Protecting Circuits for various Power switching devices.

Unit I: Power switching devices overview(6 Hrs)
Attributes of an ideal switch, application requirements, circuit symbols; Power handling capability – (SOA); Device selection strategy – On-state and switching losses – EMI due to switching - Power diodes - Types, forward and reverse characteristics, switching characteristics – rating.

Unit II :Current Controlled Devices: (6 Hrs)
BJT's – Construction, static characteristics, switchingcharacteristics; Negative temperature co-efficient and secondary breakdown; Power darlington –Thyristors – Physical and electrical principle underlying operating mode, Two transistor analogy– concept of latching; Gate and switching characteristics; converter grade and inverter grade andother types; series and parallel

operation; comparison of BJT and Thyristor – steady state and dynamic models of BJT &Thyristor.

Unit III: Voltage Controlled Devices: (6 Hrs)

Power MOSFETs and IGBTs – Principle of voltage controlled devices, construction, types, static and switching characteristics, steady state and dynamic models of MOSFET and IGBTs - Basics of GTO, MCT, FCT, RCT and GATT.

Unit IV: Firing and Protecting Circuits: (6 Hrs)

Necessity of isolation, pulse transformer, optocopler – Gate drives circuit: SCR, MOSFET, IGBTs and base driving for power BJT. - Over voltage, over current and gate protections; Design of snubbers.

Unit V: Thermal Protection: (6 Hrs)

Heat transfer – conduction, convection and radiation; Cooling – liquid cooling, vapour – phase cooling; Guidance for hear sink selection – Thermal resistance and impedance -Electrical analogy of thermal components, heat sink types and design – Mounting types

Unit VI: Phase Controlled Converters: (6 Hrs)

Performance measures of single and three-phase converters with discontinuous load current for R, RL and RLE loads. Effect of source inductance for single and three-phase converters.

Text Books:

1. Rashid M. H., "Power Electronics Circuits, Devices and Applications", Prentice Hall India,Third Edition, New Delhi.

Reference Books:

1. B.W. Williams 'Power Electronics: Devices, Drivers, Applications and Passive Components, Tata McGraw Hill.
2. M. D. Singh and K. B. Khanchandani, "Power Electronics", Tata McGraw Hill.
3. Mohan, Undeland and Robins, "Power Electronics – Concepts, applications and Design, John Wiley and Sons, Singapore.

EE6TE04(C)	Elective IV -Power Semiconductor Based Drive	3 Credit

COURSE OBJECTIVES:

1.To study the converter and Chopper control of DC drives.
2.To study the semiconductor based control of Induction and Synchronous motors.
3.To learn the basics of Switched reluctance motor and Brushless DC motor.
4.To study the non conventional and renewable energy based drives.

COURSE OUTCOMES:

CO1. **Remember** fundamental principles of power electronics and electric drives.
CO2. **Understand** the basics of construction & principle of operation ofvarious electric drives.
CO3. **Apply** suitable control methods to different motor drives.
CO4. **Analyze** the output of conventional drives and semiconductor based drives.
CO5. **Evaluate** the power factor, harmonics and ripple in motor current.
CO6. **Solve** the problems related starting, braking and speed control of motor drives.

Unit I:Dynamics of Electric Drives (7 Hrs)
Fundamentals of torque equations, speed torque convention and multiquadrant operation, components of load torques, classification of load torques, steady state stability, load equation. Speed control and drive classification, close loop control of drives.

Unit II:D.C. motor drives(7 Hrs)
Controlled rectifier fed d.c. drives, single phase and three phase rectifier control of d.c. separately excited motor. Dual converter control of D.C separately excited motor. Power factor, supply harmonics and ripple in motor current. Chopper controlled dc drives of separately excited dc motor, chopper control of series motor, source current harmonics.

Unit III:Induction motor drives(7 Hrs)

Stator voltage control, variable frequency control usingvoltage source invertors, and current sources invertors. Concept of scalar control of 3-ph Induction Motor, Basic philosophy of vector control of 3-ph I.M. their advantages and list of applications.Basic idea of energy conservation in fan and pump type loads using scalar controlled induction motordrives.(Numericals excluded)

Unit IV:Synchronous Motor Drives(7 Hrs)

Starting Braking of synchronous motor, variable frequency control selfcontrolled synchronous motor drive employing load commutated thyristor inverter or cycloconverter, starting oflarge synchronous motors.

Unit V:Advanced Motor Drives(7 Hrs)

Brushless DC motor, stepper motor drives, Introduction tosolar and battery powered drives.Energy conservation in electric drives.

Unit VI:Traction drives: (7 Hrs)

Conventional dc and ac traction drives, semiconductors converter controlled Drives, 25KV AC traction using semiconductor converter controlled dc motor. DC traction using semiconductor, chopper controlled dc motors, polyphase AC motors for traction drives.

Text Books

1.M. H. Rashid, “Power Electronics Circuits Devices and Applications”, Prentice Hall India

2.G. K. Dubey, “Fundamentals of Electric drives”, CRC Press

3.HPartab, “Modern Electric Traction”, PritamSurat, 1973.

4.Venkataratnam K., Special Electrical Machines, CRC Press, 2009.

Reference Books

1.Ned Mohan, “Power Electronics”, John Wiley and Sons, 3rd Edition

2. VedamSubramanhyam, "Electrical drives concepts and applications ", McGraw Hill 1996

EE6TE04(D)	Elective 4-High Voltage DC transmission(HVDC)	4 Credit

PRE REQUISITES: Electrical Power Systems I & II

COURSE OBJECTIVES:

1. To expose the students to the state of the art HVDC technology.
2. Methods to carry out modelling and analysis of HVDC system for inter-area power flow regulation

COURSE OUTCOME:

CO1. **Remember** basic principles of some HVDC Systems.
CO2. **Understand** the basics of HVDC Systems and their implementation.
CO3. To **identify** the different operational characteristics related to HVDC Systems.
CO4. **Analyze** the performance of HVDC Systems.
CO5. **Evaluate** the operation & characteristics of HVDC Systems.
CO6. **Solve** the different problems related to operation of HVDC Systems.

UNIT-I: DC POWER TRANSMISSION FUNDAMENTALS (07 Hrs)
Introduction, Economics of Dc Power transmission, comparison with AC system, Types of DC links, major components of converter station, planning of HVDC system.

UNIT-II: HVDC CONVERTERS (07 Hrs)
Choice of converter configuration, analysis of Gratz circuit with and without overlap, working of converter as rectifier and inverter, equivalent circuit for HVDC link.

UNIT-III: HVDC SYSTEM CONTROL (06 Hrs)
HVDC System Control: Principles of DC link control, converter control characteristics, firing angle control, current and extinction angle control, Starting and stopping of HVDC link.

UNIT-IV: CONVERTER FAULTS AND PROTECTION (07 Hrs)
Converter Faults and Protection: Types of faults-commutation failure, Arc through, Misfire, short circuit in bridge, Over current and over voltage protection, Detection of line faults, Principle of DC circuit interruption, DC breakers, Types and characteristics of DC breakers, effects of proximity of AC and DC transmission lines.

UNIT-V: Multi -Terminal DC (MTDC) Systems (05 Hrs)
Introduction to MTDC Systems, Importance of Multi-Terminal HVDC Systems, Control of MTDC Systems, Interaction between AC-DC Power Systems.

UNIT-VI: Modelling& Representation of HVDC systems (05 Hrs)
Modeling Of HVDC Systems, Per Unit System, Representation for Power Flow Solution, and Representation for Stability Studies.

Text Books

1. J. Arrillaga,"High Voltage Direct Transmission", Peter Peregrinus Ltd. London, 1983.
2. K. R. Padiyar, "HVDC Power Transmission Systems", Wiley Eastern Ltd., 1990.

Reference Books

1. E. W. Kimbark, "Direct Current Transmission", Vol.I, Wiley Interscience, 1971.
2. Erich Uhlmann, "Power Transmission by Direct Current", B.S. Publications, 2004.

EE6TO01	OpenElective I-Industrial Instrumentation	**4 Credit**

COURSE OBJECTIVES:

The objective of the course is to prepare the students:

1. To equip the students with relevant knowledge to suit the industrial requirements.
2. To provide the knowledge about various techniques used for the measurement of industrial parameters.
3. To have an adequate knowledge about electrical and mechanical transducers for measurements of various physical quantities.

COURSE OUTCOME:

At the completion of this course, students will be able to:

1. Select the instruments for measurement of various physical quantities,
2. Select a transducer based on its operating characteristics for the required application.
3. Check various available techniques and select appropriate to obtain satisfactory task for the parameter to be measured.
4. Know advantages and limitations of selected techniques.

Unit I: Introduction to Industrial Instrumentation: (6 Hrs)
Definitions, Dynamic Characteristics of Instruments, Zero-Order Instrument, First-Order Instrument, Second-Order System.
Pressure Measurement: Introduction, Basic terms, Pressure formulas, Pressure measuring instruments, Application considerations.

Unit II: Temperature and Heat Measurement: (6 Hrs)
Introduction, basic terms, Temperature and heat formulas, Temperature measuring devices, Application considerations.

Unit III: Level Measurement &Flow Measurement: **(6 Hrs)**

Introduction, basic terms, Level formulas, Level sensing devices, Application considerations. Flow formulas, Flow measuring instruments, Application considerations.

Unit IV: Position and motion sensing: **(6 Hrs)**

Basic definitions, measuring devices, application considerations.

Force, Torque and Load cell: Basic definitions, measuring devices, application considerations

Unit V: Transducers:

Introduction to instrumentation system, static and dynamic characteristics of an instrumentation system, Principles and classification of transducers, Electrical transducers, basic requirements of transducers.

Unit VI: Digital Data Acquisition systems & control:

Use of signal conditioners, scanners, signal converters, recorders, display devices, A/D & D/A circuits in digital data acquisition.Instrumentation systems.Types of Instrumentation systems.Components of an analog Instrumentation Data –Acquisition system.Multiplexing systems.Uses of Data Acquisition systems.Use of Recorders in Digital systems.Digital Recording systems.Modern Digital Data Acquisition system. Analog Multiplexed operation, operation of sample Hold circuits.

Text Books

1. Industrial Instrumentation: K Krushnaswamy, New Age International
2. E.O. Doebelin, 'Measurement Systems – Application and Design', Tata McGraw Hill publishing company, 2003.
3. R.K. Jain, 'Mechanical and Industrial Measurements', Khanna Publishers, New Delhi, 1999.

Reference Books

1. Fundamentals of Industrial Instrumentation and Process Control:
   William C. Dunn, TMH Publication, 2nd edition.
2. D. Patranabis, 'Principles of Industrial Instrumentation', Tata McGraw Hill Publishing Company Ltd, 1996.
3. A.K. Sawhney and P. Sawhney, 'A Course on Mechanical Measurements, Instrumentation and Control', DhanpathRai and Co, 2004.
4. B.C. Nakra&K.K.Chaudary, 'Instrumentation Measurement & Analysis', Tata McGraw Hill Publishing Ltd, 2004
5. S.K. Singh, 'Industrial Instrumentation and Control', Tata McGraw Hill, 2003.
6. D.P. Eckman', Industrial Instrumentation', Wiley Eastern Ltd.,

EE6L001	Microprocessor and microcontroller **Lab**	**1 Credit**

List of Practical:-

Sr.No	Title of Experiment
1	Study of architecture of 8085
2	Assembly language programmes for determination of smaller and larger no
3	Assembly language programmes for ascending and descending order
4	Multiplication/division of numbers
5	Assembly language programmes for led flashing (Interfacing of 8051 Microcontroller with various display devices.
6	Programming for speed and direction control of dc motor(Interfacing of 8051 Microcontroller with DC motor.
7	Programming for speed and direction of stepper motor
8	Study of hexadecimal, modulo-9, BCD counter

9	Write a program to move a block of data using 8085 & verify
10	Write a program using 8085 & verify for :A. Addition of Two 8-Bit Numbers,B. Addition of Two 16-Bit Numbers (With Carry).
11	Write a Program Using 8085 & Verify for :a. Subtraction of Two 8-Bit Numbers. (Display Of Borrow),b Subtraction of Two 16-Bit Numbers. (Display Of Borrow)

EE6L003	CAD **Lab**	**1 Credit**

List of Practical:-

Sr.No	Title of Experiment
1	**Introduction to CAD**
2	Study of AutoCAD software basics - GUI, limits and units, drawing tools, editing tools, annotations etc.
3	Study of Coordinate systems- Cartesian and Polar (absolute and relative system of measurement) and practice drawing by using following tools: Grid, span, O-snap, Lines, Erase, Zoom.
4	Create a 2D drawing of a given diagram by using drawing tools: circle, arc, rectangle, polygon, ellipse, and Editing tools: trim, move, copy, rotate, and practice of drawing using these commands.
5	Study and create drawing by using Geometry modifying tools: fillet, chamfer, scale, stretch.
6	Study and create drawing by using copying tools like array, mirror, block and offset.

7	Draw regular solids: Cube, Prism, Pyramid, Cylinder, Cones
8	Study and draw 3D drawing of the given object by using AutoCAD commands and tools.
9	Study and draw 3D drawing of the given object by using AutoCAD commands and tools.
10	Study and draw 3D drawing of the given object by using AutoCAD commands and tools.

EE6P004	**Mini Project (Phase II)**	**2 Credit**

Hardware Mini project should consist of Circuit design, PCB fabrication, & hardware designing of small digital or analog application circuit. Mini Project work should be carried out by a group of maximum three students. Student should use standard software available for drawing circuit schematic, simulating the design and PCB (single/double sided) layout of circuit. Project report should consist of details of work carried out including layouts, circuits, datasheets, list of components, cost .

EE6T003	**Research Methodology**	**2 Credit**

Course Objectives:
Student will be able to
1.Understand the basics of research and the research process.
2.Understand the conducting research work and formulating research synopsis andreport.
Know how to develop data analytics skills and meaningfulinterpretation to the data sets so as to solve the business/Research problem.

Course Outcomes
Student should be able to:
CO1. Remember the basic framework of research process.
CO2. Demonstrate various sources of information for research.
CO3. Develop an understanding of various research design and techniques.
CO4. Compare various sources of information for literature review and data collection.
CO5. Interpret the fundamental functions and working of analytical instruments used in research.
CO6.Discuss different methodologies and techniques used in research work.

Unit-I:
Introduction to Research Methodology Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, and Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Importance of Knowing How Research is Done, Research Process and Criteria of Good Research. Defining the Research Problem: Selecting the Problem, Necessity of Defining the Problem and Technique Involved in Defining a Problem

Unit-II:

Research Design Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs: Exploratory research, Descriptive research, diagnostic research, Basic principles of experimental Design and Important Experimental Designs.

Unit-III:

Sampling Design, Measurement and Scaling Techniques Census and Sample Survey, Implications of a Sample Design, Steps in Sampling Design, Criteria of Selecting a Sampling Procedure, Characteristics of a Good Sample Design, Different Types of Sample Designs, How to Select a Random Sample, Random Sample from an Infinite Universe, Complex Random Sampling Designs. Measurement in Research, Measurement Scales, Sources of Error in Measurement, Tests of Sound Measurement, Technique of Developing Measurement Tools, Scaling, Meaning of Scaling, Scale Classification Bases, Important Scaling Techniques

Unit-IV:

Methods of Data Collection Collection of Primary Data, Observation Method, Interview Method, Collection of Data through Questionnaires, Collection of Data through Schedules, Difference between Questionnaires and Schedules, Some Other Methods of Data Collection, Collection of Secondary Data, Selection of Appropriate Method for Data Collection and Case Study Method.

Unit-V:

Simulation in Research

Meaning of Simulation, Need of Simulation, Appropriateness of Simulation, Advantages and Disadvantages of Simulation, Areas of Application, Study of any one tool relevant to electrical engineering area is compulsory

Text Books/References:

1. C. R. Kothari, Research Methodology: Methods and Techniques, Second Revised Edition, New Age International Publication, 2004.
2. J. Banks, J. C. Carson II, B. L. Nelson, D. M. Nicol, Discrete Event System Simulation, Fourth Edition, Prentice Hall of India Publication, 2006.
3. K. N. Krishanaswamy, Appa lyer Sivakumar, M. Mathiranjan, Management Research Methodology: Integration of Principles, Methods and Techniques, Pearson Education, New Delhi, 2006.

Dr.S.R.Vaishnav

Chairman

Board of Studies, EE Dept

Dr. Babasaheb Ambedkar Technological University, Lonere.

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COURSE STRUCTURE AND SYLLABUS

For

Final Year B. Tech. Electrical Engineering / Electrical Engineering (Electronics and Power)/ Electrical & Electronics Engg / Electrical & Power Engineering

With effect from the Academic Year 2020-2021(Final Year)

Dr. Babasaheb Ambedkar Technological University, Lonere.

B.Tech (Electrical Engineering / Electrical Engineering (Electronics and Power)/ Electrical & Electronics Engg / Electrical & Power Engineering)

Curriculum for Semester VII [Final Year]

Sr. No.	Course Code	Type of Course	Course Title	Hours per week			Evaluation Scheme			Total Marks	Credits
				L	T	P	MSE	CA	ESE		
1	BTEEC701	PCC1	Power System Operation & Control	3	0	0	20	20	60	100	3
2	BTEEC702	PCC2	High Voltage Engineering	3	0	0	20	20	60	100	3
3	BTEEC703	PCC3	Electrical Drives	3	0	0	20	20	60	100	3
4	BTEEE704	PEC1	Elective-IX	3	0	0	20	20	60	100	3
5	BTEEE705	PEC2	Elective-X	3	0	0	20	20	60	100	3
6	BTEEL706	Lab	Power System Operation & Control Lab	0	0	2	--	30	20	50	1
7	BTEEL707	Lab	High Voltage Engineering Lab	0	0	2	--	30	20	50	1
8	BTEEL708	Lab	Electrical Drives Lab	0	0	2	--	30	20	50	1
9	BTEES709	Seminar	Seminar	0	0	2	--	30	20	50	1
10	BTEEP710	Project	Project Part-I	0	0	6	--	30	20	50	3
11	BTEEF711	--	Field Training /Internship/Industrial Training III	--	--	--	--	--	50	50	1
			Total	**15**	**0**	**14**	**100**	**250**	**450**	**800**	**23**

Elective-IX	Elective-X
A) Special Purpose Electrical Machines	A) Digital Signal Processing
B) Electrical Traction and Utilization	B) Energy Audit and Conservation
C) Engineering System Design and Optimization	C) Electrical Power Quality
D) Financial Management	D) HVDC Transmission and FACTS

Dr. Babasaheb Ambedkar Technological University, Lonere.

B.Tech (Electrical Engineering / Electrical Engineering (Electronics and Power)/ Electrical & Electronics Engg / Electrical & Power Engineering)

Curriculum for Semester VIII [Final Year]

Sr. No.	Course Code	Course Title	Hours per week			Evaluation Scheme			Total Marks	Credits
			L	T	P	MSE	CA	ESE		
	1.Power Management Integrated Circuits 2.DC Power Transmission Systems 3.High Power Multilevel Converters 4.Fuzzy Sets, Logic and Systems & Applications 5.The Joy of Computing using Python 6.Introduction to Industry 4.0 and Industrial Internet of Things 7.Entrepreneurship Essentials **# Student to opt any two subjects from above list**		3	0	0	20*	20*	60*	100	3
			3	0	0	20*	20*	60*	100	3
6	BTEEP803	Project - II	0	0	30	--	100	150	250	15
		Total	**6**	**0**	**30**	**40**	**240**	**270**	**450**	**21**

** Six months of Internship in the industry*

**Students doing project at institute will have to appear for CA/MSE/ESE*

** Student doing project at Industry will give NPTEL examination / Examination conducted byuniversity i.e. CA/MSE/ESE*

 # These subjects are to be studied on self –study mode using SWAYAM/NPTEL/Any other source

 # Teacher who work as a facilitator for the course should be allotted 3 hrs/week load.

 # Project Load: 2hrs/week/project.

Mapping of Courses with MOOCs Platform SWYAM / NPTEL

S.N.	Course Name	Duration	Name of Professor	Institute offering Course
1	Power Management Integrated Circuits	12 Weeks	Prof. Qadeer Ahmad Khan	IITM
2	DC Power Transmission Systems	12 Weeks	Prof. Krishna S	IITM
3	High Power Multilevel Converters	12 Weeks	Prof. Anandarup Das	IITD
4	Fuzzy Sets, Logic and Systems & Applications	12 Weeks	Prof. Nishchal Kumar Verma	IITK
5	The Joy of Computing using Python	12 Weeks	Prof. Sudarshan Iyengar Prof. Yayati Gupta	IIT Ropar
6	Introduction to Industry 4.0 and Industrial Internet of Things	12 Weeks	Prof. Sudip Misra	IIT KGP
7	Entrepreneurship Essentials	12 Weeks	Prof. Manoj Kumar Mondal	IIT KGP

BTEEC701: POWER SYSTEM OPERATION AND CONTROL	
Teaching Scheme:	Examination Scheme:
Theory: 3hr	Mid-term Test: 20 Marks
Tutorial: 0	Internal Assessment: 20 Marks
Total Credits: 3	End Term Exam: 60 Marks

Prerequisite:

1. Power System-II

Course Objectives:

1. To understand the fundamental concepts of power system.
2. To obtain mathematical model of Synchronous machine, excitation and speed governing system.
3. To analyze the transient stability of power system.
4. To understand the economic operation of power system.
5. To explain various techniques of reactive power and voltage Control

Course Outcome:

1. Explain the fundamental concept of power system.
2. Design the mathematical model of synchronous machine.
3. Design the mathematical model Excitation system and speed governing system.
4. Analyze the transient stability of power system using swing equation and equal area criteria.
5. Analyze the economic operation of power system.
6. Explain the methods of Voltage control.

UNIT I. FUNDAMENTALS OF POWER SYSTEM: (6hr)

Concepts of real and reactive powers, complex power, per-unit representation of power system, Transmission capacity, load characteristics, real power balance and its effect on system frequency, load frequency mechanism, reactive power, balance and its effect, on-load tap changing transformer and regulating transformer

UNIT II. SYNCHRONOUS MACHINE MODELLING (8hr)

Schematic diagram, Physical description: armature and field structure, machines with multiple pole pairs, MMF waveforms, direct and quadrature axes, Mathematical Description of a Synchronous Machine: Basic equations of a synchronous machine: stator circuit equations, stator self, stator mutual and stator to rotor mutual inductances, dq0 Transformation: flux linkage and voltage equations for stator and rotor in dq0 coordinates, electrical power and torque, physical interpretation of dq0 transformation

UNIT III. MODELLING OF EXCITATION AND SPEED GOVERNING SYSTEM (8hr)

Elements of an Excitation System; Types of Excitation System; Control and protective functions; Functional Block Diagram of Power Generation and Control, Schematic of a hydroelectric plant, classical transfer function of a hydraulic turbine, special characteristic of hydraulic turbine, electrical analogue of hydraulic turbine, Governor for Hydraulic Turbine: Requirement for a transient droop, Block diagram of governor with transient droop compensation, Steam turbine modelling: Single reheat tandem compounded type and cross compound type.

UNIT IV. TRANSIENT STABILITY: (6hr)

Solution of Swing equation using classical model, application of equal area creation on point by point solution

UNIT V. ECONOMIC OPERATION OF POWER SYSTEM: (6hr)

Distribution of load between units within a plant, transmission loss as function of plant generation, calculation of loss-coefficient, distribution of loads between plants with special reference to steam and hydro plants, automatic load dispatching, Unit commitment, constraints on unit commitment – spinning reserve, thermal and hydro constraints, methods of unit commitment – priority list and dynamic programming.

UNIT VI. REACTIVE POWER AND VOLTAGE CONTROL: (6hr)

Production and absorption of reactive power- Methods of Voltage Control – Shunt reactors – Shunt Capacitors – Series Capacitors – Synchronous condensers – Static Var systems – Principles of Transmission system compensation – Modeling of reactive compensating devices

Reference Books:

1. P. Kundur, "Power System Stability and Control", McGraw-Hill, 1993.
2. Gross C. A., 'Power System Analysis' McGraw Hill
3. Arrilaga J., 'Computerised Power system Analysis' McGraw Hill
4. Foud Anderson, 'Power system control dynamics' McGraw Hill
5. Kaushik, 'Computerised Power system Analysis' McGraw Hill
6. Padiyar K. R., 'Power system dynamics, ' New Age International

BTEEC702: HIGH VOLTAGE ENGINEERING	
Teaching Scheme:	Examination Scheme:
Theory: 3hr	Mid-term Test: 20 Marks
Tutorial: 0	Internal Assessment: 20 Marks
Total Credits: 3	End Term Exam: 60 Marks

Pre-requisite: Electrical Engineering Materials,Power systems I, Power Systems II

Course Objectives:

1. To study conduction and breakdown in gases, liquids and solids.
2. To understand the methods and measurement of high voltage generation and measurement
3. To explain the lightening phenomenon and insulation co-ordination.
4. To know different non-destructive testing and standards in HV.

Course Outcomes:

1. Illustrate the concept of electric field stresses, applications of insulating materials and methods for Non-destructive testing of equipment like transformers, insulators, isolators, bushings, lightning arrestors, cables, circuit breakers and surge diverters.
2. Explain the breakdown process in solid, liquid, and gaseous materials
3. Analyze methods for generation and measurement of High Voltages and Currents (both ac and dc)
4. Describe the phenomenon of over-voltage and choose appropriate insulation co-ordination levels based on IS & IEC Standards.

UNIT I: INTRODUCTION TO HIGH VOLTAGE ENGINEERING (2hr)

Electric Field Stresses,Poisson's equation, Estimation and Control of Electric Stress, Surge Voltages, their distribution and control.

UNIT II:CONDUCTION & BREAKDOWN IN GASES: (6hr)

Gases as insulation media, ionization processes, Townsend's current growth equation, current growth in presence of secondary processes, Townsend's criterion for breakdown in electronegative gases, time lags for breakdown, Streamers theory, Paschen's law, breakdown in non-uniform fields and corona discharge, corona under positive & negative polarities, glow & arc discharge, considerations in using gases for insulation purpose.

UNIT III: BREAKDOWN IN DIELECTRIC MATERIALS: (8hr)

Conduction & breakdown in liquid dielectrics: Pure and commercial liquids, breakdown in pure and commercial liquids, theories of breakdown in liquids. Breakdown in solid dielectrics: Intrinsic, electromechanical& thermal breakdown, chemical, electrochemical deterioration, treeing, tracking, internal discharges, breakdown in composite insulation, properties of solid insulators & other materials used in practice. Insulating materials: In power transformers, rotating machines, circuit breakers, cables, power capacitors & other equipment.

UNIT IV: OVER VOLTAGE DUE TO LIGHTENING PHENOMENON: (8hr)

Natural causes for over voltages – Lightning phenomenon, Overvoltage due to switching surges, system faults and other abnormal conditions, propagation of lightning voltage & current waves on transmission lines, reflection & transmission of traveling wave at junction, system control of over voltage due to switching protection of transmission lines against over voltage. Insulation co-ordination, surge diverters, equipment insulation level & co-ordination of substations.

UNIT V:GENERATION & MEASUREMENT OF HIGH VOLTAGES & CURRENTS: (10hr)

Generation of a) high d. c voltage b) power frequency high alternating voltage c) high frequency a. c. d) impulse voltages Standard impulse waves shapes and it's equation, multistage impulse generator, matrix circuit, generation of switching surges, tripping & control of impulse generators, generation of impulse currents.

Measurement of High Direct Current voltages, Abraham Voltmeter Measurement of High Voltages alternating and impulse, Measurement of High Currents-direct, alternating and Impulse, Oscilloscope for impulse voltage and current measurements

UNIT VI:NON DESTRUCTIVE TESTING: (6hr)

I.E.C. & IS codes for high voltage tests on electrical appliances & power apparatus &electrical motors, non- destructive testing, testing of insulators, bushings, isolators, circuit breakers, cables, transformers, surge diverter, layout of high voltage laboratories & test facilities.

Reference Books:

1) High Voltage Engineering: Fundamentals by E.Kuffel, W.S.Zaengl, J.Kuffel by Elsevier, 2nd Edition
2) High Voltage Insulation Engineering by Ravindra Arora, Wolfgang Mosch, New Age International (P) Limited, 1995.
3) High Voltage Engineering, Theory and Practice by Mazen Abdel Salam, Hussein Anis, Ahdan El-Morshedy, RoshdyRadwan, Marcel Dekker

Text Books:

1. Kamaraju V. & Naidu M. S., 'High Voltage Engineering', Tata-McGraw Hill
2. C. L. Wadhwa, "High Voltage Engineering", New Age International Pvt. Ltd

BTEEC703: ELECTRICAL DRIVES	
Teaching Scheme:	Examination Scheme:
Theory: 3hr	Mid-term Test: 20 Marks
Tutorial: 0	Internal Assessment: 20 Marks
Total Credits: 3	End Term Exam: 60 Marks

Pre requisite : Electrical machine-II, Power Electronics

Course objective :

Students will be able to understand the dynamics of drive system.
Students will be able to use various methods of speed control of AC and DC Drive.
Students will be have the ability to analyze the drive system
Students will be able to select proficiently and the proper drive system for particular application.
Students will be able to have basic knowledge of recent advancement in Electric Drive.

Course outcomes:

Analyze the dynamics of Electrical Drives system.
Use various control techniques for controlling the speed of AC and DC motors.
Analyze the AC and DC drives.
To Select/recommend the appropriate Drive according to the particular applications.
State the recent technology of AC and DC drive

UNIT I: . INTRODUCTION (8hr)

Advantages of Electrical Drives, Parts of Electrical drive, Choice of Electric drives Dynamics of Electrical drives: fundamental torque equations, multiquadrant operation, nature and classification of load torques, steady state stability, concept of load equalization in drives

UNIT II. .CONTROL OF ELECTRICAL DRIVES (6hr)

Modes of operation: Steady state, Acceleration, Deceleration, Drive classification. Closed loop control of drives : Current limit control, torque control, speed control, position control, Control of multi motor drives, speed sensing, current sensing, Classes of motor duty & criteria for selection of motor.

UNIT III. DC MOTOR DRIVES (7hr)

Review of basic characteristics of DC motors, Single phase drives : Single phase half wave converter drives, semi converter drives, Full converter drives, Dual converter drives. Three phase drives : Three phase half wave drives, semi-converter drives, full converter drives, dual-converter drives, DC-DC converter drives: Principle of Rheostatic and regenerative braking control, combined control, two and four quadrant DC-DC converter fed drives. Introduction to closed loop control of DC drives.

UNIT IV: INDUCTION MOTOR DRIVES (7hr)

Review of starting, braking and speed control of three phase induction motors, Stator voltage control, Rotor voltage control, frequency control, Voltage and frequency control, Current control, Closed loop control of Induction motors, Principle of Scalar and Vector control of Induction motor, Multiquadrant operation of induction motor drives fed from Voltage Source Inverters. Static rotor resistance control method, static slip power recovery control-Static Scherbius drive and StaticKramer drive.

UNIT V: SYNCHRONOUS MOTOR DRIVES (6hr)

Review of starting, pull in and braking of Synchronous motor,Static variable frequency control for Synchronous motors,Load commutated inverter fed Synchronous motor drive, Introduction to closed loop control of Load commutated inverter fed Synchronous motor drive.

UNIT VI: DRIVES FOR SPECIFIC APPLICATIONS (6hr)

Textile Mill: various stages and drive requirements control of ac motors for controlling torque. Steel Rolling Mill : reversing and continuous hot and cold rolling mills, Drive requirements, motors for mill drive. Cement mill : Stages in cement production, requirements of mill motors, Kiln drives, crusher drives, fan/blower drives, compressor drive. Sugar Mill : Requirements for various drive motors, selection of motors for various processes

Ref Books:

1. Dubey G. K., “Fundamentals of Electrical Drives”, Narosa Publishing house
2. De N. K., Sen P. K., “Electric Drives”, Prentice Hall of India
3. VedamSubramanyam, “Electrical Drives and Control”, TMH Publications

BTEEE704A: SPECIAL PURPOSE ELECTRICAL MACHINES	
Teaching Scheme:	Examination Scheme:
Theory: 3hr	Mid-term Test: 20 Marks
Tutorial: 0	Internal Assessment: 20 Marks
Total Credits: 3	End Term Exam: 60 Marks

Prerequisite:

AC Machines and DC Machines

Course Objectives:

To impart knowledge on Construction, principle of operation and performance of synchronous reluctance motors, stepping motors, switched reluctance motors, Permanent magnet brushless D.C. motors , Permanent magnet synchronous motors.

Course Outcome:

After Completion of this Course, student will be able

1. Demonstrate construction, working principle, and application of various types of special purpose electrical machines
2. Select a special Machine for a particular application
3. Demonstrate behaviour of induction generator and induction machine.

UNIT I. SYNCHRONOUS RELUCTANCE MOTORS (6hr)

Constructional features , Types – Axial and radial air gap motors – Operating principle – Reluctance – Phasor diagram - Characteristics – Vernier motor.

UNIT II. STEPPING MOTORS (6hr)

Constructional features – Principle of operation – Variable reluctance motor – Hybrid motor – Single and multi stack configurations – Theory of torque predictions – Linear and non-linear analysis – Characteristics – Drive circuits.

UNIT III. SWITCHED RELUCTANCE MOTORS (6hr)

Constructional features – Principle of operation – Torque prediction – Power controllers – Non-linear analysis – Microprocessor based control - Characteristics – Computer control.

UNIT IV. PERMANENT MAGNET BRUSHLESS D.C. MOTORS (8hr)

Principle of operation – Types – Magnetic circuit analysis – EMF and torque equations – Power controllers – Motor characteristics and control.

UNIT V. PERMANENT MAGNET SYNCHRONOUS MOTORS (8hr)

Principle of operation – EMF and torque equations – Reactance – Phasor diagram – Power controllers - Converter - Volt-ampere requirements – Torque speed characteristics - Microprocessor based control.

UNIT VI. INDUCTION MACHINES **(6hr)**

Induction generator–self excitation requirement – voltage regulation – different methods of voltage control –doubly fed induction machine – generation operating mode– linear Induction Motor

Text Books:

1. K.Venkataratnam, Special Electrical Machines, Universities Press (India) Private Limited, 2008.
2. T. Kenjo, Stepping Motors and Their Microprocessor Controls, Clarendon Press London, 1984
3. E.G. Janardanan, Special electrical machines, PHI learning Private Limited, Delhi, 2014.

References:

1. R.Krishnan, Switched Reluctance Motor Drives – Modeling, Simulation, Analysis, Design and Application, CRC Press, New York, 2001.
2. T. Kenjo and S. Nagamori, Permanent Magnet and Brushless DC Motors, Clarendon Press, London, 1988.
3. T.J.E.Miller,Brushless Permanent-Magnet and Reluctance Motor Drives, Oxford University Press, 1989.
4. R.Srinivasan, Special Electrical Machines, Lakshmi Publications, 2013.

BTEEE704B: ELECTRIC TRACTION & UTILIZATION	
Teaching Scheme:	Examination Scheme:
Theory: 3hr	Mid-term Test: 20 Marks
Tutorial:	Internal Assessment: 20 Marks
Total Credits:3	End Term Exam: 60 Marks

Prerequisite:

- Basics of Electrical Engineering and Electrical Machine-II.

Course Objectives:

1. To possess knowledge of advanced and emerging topics in traction mechanism and illumination engineering and their applications in the field.
2. An ability to design a traction system, a component, to meet desired needs of locomotive industry within realistic constraints and confirms manufacturability, and sustainability.
3. To mold students professionally to possess in-depth and advanced knowledge by course contents along with emerging topics.

Course Outcomes:

After Completion of this Course, student will be able to

1. Identify types of Traction System.
2. Interprete Various Power supply in Electric Traction.
3. Analyze Various Traction Motors.
4. Define methods of Traction motor Control.
5. Elobrate Train movement & Breaking in Traction system.
6. Classify the indoor and outdoor Illumination system.

UNIT I: ELECTRIC TRACTION SYSTEM: (8hr)

Electrical transmission: Electrical transmission system employing D.C. generator D.C. series motor, Electrical transmission system employing 3 phase alternator supplying D.C. traction motors, electrical transmission employing 3 phase alternator supplying induction motors, Choice of traction system-battery drive, hybrid drive, flywheel drive, tramways, trolley bus. Track electrification: D.C. System, single phase low frequency A.C. system, single phase high frequency A.C. system, 3 phase A.C. system and composite system.

UNIT II: POWER SUPPLY FOR ELECTRIC TRACTION: (6hr)

Current collection system, current collectors for Over Head Systems, Overhead construction for Tramways and trolley buses and railways, Sag and Tension calculation for a trolley wire, Traction substations, location of substations, feeding and distributing system, substation equipment's. Block Diagram of AC Electric locomotive, Signaling interference in tele-communication circuits.

UNIT III: TRACTION MOTORS: (6hr)

Characteristics of traction motors, straight D.C. series motor, suitability of series motor for traction duty, constructional details of D.C. Traction Motors, Series motor using undulating D.C, suitability of shunt motor for traction duty, single phase series motors, Repulsion motor, compensated repulsion motor, Induction motor with variable frequency with SCR, Linear Induction motor.

UNIT IV: TRACTION CONTROL: (6hr)

Traction control: Duty cycle, Methods of traction motor control, series-Parallel and other types of controllers, use of interlocks, run back prevented, multiple unit control, Master controllers, Reverses, Dead man's handle, use of Metaldyne and Megavolt.

UNIT V: TRAIN MOVEMENT AND BRAKING: (8hr)

Speed time curve, its analysis and construction, schedule speed and factors affecting it, train resistance and its components. Tractive effort calculations, average acceleration and speed, energy output and consumption.

Braking: Mechanical versus electric breaking, rheostatic braking, Regenerative braking, method and energy saved in the process, Magnetic track brakes.

UNIT VI: ILLUMINATION: (6hr)

Requirement of good lighting, Classification of light fitting & luminaries, factors to be considered for design of indoor & outdoor lighting scheme, Design Procedure for factory lighting, street lighting.

Reference Books:

1) Utilization of Electrical Power and Electic Traction by J.B. Gupta. (Katson Book publisher)
2) H. Partab: Modern Electric Traction, Dhanpat Rai & sons.
3) Upadhayay J. & Mahindra S.N., Electric Traction, Allied Publishers Ltd., 1st Ed.
4) Rao P.S., Principle of 25 KV Overhead Equipments. R. (Nasik) Printpack Pvt Ltd,, 1st Ed.
5) Electric Traction for Railway Trains, by Edward P. Burch. McGraw Hill Book Co. Inc.
6) C.L.Wadhwa, "Generation, Distribution and Utilization of Electrical Energy", New Age International Publishers.

BTEEE704C: ENGINEERING SYSTEM DESIGN OPTIMIZATION	
Teaching Scheme:	Examination Scheme:
Theory: 3hr	Mid-term Test: 20 Marks
Tutorial:	Internal Assessment: 20 Marks
Total Credits: 3	End Term Exam: 60 Marks

Pre requisite: Linear Algebra, Non-linear Problems

Course Outcome:

1. To understand different level optimization problem formulation.
2. To study novel methods in optimization.
3. To understand and develop genetic algorithm for engineering problems.

UNIT I: INTRODUCTION (8hr)

Introduction to Optimization problem formulation, optimization algorithms, applications and examples, different optimization methods available

UNIT II: SINGLE VARIABLE OPTIMIZATION (6hr)

Optimization criteria, bracketing methods– Exhaustive search method, bound phase method, Region Elimination methods– Fibonacci search method, Golden search method, Gradient based methods– Newton Raphson method, Bisection method, Root finding using optimization technique

UNIT III: MULTI OBJECTIVE OPTIMIZATION (6hr)

Optimization criteria, Different search methods, Unidirectional search, Direct search method – Evolutionary optimization method, Powell's conjugate direction method, Gradient based methods– Newton's method and Variable metric method.

UNIT IV: SPECIALIZED METHODS (6hr)

Integer programming, Geometric programming, simulated annealing, Global optimization using - steep descent method, simulated annealing.

UNIT V: GENETIC ALGORITHMS AND EVOLUTIONARY APPROACHES (6hr)

Differences and similarities between genetic algorithms and traditional techniques, operators of GA's, Computer program for simulated annealing, Newton Raphson method, Evolutionary optimization method.

References

1. Kalyanmoy Deb, "Optimization for Engineering design", Prentice Hall,India, 2005.
2. Kalyanmoy Deb, "Multi objective optimization using Evolutionaryalgorithms", John Wiley,2001

BTEEE704D: FINANCIAL MANAGEMENT	
Teaching Scheme:	Examination Scheme:
Theory: 3hr	Mid-term Test: 20 Marks
Tutorial:	Internal Assessment: 20 Marks
Total Credits:3	End Term Exam: 60 Marks

Course Objectives:

• To help the students to develop cognizance of the importance of Financial Management in corporate valuation

• To enable students to describe how people analyze the corporate leverage under different conditions and understand why people valuate different corporates in different manner.

• To provide the students to analyze specific characteristics of Supply Chain Industry and their future action for cash flow

• To enable students to synthesize related information and evaluate options for most logical and optimal solution such that they would be able to predict and control Debt Equity incurrence and improve results.

Course Outcomes: At the end of this course students will demonstrate the ability to

1. The students would be able to understand and define basic terminology used in finance and accounts
2. The students would be able to prepare& appraise Financial Statements and evaluate a company in the light of different measurement systems.
3. The students would be able to analyze the risk and return of alternative sources of financing.
4. Estimate cash flows from a project, including operating, net working capital, and capital spending.
5. To estimate the required return on projects of differing risk ,to estimate the cash flows from an investment project, calculate the appropriate discount rate, determine the value added from the project, and make a recommendation to accept or reject the project
6. To describe and illustrate the important elements in project finance Using financial calculator and Excel in a variety of problems.

UNIT I: INTRODUCTION

Introduction to Financial Accounting, Book keeping & Recording: Meaning, Scope and importance of Financial Accounting. Financial Accounting - concepts and conventions, classification of accounts, Rules and principles governing Double Entry Book-keeping system, Meaning, Preparation of Journal, Ledger , Cash book & Trial balance.

UNIT II: FINANCIAL STATEMENT PREPARATION, ANALYSIS & INTERPRETATION

Preparation of financial statement and Profit & Loss Account, Balance Sheet. , Ratio Analysis - classification of various ratios.

UNIT III: INTRODUCTION TO FINANCIAL MANAGEMENT

Concept of business finance, Goals & objectives of financial management, Sources of financing, Long Term financing- shares, debentures, term loans, lease & hire purchase, retained earnings, public deposits, bonds (Types, features & utility). Short Term Financing- bank finance, commercial paper, trade credit

UNIT IV: WORKING CAPITAL MANAGEMENT

Concept of working Capital, significance, types. Adequacy of working capital, Factors affecting working capital needs, financing approaches for working capital, Methods of forecasting working capital requirements, Methods of Forecasting.

UNIT V: TIME VALUE OF MONEY & CAPITAL BUDGETING

Concept of time value of money, Compounding & discounting; Future value of single amount & annuity, present value of single amount & annuity; Practical application of time value technique. Capital budgeting - Nature and significance, techniques of capital budgeting –Pay Back Method, Accounting rate of return, Internal Rate of Return, DCF, Net Present Value and profitability index.

UNIT VI: PROJECT FINANCING

Details of the company, its promoters and project finances required, profitability etc., Loan documentation-Appraisal of terms loans by financial institutions. Basic components of project finance.

TEXT & REFERENCE BOOKS:

1. Financial Management by Khan & Jain, Text, Problem & Cases, Tata McGraw Hill Publication 5th Edition.

2. Tulsian Financial Management by Dr. P.C.Tulsian, S Chand Publication 5th Edition.

3. Taxman's Financial Management by Ravi M. Kishore, Taxmann 2017 Edition.

4. A Textbook of Financial , Cost & Management Accounting by Dr.P.Pariasamy, Himalaya Publishing House

5. Fundamentals of financial Management by Bhabhtosh Banerjee, PHI publication, 2nd Edition.

BTEEE705A: DIGITAL SIGNAL PROCESSING	
Teaching Scheme:	Examination Scheme:
Theory: 3hr	Mid-term Test: 20 Marks
Tutorial:	Internal Assessment: 20 Marks
Total Credits:3	End Term Exam: 60 Marks

Prerequisite:

Digital Systems, Interfacing, Z-Transform, Fourier Transform

Course Objectives:

To understand the design and implementation of digital Signal processing systems

Course Outcomes:

After Completion of this Course, student will be able to

1. Represent signals, systems and digital processing of analog signals.
2. Represent discrete time signals, systems and analysis of Discrete-Time Linear Time-Invariant Systems.
3. Apply digital signal processing techniques to analyze discrete time signals in time domain.
4. Apply digital signal processing techniques to analyze discrete time signals in frequency domain.
5. Design different filter structure
6. Validate system functionality and evaluate results.

UNIT I: INTRODUCTION TO DIGITAL SIGNAL PROCESSING (8 hr)

Signals, Systems and Signal Processing: Basic Elements of a Digital Signal Processing System, Advantages of Digital over Analog Signal Processing.

Classification of Signals: Multichannel and Multidimensional Signals, Continuous-Time versus Discrete-Time Signals, Continuous-Valued Versus Discrete-Valued Signals, Deterministic Versus Random Signals.

The Concept of Frequency in Continuous-Time and Discrete-Time Signals: Continuous-Time Sinusoidal Signals, Discrete-Time Sinusoidal Signals, Harmonically Related Complex Exponentials.

Analog-to-Digital and Digital-to-Analog Conversion: Sampling of Analog Signals, the Sampling Theorem, Quantization of Continuous-Amplitude Signals, Quantization of Sinusoidal Signals, Coding of Quantized Samples, Digital-to-Analog Conversion, Analysis of Digital Signals and Systems versus Discrete-Time Signals and Systems.

UNIT II: DISCRETE-TIME SIGNALS AND SYSTEMS (8 hr)

Discrete-Time Signals: Some Elementary Discrete-Time Signals, Classification of Discrete-Time Signals, Simple Manipulations of Discrete-Time Signals.

Discrete-Time Systems: Input-Output Description of Systems, Block Diagram Representation of Discrete-Time Systems, Classification of Discrete-Time Systems, Interconnection of Discrete-Time Systems.

Analysis of Discrete-Time Linear Time-Invariant Systems: Techniques for the Analysis of Linear Systems, Resolution of a Discrete-Time Signal into Impulses, Response of LTI Systems to Arbitrary Inputs: The Convolution Sum, Properties of Convolution and the Interconnection of LTI Systems, Causal Linear Time-Invariant Systems, Stability of Linear Time-Invariant Systems, Systems with Finite-Duration and infinite-Duration Impulse Response.

Discrete-Time Systems Described by Difference Equations: Recursive and Nonrecursive Discrete-Time Systems, Linear Time-Invariant Systems Characterized by Constant-Coefficient Difference Equations, Solution of Linear Constant-Coefficient Difference Equations, The Impulse Response of a Linear Time-Invariant Recursive System

UNIT III: Z-TRANSFORM AND ITS APPLICATION TO THE ANALYSIS OF LTI SYSTEMS (6 hr)

Z-Transform: Direct z-Transform, Inverse z-Transform. Properties of z-transform. Rational z-Transforms: Poles and Zeros. Pole Location and Time-Domain Behavior for Causal Signals, System Function of a Linear Time-Invariant System. Inversion of the z-Transform: Inverse z-Transform by Contour Integration, Inverse z-Transform by Power Series Expansion, Inverse z-Transform by Partial-Fraction Expansion, Decomposition of Rational z-Transforms, One-sided z-Transform: Definition and Properties, Solution of Difference Equations.

UNIT IV: FREQUENCY ANALYSIS OF SIGNALS AND SYSTEMS (4 hr)

Properties of the Fourier Transform for Discrete-Time Signals: Symmetry Properties of the Fourier Transform, Fourier Transform Theorems and Properties.

UNITV:DISCRETE FOURIER TRANSFORM: PROPERTIES AND APPLICATIONS (8 hr)

Frequency Domain Sampling: The Discrete Fourier Transform: Frequency-Domain Sampling and Reconstruction of Discrete-Time Signals, Discrete Fourier Transform (DFT), DFT as a Linear Transformation, Relationship of the DFT to Other Transforms. Properties of the DlT: Periodicity. Linearity and Symmetry Properties, Multiplication of Two DFTs and Circular Convolution, Additional DFT Properties.

UNIT VI: IMPLEMENTATION OF DISCRETE- TIME SYSTEMS (6 hr)

Structures for the Realization of Discrete-Time Systems. Structures for FIR Systems: Direct-Form Structure, Cascade-Form Structures, Frequency-Sampling Structures, Lattice Structure.

Structures for IIR Systems: Direct-Form Structures, Signal Flow Graphs and Transposed Structures, Cascade-Form Structures, Parallel-Form Structures, Latticc and Lattice-Ladder Structures for IIR Systems.

Reference Book:

1) John G. Proakis, Dimitris G.Manolakis, "Digital Signal Processing".
2) Shalivahanan, Vallavaraj and Gnanapriya, "Digital Signal Processing"

Text Book:

1) N.G.Palan, "Digital Signal Processing"
2) Ramesh Babu, "Digital Signal Processing"
3) Alon V. Oppenhelm, "Digitsl Signal Processing", PHI Pub.
4) S.K.Mitra, "Digital Signal Processing", TMH Pub.

BTEEE705B: ENERGY AUDIT AND CONSERVATION	
Teaching Scheme:	Examination Scheme:
Theory: 3hr	Mid-term Test: 20 Marks
Tutorial:	Internal Assessment: 20 Marks
Total Credits:3	End Term Exam: 60 Marks

Pre Requisite:

Basics of Electrical Machines, Power Plant Engineering

Course Objectives:

1. To understand the basic process involved in the energy audit and the terminologies associated in the process.
2. To be able to develop audit reports of any firm including large and small scale industries, residential and commercial establishments.
3. To select and comment on the appropriate method for the planning and monitoring of any energy conservation project.

Course Outcomes:

After Completion of this Course, student will be able

1. To recognize Global Environmental Issues and Role of Renewable & non-conventional energy sources
2. To estimate Energy efficiency opportunities in Thermal- Mechanical Systems and Electrical System.
3. To analyze Energy Conservation Proposals economically and prepare audit reports.

UNIT I: SOURCES OF ENERGY: (6hr)

Energy resources, Stored & running resources, Environmental Concerns – Global Warning , Depletion of Ozone layer, Kyoto Protocol, UNFCCC, CDM, Carbon Emissions, Role of Renewable Energy Sources

UNIT II: (7hr)

Energy Conservation Act 2001, Designated Consumers, Energy Policy, BEE and its role in Energy Conservation, Energy Audit – Need, Types , Methodology, Steps involved in Energy Audit, Energy Costs and Benchmarking , Measurements for Energy Audit, Energy Management Duties and Responsibilities.

UNIT III: THERMAL MECHANICAL SYSTEMS (8hr)

Boiler Efficiency by direct and indirect methods, Energy efficiency opportunities in boilers, HVAC, and refrigeration systems, compressed air systems, pumps, cooling towers, fans and blowers, Cogeneration – Need and Principle , Prime movers for cogeneration, Waste heat recovery systems – Recuperators, economizer heat recovery boilers.

UNIT IV: ELECTRICAL SYSTEMS (7hr)

Utilities: Energy conservation in generation, transmission,distribution & utilization, Electrical billing , load management ,maximum demand control, APFC Panel , PF improvement and benefits , Energy Efficient motors and starter, lightning systems, Electronic Ballast

UNIT V: (6hr)

Planning, Implementation & monitoring of energy conservation project, Time Value of money, Financial Investment – Simple payback period, ROI (Return on Investment), Net Present value, Internal rate of return, profitability index. All calculations and numerical interpretation.

UNIT VI: (6hr)

Case studies on various industrial sectors like Steel Plant, Thermal Plant, Industries Building and Commercial Establishments and preparing audit reports

Text Books:

1. "Industrial Energy Conservation" Charles M Gottschalk ,John Willey and Sons
2. "Energy Management" Paul O Callagham, Tata Mc Grawhill
3. "Energy Technology" – S Rao and B Parulekar , Khanna Publisher

References:

1. "Energy Management Handbook" – Wayne C Turner

BTEEE705C: ELECTRICAL POWER QUALITY	
Teaching Scheme:	Examination Scheme:
Theory: 3hr	Mid-term Test: 20 Marks
Tutorial:	Internal Assessment: 20 Marks
Total Credits:3	End Term Exam: 60 Marks

Prerequisite:

1. Basic Electrical concepts
2. Power Electronics concepts
3. Power system concepts

Course Objectives:

1. To study the various power quality issues, their production, monitoring and mitigation.
2. To study the various power quality standards.
3. To study various power quality monitoring methods.
4. To apply appropriate solution techniques for power quality Problems.

Course Outcome:

After Completion of this Course….

1. Student will be able to get the in-depth understanding of power quality issues & standards.
2. Students will be able to understand working of power quality improving Equipment's.

UNIT I: INTRODUCTION (7hr)

Understanding Power quality, definitions, growing concerns to Power Quality, Evaluation Procedure,General Classes of Power Qualitydisturbances, causes and effects of Power Quality disturbances

UNIT II: TRANSIENT OVER VOLTAGES (7hr)

Sources, causes and effects, Principle of Overvoltage protection and solutions. VoltageSag and Interruptions: causes and effects, estimation of voltage sag performance, principle ofprotection and solutions.

UNIT III: LONG-DURATION VOLTAGE VARIATIONS (7hr)

Long Duration Voltage variations, principles of regulating voltage Devices for voltage regulation, flickers, flicker sources and mitigation, quantifying flicker.

UNIT IV: FUNDAMENTALS OF HARMONICS **(7hr)**

Harmonic distortion, sources of harmonics, effects of harmonic distortion, Voltage Vs Current Harmonics,Active, Reactive, Volt-Amp power under non sinusoidal conditions, Harmonic Indices (THD and TDD),principles of harmonic control, mitigating devices, interharmonics, IEEE standard 519.

UNIT V: WIRING AND GROUNDING **(4hr)**

Reasons for Grounding, wiring and grounding problems and solutions

UNIT VI: POWER QUALITY MONITORING **(7hr)**

Monitoring Considerations, site survey, Monitoring Quality, monitoring location, PQ measuringinstruments, assessment of power quality measurement data, IEEE 1159 Standard. Impact of poor power quality on Reliability Indices.

References/Books:

1.Chattopadhyay, Surajit, Mitra, Electric Power Quality, Springer.
2.Haytt G. T., ―Electric Power Quality‖, Stars In Circle Publication.
3. NPTEL courses
   a) NOC:Power Quality Improvement Technique, IIT Roorkee by Avik Bhattacharyya.
   b) Power Quality in Power Distribution Systems, IIT Madras by Dr. Mahesh Kumar.

BTEEE705D: HVDC TRANSMISSION AND FACTS	
Teaching Scheme:	Examination Scheme:
Theory: 3hr	Mid-term Test: 20 Marks
Tutorial:	Internal Assessment: 20 Marks
Total Credits: 3	End Term Exam: 60 Marks

Pre requisite: Power System-II, Power Electronics

Course Outcome:

1. To understand importance, configuration and types of HVDC transmission.
2. To analyst the operation of HVDC converter, system control and protection.
3. To understand the concept of FACTS, their role, type and functionality.
4. To analyze the operation of static series and shunt compensator.

UNIT I: DC POWER TRANSMISSION FUNDAMENTALS (8hr)

Introduction, Economics of Dc Power transmission, comparison with AC system, Types of DC links, major components of converter station, planning of HVDC system.

UNIT II: HVDC CONVERTER (6hr)

Choice of converter configuration, analysis of Gratz circuit with and without overlap, working of converter as rectifier and inverter, equivalent circuit for HVDC link

UNIT III: HVDC SYSTEM CONTROL (6hr)

HVDC System Control: Principles of DC link control, converter control characteristics, firing angle control, current and extinction angle control, Starting and stopping of HVDC link

UNIT IV: CONVERTER FAULTS AND PROTECTION (6hr)

Converter Faults and Protection: Types of faults-commutation failure, Arc through, Misfire, short circuit in bridge, Over current and over voltage protection, Detection of line faults, Principle of DC circuit interruption, DC breakers, Types and characteristics of DC breakers, effects of proximity of AC and DC transmission lines.

UNIT V: FACTS CONCEPT AND GENERAL SYSTEM CONSIDERATIONS (6hr)

Transmission Interconnections, Flow of Power in an AC System, Loading Capability limits, Power Flow and Dynamic Stability Considerations of a Transmission Interconnection, Relative Importance of Controllable Parameters, Basic types of FACTS Controllers, Description and Definitions of FACTS Controllers, Benefits from FACTS Technology, Comparison between HVDC & FACTS.

UNIT VI: STATIC SHUNT COMPENSATORS (6hr)

Static Shunt Compensators: Objective of shunt compensation, Methods of Controllable VAR Generation, Static VAR Compensators: SVC and STATCOM, Comparison of SVC and

STATCOM, Static VAR Systems (SVS)Static Series Compensation: Objective of series compensation, Variable Impedance Type Series Compensators, Switching Converter Type Series Compensators

References

1. Padiyar K. R., “HVDC Power Transmission Systems”, New Age International.
2. Kimbark, “ HVDC Transmission”, John Willey AndSons.
3. Hingorani N. G., “ Understanding FACTS”, IEEE Press2001
4. Yong Hua Song, ‘ Flexible AC transmission systems(FACTS)’IEEE

BTEEL706: POWER SYSTEM OPERATION AND CONTROL LAB	
Teaching Scheme:	Examination Scheme:
Practical: 2hr	Continuous Assessment: 30 Marks
Total Credits: 1	End Term Exam: 20 Marks

Sr. No.	List of the Experiment
1	Write a program for economic dispatch in power systems using
2	Simulation of Automatic voltage regulator using MATLAB.
3	Write a program to compute the voltage and power factor for a given system using MATLAB.
4	Write a program to solve Swing Equation by Classical Method.
5	Write a program to plot power angle curve of synchronous machine using MATLAB.
6	Write a program to solve the given Equal Area Criteria problem using MATLAB.
7	To demonstrate the Excitation System for Synchronous machine using MATLAB
8	Simulation of single area load frequency control using MATLAB.

BTEEL707: HIGH VOLTAGE ENGINEERING LAB	
Teaching Scheme:	Examination Scheme:
Practical: 2hr	Continuous Assessment: 30 Marks
Total Credits: 1	End Term Exam: 20 Marks

Sr. No.	List of Experiment
1	Study of Faraday Cage for HV labs.
2	Study of Standard HV Laboratory layouts.
3	One min. (1-min.) DC high voltage withstand test on Equipment. (Max. up to 10 KV).
4	Effect of gap length on liquid insulating material.
5	Breakdown Strength of composite dielectric material.
6	Study of impulse generator.
7	High voltage withstand test on cables/safety gloves/shoes, as per IS. (Max. 2.25 KV DC)
8	Horn gap arrangement as surge diverter.
9	Measurement audible and visible corona inception and extinction voltage
10	Development of tracks and trees on polymeric insulation.
11	Study of Effect of EHV field on Human, Animals & Plants.

BTEEL708: ELECTRICAL DRIVES LAB	
Teaching Scheme:	Examination Scheme:
Practical: 2hr	Continuous Assessment: 30 Marks
Total Credits: 1	End Term Exam: 20 Marks

Pre requisite	Basic electronics engineering, basic electronics engineering Course
Course Outcome	• Efficiently use various AC and DC drive. • Simulate various drive system
Sr.No	List of Experiments
1	Study the ramp comparator firing circuit.
2	Study of single phase half wave converter and semi converter DC Drive .
3	Study of single phase full controlled converter (Bridge converter) DC Drive.
4	Speed control of DC motor using chopper.
5	Simulation of single phase half wave and semiconductor controlled DC drive.
6	Simulation of chopper fed DC Drive .
7	Study of AC Drive .
8	Study of V/f control of AC drive
9	Study the inverter fed induction motor drive.
10	Simulation of AC drive .

BTEES709: SEMINAR	
Teaching Scheme:	Examination Scheme:
Practical: 2hr	Continuous Assessment: 30 Marks
Total Credits: 1	End Term Exam: 20 Marks

Student shall choose a topic of his/her interest in consultation with faculty in the department. The topic for seminar may be related to Recent Developments in Instrumentation Engineering area and/or interdisciplinary area. Student shall attempt to collect necessary information and present a summary indicating comprehension of the topic and acquired depth of knowledge. A brief report on topic of seminar shall be submitted. Evaluation shall be based on report and power point presentation.

BTEEP710: PROJECT PART-I	
Teaching Scheme:	Examination Scheme:
Practical: 6hr	Continuous Assessment: 30 Marks
Total Credits: 3	End Term Exam: 20 Marks

Term work shall consist of detailed report for chosen topic and output of final working proposed. Report shall summarize the literature survey, spell out the scope of work, methodology and results. Viva-voce Examination shall be based on work carried out by the student. In case of students opting for Internship in the eighth semester, the Project may be industry-based.

BTEEF711: FIELD TRAINING/INTERNSHIP/INDUSTRIAL TRAINING III	
Teaching Scheme:	Examination Scheme:
Practical: --	Continuous Assessment: --
Total Credits: 1	End Term Exam: 50 Marks

Students are expected to undergo industrial training for at least four weeks at factory / design offices or in combination of these after VI semester. Training session shall be guided and certified by qualified engineer / industry expert. A neat detailed report on activities carried out during training is expected. Students should undergo training in Summer Vacation after Semester VI and appear at examination in Semester VII. A brief report of industrial training shall be submitted. Evaluation shall be based on report and power point presentation.

POWER MANAGEMENT INTEGRATED CIRCUITS	
Teaching Scheme:	Examination Scheme:
Theory: 3hr	Mid-term Test: 20* Marks
Total Credits: 3	Internal Assessment: 20* Marks
	End Term Exam: 60* Marks

Prof. Qadeer Ahmad Khan | IIT Madras
Course Duration: 12 weeks

CourseOutline:

This course is intended to develop understanding of why power management circuits are needed in a VLSI system, what are the different components of a power management system with focus on voltage regulators. By the end of this course, students should be able to understand the concept behind power management circuits and design a linear (LDO) and switching regulator (dc-dc converter) for a given specifications using behavioral and circuit level simulators.

Course Plan:

Week 1 : Introduction to Power Management - Application, Need, Discrete vs. Integrated PMIC; DC-DC Converters, Types of DC-DC Converters, Linear versus Switching Regulator, Choosing between Linear and Switching Regulators, Choosing the Type of Regulator in a Multi-Chip System; Performance Parameters - Efficiency, Accuracy, Line and Load Regulation, Line and Load Transient, PSRR; Remote versus Local Feedback, Point-of-Load Regulator, Kelvin Sensing, Droop Compensation; Current Regulators and their Applications; Bandgap Voltage Reference - Designing a Bandgap Reference using PTAT and CTAT Voltage References, Brokaw Bandgap Circuit.

Week 2: Sub-1-volt Bandgap Reference; Introduction to Linear Regulator, Applications of Linear Regulator; Review of Feedback Systems and Bode Plots, Loop Gain AC Analysis, Stability Criterion and Phase Margin, Review of First-Order and Second-Order Systems, Relationship between Damping Factor and Phase Margin; Parasitic Capacitances in a MOS transistor, Finding the Poles of the Error Amplifier; Stabilising a Linear Regulator - Frequency Compensation Techniques, Dominant Pole Compensation.

Week 3 : Miller Compensation, R.H.P. zero due to Miller Compensation, Intuitive Methods of Determining Poles and Zeros after Miller Compensation, Pole Splitting due to Miller Compensation, Reducing the Effect of R.H.P. zero; LDO with NMOS Pass Element; Load Regulation and Output Impedance of LDO; Line Regulation and PSRR of LDO; Sources of Error in a Regulator, Static Offset Correction, Dynamic Offset Cancellation.

Week 4 : Digital LDO, Avoidance of Limit-Cycle Oscillations in a Digital LDO, Hybrid LDO; Short-Circuit Protection and Foldback Current Limit in an LDO; Basic Concept of a Switching Regulator, Inductor volt-second Balance, Power Stage of a Buck Converter and Calculation of Duty Cycle; Transformer Model of a Buck Converter, Resistive Losses, Efficiency of a Switching Regulator, Efficiency considering only Conduction Losses; Synchronous and Non-Synchronous Switching Converters; PWM Control Techniques (Voltage-Mode and Current-

Mode Control); Losses in Switching DC-DC Converter- Conduction Loss, Gate-Driver Switching Loss, Segmented Power FETs, Dead-Time Switching Loss.

Week 5 : Hard Switching Loss, Magnetic Loss, Relative Significance of Losses as a Function of the Load Current; Inductor Current Ripple and Output Voltage Ripple in a DC-DC Converter, Ripple Voltage versus Duty Cycle, Ripple Voltage versus Input Supply Voltage; Choosing the Inductor and Capacitor of a Buck Converter; Continuous and Discontinuous Conduction Modes - Boundary Condition, Voltage Conversion Ratio in DCM; Concept of Pulse Frequency Modulation (PFM); Classification of Pulse Width Modulators -- Trailing, Leading and Dual-Edge PW Modulators; Control Techniques for DC-DC Converters; Voltage Mode Control, Small-Signal Modeling of a DC-DC Converter, Loop Gain and Stability Analysis using Continuous-Time Model.

Week 6 : Compensating a Voltage-Mode-Controlled Buck Converter; Designing Type-I (Integral), Type-II (PI) and Type-III (PID) Compensators; Implementation of Compensators using Op Amp-RC and Gm-C Architectures, Finding Compensation Parameters; Design Examples with Simulation Demonstrations.

Week 7 : Designing Type-III Compensator using Gm-C Architecture and Design Example; Ramp Generator with Feed-Forward Line Compensation, Loop Gain Compensation via Gm-modulation; Designing a Buck Converter - Power Loss Budgeting, Sizing of Power FETs, Estimation of Switching Losses and Choice of Switching Frequency, Choosing the External Passive Components (L and C); Choice of C in Relation to Factors that Limit the Load Transient Response; Inductor and Capacitor Characteristics, Reducing the Effect of Capacitor ESL.

Week 8 : Designing the Gate-Driver (Gate Buffer and Non-Overlap Clock Generator), Designing the Ramp Generator in a Pulse-Width Modulator, Design Considerations of the Error Amplifier; Delays Associated with Pulse-Width Modulators; PFM/PSM for Light Load, Using PSM in CCM to Avoid Duty Cycle Saturation; DCM Operation using an NFET; Designing a Zero-Cross Detector/Comparator; Introduction to Current Mode Control; Peak, Valley and Average CMC; Sub-Harmonic Oscillations, Avoiding Current Loop Instability via Slope Compensation in a Current-Mode-Controlled Buck Converter.

Week 9 : Non-Linear Control Techniques for DC-DC Converters; Hysteretic Control - Stability Issues due to Phase Shift between Inductor Current and Capacitor Voltage; Voltage-Mode versus Current-Mode Hysteretic Control, Stabilising a Voltage-Mode-Controlled Hysteretic Converter using R_esr, Relation between Hysteresis Window and Switching Frequency, Using R-C Circuit as Ripple Generator in a Current-Mode-Controlled Hysteretic Converter, Hybrid Voltage-Mode and Current-Mode Hysteretic Control, Fixed-Frequency Hysteretic Control, Effect of Loop Delay, Frequency-Regulation and Voltage-Regulation Loops in a Fixed-Frequency Hysteretic Converter; Constant ON/OFF-Time Control; Basic Concept of a Boost Converter, RHP zero in a Boost Converter.

Week 10 : Introduction to the Buck-Boost Converter, Tri-Mode Buck-Boost Converter, Boundary Conditions for Mode Transition in a Tri-Mode Buck-Boost Converter, Generation of Buck and Boost Duty Cycles; Introduction to Switched-Capacitor DC-DC Converters, Applications of SC DC-DC Converters in Open-Loop, Output Regulation in SC DC-DC Converters using Feedback Control, H-Bridge SC DC-DC Converter, Multiple Gain Settings in SC DC-DC Converters; Current-Sensing Techniques in DC-DC converters.

Week 11 : Selecting the Process Node for a PMIC, Chip-Level Layout and Placement Guidelines, Board-Level Layout Guidelines, EMI Considerations; Introduction to Advanced Topics in Power Management --- Digitally-Controlled DC-DC Converters, Adaptive Compensation Techniques, Limitations of Analogue and Digital Controllers, Time-Based Control Techniques and their Drawbacks, Multi-Phase DC-DC Converters; Dynamic Voltage and Frequency Scaling (DVFS); Single-Inductor Multiple-Output (SIMO) DC-DC Converters.

Week 12 : Introduction to Advanced Topics in Power Management (continued) - DC-DC Converters for LED Lighting, LCD/AMOLED Display Drivers, LED Drivers for Camera Flash, Lithium-ion Battery and its Charging Phases, Battery Charger ICs.

DC POWER TRANSMISSION SYSTEM	
Teaching Scheme:	Examination Scheme:
Theory: 03	Mid-term Test: 20* Marks
Tutorial: 00	Internal Assessment: 20* Marks
Total Credits: 3	End Term Exam: 60* Marks

Prof. Krishna S, IIT Madras

Course Duration: 12 weeks

CourseOutline:

This course gives an introduction to the DC power transmission system using the conventional line commutated converters. The topics covered include a detailed analysis of the 6 pulse line commutated converter (LCC), 12 pulse LCC, capacitor commutated converter, DC link control, and design of single tuned filter.

Course Plan:

Week 1: Introduction, choice of converter configuration
Week 2: Converter configuration for pulse number equal to 6, analysis of 6 pulse LCC neglecting overlap
Week 3: Fourier series, analysis of 6 pulse LCC neglecting overlap
Week 4: 2 and 3 valve conduction mode of 6 pulse LCC
Week 5: Extinction angle, 3 and 4 valve conduction mode and 3 valve conduction mode of 6 pulse LCC
Week 6: Commutation margin angle, normalization, characteristics of 6 pulse LCC, steady state analysis of a general LCC
Week 7: 6 pulse LCC with other circuits on the AC and DC sides
Week 8: Capacitor commutated converter, 12 pulse LCC
Week 9: Mode of operation of 12 pulse LCC, purposes of transformer, applications of DC transmission, types of DC link, DC link control
Week 10: Converter control characteristics, MTDC systems, non-characteristic harmonics
Week 11: Design of single tuned filter
Week 12: Double tuned and damped filters, reactive power requirement, comparison of AC and DC transmission

HIGH POWER MULTILEVEL CONVERTERS	
Teaching Scheme:	Examination Scheme:
Theory: 3hr	Mid-term Test: 20* Marks
Tutorial:	Internal Assessment: 20* Marks
Total Credits: 3	End Term Exam: 60* Marks

Prof. Anandarup Das, IIT Delhi

Course Duration: 12 weeks

CourseOutline:

The course covers different types of high power converters used in the industry for applications in HVDC, FACTS, Motor Drives, Power quality improvement. Traditional converters like NPC and emerging converters like modular multilevel converters will be covered. Operational issues and design considerations for these medium/high voltage high power converters will be covered. The course will discuss many practical issues faced in the industry while designing and operation of these converters.

Course Plan:

Week 1 : (a) Half bridge, Full bridge and three phase converters, sinusoidal PWM

Week 2 : (a) 3rd harmonic addition, space vector PWM

Week 3 : (a) Different types of multilevel converters
(b) Cascaded H-Bridge converter – Basic operation

Week 4 : (a)PWM Techniques for CHB converter
(b) Fault tolerant operation of CHB converter

Week 5 : (a) Modular Multilevel converter- Topology, operation and PWM

Week 6 : (a) Capacitor voltage balancing in MMC
(b) Design of components of MMC

Week 7 : (a) NPC converter – Basic operation
(b) NPC (3 level) Space vector diagram

Week 8 : NPC - PWM technique and midpoint balancing

Week 9 : (a) Case study of High Power converters for Motor drive and HVDC application

Week 10 : (a) Multi –pulse transformers

Week 11 : (a) Gate Drive circuit designing, protection and condition monitoring in high power converters

Week 12 : (a) Other topologies : conclusion

FUZZY SETS, LOGIC AND SYSTEMS & APPLICATIONS	
Teaching Scheme:	**Examination Scheme:**
Theory: 3hr	Mid-term Test: 20* Marks
Tutorial:	Internal Assessment: 20* Marks
Total Credits: 3	End Term Exam: 60* Marks

Prof. Nishchal Kumar Verma, IIT Kanpur

Course Duration: 12 weeks

CourseOutline:

The course is designed to give a solid grounding of fundamental concepts of fuzzy logic and its applications. The level of the course is chosen to be such that all students aspiring to be a part of computational intelligence directly or indirectly in near future should get these concepts.

Course Plan:

Week 1 : Introduction and Fuzzy Sets Theory

Week 2: Membership Functions

Week 3: Set Theoretic Operations

Week 4: Fuzzy Arithmetic

Week 5: Fuzzy Relations

Week 6: Fuzzy Inference Systems I

Week 7: Fuzzy Inference Systems II

Week 8: Wang and Mendel Model

Week 9: TSK Model

Week 10: Fuzzifiers and Defuzzifiers

Week 11: ANFIS Architecture

Week 12: Fuzzy Systems and Machine Learning

THE JOY OF COMPUTING USING PYTHON	
Teaching Scheme:	Examination Scheme:
Theory: 3hr	Mid-term Test: 20* Marks
Tutorial: 1hr	Internal Assessment: 20* Marks
Total Credits: 3	End Term Exam: 60* Marks

Prof.Sudarshan Iyengar, Department of Computer Science and Engineering, IIT Ropar

Course Duration: 12 weeks

CourseOutline:

ThisisamostfundamentalDigitalCircuitDesigncourseforpursingamajorinVLSI. We do not deal with any Verilog coding during this course and instead discuss transistor level circuit design concepts in greatdetail.

Learning objectives of this course are:

- Characterize the key delay quantities of a standardcell
- Evaluate power dissipated in a circuit (dynamic andleakage)
- Design a circuit to perform a certain functionality with specifiedspeed
- Identify the critical path of a combinationalcircuit
- Convert the combinational block to pipelinedcircuit
- Calculate the maximum (worst case) operating frequency of the designedcircuit

Course Plan:

Motivation for Computing
Variables and Expressions: Design your own calculator
Loops and Conditionals: Hopscotch once again
Lists, Tuples and Conditionals: Let’s go on a trip
Abstraction Everywhere: Apps in your phone
Counting Candies: Crowd to the rescue
Birthday Paradox: Find your twin
Google Translate: Speak in any Language
Currency Converter: Count your foreign trip expenses
Monte Hall: 3 doors and a twist
Sorting: Arrange the books
Searching: Find in seconds
Substitution Cipher: What’s the secret !!
Sentiment Analysis: Analyse your Facebook data
20 questions game: I can read your mind
Permutations: Jumbled Words
Spot the similarities: Dobble game
Count the words: Hundreds, Thousands or Millions.
Rock, Paper and Scissor: Cheating not allowed !!
Lie detector: No lies, only TRUTH

Calculation of the Area: Don’t measure.
Six degrees of separation: Meet your favourites
Image Processing: Fun with images
Tic tac toe: Let’s play
Snakes and Ladders: Down the memory lane.
Recursion: Tower of Hanoi
Page Rank: How Google Works !!

INTRODUCTION TO INDUSTRY 4.0 AND INDUSTRIAL INTERNET OF THINGS	
Teaching Scheme:	**Examination Scheme:**
Theory: 3hr	Mid-term Test: 20* Marks
Tutorial:	Internal Assessment: 20* Marks
Total Credits: 3	End Term Exam: 60* Marks

Prof. SudipMisra, IIT Kharagpur
Course Duration: 12 weeks

CourseOutline:

Industry 4.0 concerns the transformation of industrial processes through the integration of modern technologies such as sensors, communication, and computational processing. Technologies such as Cyber Physical Systems (CPS), Internet of Things (IoT), Cloud Computing, Machine Learning, and Data Analytics are considered to be the different drivers necessary for the transformation. Industrial Internet of Things (IIoT) is an application of IoT in industries to modify the various existing industrial systems. IIoT links the automation system with enterprise, planning and product lifecycle.

Course Plan:

Week 1 : Introduction: Sensing & actuation, Communication-Part I, Part II, Networking-Part I, Part II

Week 2 : Industry 4.0: Globalization and Emerging Issues, The Fourth Revolution, LEAN Production Systems, Smart and Connected Business Perspective, Smart Factories

Week 3 : Industry 4.0: Cyber Physical Systems and Next Generation Sensors, Collaborative Platform and Product Lifecycle Management, Augmented Reality and Virtual Reality, Artifical Intelligence, Big Data and Advanced Analysis

Week 4 : Cybersecurity in Industry 4.0, Basics of Industrial IoT: Industrial Processes-Part I, Part II, Industrial Sensing & Actuation, Industrial Internet Systems.

Week 5 :IIoT-Introduction, Industrial IoT: Business Model and RefereceArchiterture: IIoT-Business Models-Part I, Part II, IIoT Reference Architecture-Part I, Part II.

Week 6 : Industrial IoT- Layers: IIoT Sensing-Part I, Part II, IIoT Processing-Part I, Part II, IIoT Communication-Part I.

Week 7 : Industrial IoT- Layers: IIoT Communication-Part II, Part III, IIoT Networking-Part I, Part II, Part III.

Week 8 : Industrial IoT: Big Data Analytics and Software Defined Networks: IIoT Analytics - Introduction, Machine Learning and Data Science - Part I, Part II, R and Julia Programming, Data Management with Hadoop.

Week 9 : Industrial IoT: Big Data Analytics and Software Defined Networks: SDN in IIoT-Part I, Part II, Data Center Networks, Industrial IoT: Security and Fog Computing: Cloud Computing in IIoT-Part I, Part II.

Week 10 : Industrial IoT: Security and Fog Computing - Fog Computing in IIoT, Security in IIoT-Part I, Part II, Industrial IoT- Application Domains: Factories and Assembly Line, Food Industry.

Week 11 : Industrial IoT- Application Domains: Healthcare, Power Plants, Inventory

Management & Quality Control, Plant Safety and Security (Including AR and VR safety applications), Facility Management.

Week 12 : Industrial IoT- Application Domains: Oil, chemical and pharmaceutical industry, Applications of UAVs in Industries, Real case studies :

Case study - I : Milk Processing and Packaging Industries

Case study - II: Manufacturing Industries - Part I

Case study - III : Manufacturing Industries - Part II

Case study - IV : Student Projects - Part I

Case study - V : Student Projects - Part II

Case study - VI : Virtual Reality Lab

Case study - VII : Steel Technology Lab

ENTREPRENEURSHIP ESSENTIALS	
Teaching Scheme:	Examination Scheme:
Theory: 3hr	Mid-term Test: 20* Marks
	Internal Assessment: 20* Marks
Total Credits: 3	End Term Exam: 60* Marks

Prof. Manoj Kumar Mondal, IITKharagpur

Course Duration: 12 weeks

CourseOutline:

The course provides foundational knowledge on various aspects of entrepreneurial venture creation and management during its life-cycle. It has been designed to address multidisciplinary audiences. The objective of the course is to teach key issues faced by entrepreneurs and managers at different stages of the life-cycle of an enterprise and is relevant both for aspiring entrepreneurs and for decision makers in established enterprises. Topics can be classified in some major themes such as : Making a choice to create an entrepreneurial venture, current trend of technology entrepreneurship, how to start a start-up, identifying opportunities, factors driving competitive advantages, organizational structure, basic knowledge of financial statements and project report,introductory knowledge on marketing management, human resource management, & strategic management, risk analysis, legal aspect of business, how to raise fund during life-cycle of a new ventures.

Course Plan:

Week 1 : Introduction
DhirubhaiAmbani& Sofia
Myths & Realities about entrepreneurship
entrepreneurial qualities
Why start-ups fail?

Week 2: Mission, vision, entrepreneurial qualities – I
Mission, vision, entrepreneurial qualities – II
Value proposition
Business Model canvas
Business model generation

Week 3: Competitive advantage
Lean start-up – 1
Lean start-up – 2
Team and early recruit
Legal forms of business

Week 4: Marketing management 1
Marketing management 2
Market research –I
Market research –II
Market research –Example

Week 5: Introduction to financial statements
Profit & Loss statement
Balance sheet

Cash flow
Example – 1
Example – 2
Cost-volume-profit & Bread-Even analysis
Capital budgeting

Week 6: Business plan-I
Business plan-II
Pitching
Go-to-market strategies
Does & Don'ts

Week 7: How to innovate
Design Thinking
Design-Driven Innovation, Systems thinking
Open innovation, TRIZ
How to start a start-up?

Week 8: Government incentives for entrepreneurship (1 lecture)
Incubation, acceleration
Funding new ventures – bootstrapping, crowd sourcing, angel investors, VCs, debt financing (3), due diligence
Legal aspects of business (IPR, GST, Labour law)

Week 9: Cost, volume, profit and break-even analysis
Margin of safety and degree of operating leverage
Capital budgeting for comparing projects or opportunities
Product costing
Product pricing

Week 10: Funding new ventures – bootstrapping, crowd sourcing, Angel investors, VCs, debt financing (3), and due diligence
Incubation and acceleration
Government incentives for entrepreneurship
Project cost and Financial Closure

Week 11: Dos &Donts in entrepreneurship
Growth Hacking
Growth Strategy
Legal aspects of business (IPR, GST, Labor law)
Negotiation skill

Week 12: Human Resource management in startups
Pivoting
Entrepreneurial cases
Risk assessment and analysis
Strategy management for entrepreneurial ventures
Factors driving success and failure of ventures
Concluding remarks

BTEEP803: PROJECT-II	
Teaching Scheme:	Examination Scheme:
Practical: 30hr	Continuous Assessment: 100 Marks
Total Credits: 15	End Term Exam: 150 Marks

Since Project Stage II is in continuation to Project Stage I, the students are expected to complete the total project by the end of semester VIII. After completion of project work, they are expected to submit the consolidated report including the work done in stage I and stage II.

The report shall be comprehensive and presented typed on A4 size sheets and bound. The number of copies to be submitted is number of students plus two. The assessment would be carried out by the panel of examiners for both, term work and oral examinations.

JAIDEV EDUCATION SOCIETY'S
J D COLLEGE OF ENGINEERING AND MANAGEMENT
An Autonomous Institute, with NAAC "A" Grade
At: Khandala, Post- Valni, Kalmeshwar Road, Nagpur
Department of Information Technology

"A Place to Learn, A Chance to Grow"

Session: 2020-21

Course Structure and Syllabus (Autonomous)

For

B. Tech. Information Technology Programme

JAIDEV EDUCATION SOCIETY'S

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INDEX

VISION AND MISSION OF INSTITUTE

VISION

To be a centre of excellence imparting professional education satisfying societal and global needs.

MISSION

Transforming students into lifelong learners through quality teaching, training and exposure to concurrent technologies. Fostering conducive atmosphere for research and development through well-equipped laboratories and qualified personnel in collaboration with global organizations.

VISION AND MISSION OF DEPARTMENT

VISION

To Produce Competent Professionals equipped with technical knowledge and commitment for satisfying the needs of society.

MISSION

1. To impart advanced knowledge with an inclination towards Research with well equipped Lab.

2. To develop an ability to work ethically and Responsive towards the need of society

PROGRAM EDUCATIONAL OBJECTIVES (PEO's)

PEOs	ATTRIBUTES
PEO 1	Students will have In-depth knowledge of trending technologies, effective communication skills, lifelong learning with leadership qualities in order to work in any multidisciplinary areas in a team or individually.
PEO 2	Students will be able to interpret and analyze the requirements of the software design and development to provide efficient engineering solutions with novel product designs within the jurisdiction of humanity and social constraints
PEO 3	Students will have the attitude to pursue higher studies or research work or initiate entrepreneurial activity

PROGRAM OUTCOMES (PO's)

POs	ATTRIBUTES
1	An Understanding of IT architecture, software and hardware concepts, functionalities and applications
2	An Ability to design, develop and test computer programs involving various algorithms, methodology and programming languages.
3	Competency of business domains and functional processes that employ IT systems and applications
4	Practical use of communication protocols and their applications in the field of internet and world wide web.
5	Sound understanding of fundamentals of computer as the central enabling platform for information management in 21st century .
6	An Ability to develop, integrate, maintain and innovate software applications deployed in various multi-disciplinary domains.
7	Thought leadership to design and implement practical solutions for global industry needs.
8	An Acumen to embrace and adopt futuristic IT technological developments.
9	Sound knowledge of entrepreneurship traits to succeed.
10	Adoption of practices that are ethical ensuring transparency and accountability.
11	Capability to provide solutions that are socially empowering and environment friendly.
12	Effective communication and collaboration techniques with stakeholders to achieve best results.

PROGRAM SPECIFIC OUTCOMES (PSOS):

At the end of Electronics and Telecommunication program the student will have following Program specific outcomes.

PSO1: The ability to understand, analyze and develop computer programs in the areas related to algorithms, system software, multimedia, web design, big data analytics, and networking for efficient design of computer-based systems of varying complexity

PSO2: The ability to apply standard practices and strategies in software project development using open-ended programming environments to deliver a quality product for business success.

PSO3: The ability o employ modern computer languages, environments, and platforms in creating innovative career paths to be an entrepreneur, lifelong learning & a zest for higher studies and also acts as good citizen by inculcating in them moral values & ethics.

Recommendations for conducting one theory course of curriculum through online Teaching / Learning

1. Only Swayam / NPTEL platform is allowed.

2. One defined subject per semester in online mode and BOS should declare that one subject for online mode based on availability of NPTEL offering before commencement of the semester.

3. Student will be allowed to appear for NPTEL / Institute level / University Examination as applicable.

4. In order to ensure learning, NPTEL lectures to be telecast in the class by including it in regular time table if required.

5. 75% assignment submission is mandatory for these online classes also like regular lecture attendance.

6. One faculty to be allotted for this subject, who will discuss and solve student's doubts. Allot 3 hrs/week load to teacher who is allotted to work as facilitator of online course.

7. For Autonomy Students: For online mode the student should submit all assignment given by nptel then his/her score has weightage of 40% for CA & MSE. And if student clear the nptel final exam and producing certificate then 60% weightage should be given as ESE, otherwise he/she has to appear for Makeup exam of Institute.

If student cannot enroll for NPTEL then he/she has to study online videos / material and these students should appear for Mid Semester, CA-I , CA-II and End sem exams of the Institute.

8. For DBATU students: For online mode he has to appear for CA-I, CA-II, Mid sem exam of the institute and End sem exam of University.

If student can't enroll for NPTEL then he/she has to study online videos / material and these students should appear for Mid Semester, CA-I , CA-II of the institute and End sem exams of the University.

10. If the credits of NPTEL/ SWAYAM courses do not match with the existing subject proper scaling will be done)

This system will ensure real learning; avoid any problem arising due to cancellation of NPTEL exam as it happened in this semester. At least for first year and in the unpredictable situation of covid pandemic these provisions will avoid any last moment chaos.

Course Structure and Syllabus

For

B. Tech. Information Technology Programme

Curriculum for Semester- I [First Year]

1st Semester

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				Credit
				L	T	P	CA	MSE	ESE/Ext. Pra.	Total	
1	HSMC	HU1T002	Introduction to Computer programming	2	0	0	20	20	60	100	2
2	BSC	MA1T001	Engineering Mathematics - I	3	1	0	20	20	60	100	4
3	BSC	IT1T005	Engineering Physics	3	1	0	20	20	60	100	4
4	ESC	IT1T006	Energy and Environment Engineering	3	0	0	20	20	60	100	3
5	HSMC	HU1L002	Introduction to Computer programming Lab	0	0	4	60	0	40	100	2
6	ESC	WS1L001	Workshop Practices	0	0	4	60	0	40	100	2
7	BSC	IT1L005	Engineering Physics Lab	0	0	2	60	0	40	100	1
8			Induction Programme	3 Weeks							
9	ESC	IT1T007	Basic Electrical and Electronics Engineering	2	0	0	10	15	25	50	Audit
				13	**2**	**10**					**18**

HU1T002	Introduction to Computer Programming	4 Credit

Course Objectives:

1. To understand the importance of Programming
2. To understand the application of C Programming.
3. To investigate the key concepts of C Programming.
4. To enable students build a applications based on C programming

Course Outcome:

CO1: Define the algorithms, flowcharts, array, pointer, structure, function, and python.

CO2: Discuss and differentiate between variables, operators, statements, loops, array dimensions.

CO3: Demonstrate working programs using functions, loops, conditional statements, array, pointer, structure and files in C and python language.

CO4:Distinguish between different steps of programming and prioritize levels of programming.

CO5:Find errors and predict outcome in C and python programming.

CO6:Compose and develop any application using C and python programming.

Unit I: Basic of Programming Language [6 Hrs]

HLL, LLL, Language translator, Error checking, Debugging, Programming processes, Flowcharts, Algorithms along with asymptotic notation.

Unit II: Types, Operators and Expressions in C language [6 Hrs]

Variable names, Data types, sizes, constants, declarations, arithmetic operators, relational and logical operators, type conversions, increment and decrement operators, bitwise operators, assignment operators and expressions, conditional expressions precedence and order of evaluation.

Unit III: Control Flow: [6 Hrs]

Statements and Blocks. If-else, else-if, switch, Loops: while and for, do-while break and continue go to and Labels. Initializing arrays, Initializing character arrays, multidimensional arrays, Introduction to pointers.

Unit IV: Functions and Pointers in Python **[6 Hrs]**

Functions and Program Structure: Basic of functions, functions returning non-integers external variables scope rules.

Pointers in Python: Pointers to integers, characters, floats, arrays.

Unit V: **[6 Hrs]**

Structures in Python: Basics of structures, structures with functions, arrays of structures.

File handling in Python: Basics of file handling.

Text Books

1. Let Us C by Yashavant Kanetkar.
2. Let Us C Solutions by Yashavant Kanetkar
3. Data Structure through C by Yashavant Kanetkar.

Reference Books

1. C Programming: A Modern Approach (2nd Edition) - K. N. King (2008). A good book for learning C.
2. Programming in C (4th Edition) - Stephen Kochan (2014). A good general introduction and tutorial.
3. C Primer Plus (5th Edition) - Stephen Prata (2004)
4. A Book on C - Al Kelley/Ira Pohl (1998).
5. The C Book (Free Online) - Mike Banahan, Declan Brady, and Mark Doran (1991).

MA1T001	Engineering Mathematics-1	4 Credit

COURSE OBJECTIVES

1. To understand the importance of Mathematics
2. To understand the application of Mathematics in engineering and in real life.
3. To investigate the key concepts of Mathematics.
4. To enable students to analyse a problem

COURSE OUTCOMES

At the end of the course students will be able to

1. Describe rank, Bernoulli's theorem, Taylor's and Maclaurin's theorems for functions of two variables, – Euler's Theorem for functions containing two and three variables, Lagrange's theorem
2. Illustrate the examples of ordinary differential equation, partial differential equation, matrices.
3. Solve questions related to ordinary differential equation, partial differential equation, matrices and their applications.
4. Apply the knowledge of matrices, ordinary differential equation, partial differential equation, and their applications to real world problems.
5. Interpret the results of matrices, ordinary differential equation, partial differential equation and their applications.
6. Design a method or modal on matrices, ordinary differential equation, and partial differential equation.

Unit 1: Linear Algebra- Matrices [09 Hours]

Determinants & Matrix, Inverse of Matrix by adjoin method, Inverse by partitioning method, solution of system of linear equations, Rank of Matrix, Consistency of linear system of equation.

Unit 2: Ordinary Differential Equations of First Order and First Degree and Their Applications [09 Hours]

Linear equations; Reducible to linear equations (Bernoulli's equation); Exact differential equations; Equations reducible to exact equations; Applications to orthogonal trajectories, mechanical systems and electrical systems.

Unit3: Linear Differential Equations with Constant Coefficients [09 Hours]

Introductory remarks - complementary function, particular integral; Rules for finding complementary functions and particular integrals; Method of variation of parameters; Cauchy's homogeneous and Legendre's linear equations.

Unit 4:Partial Differentiation **[09 Hours]**

Partial derivatives of first and higher orders; Homogeneous functions – Euler's Theorem for functions containing two and three variables (with proofs); Total derivatives; Change of variables.

Unit 5:Applications of Partial differentiation **[09 Hours]**

Jacobians - properties; Taylor's and Maclaurin's theorems (without proofs) for functions of two variables; Maxima and minima of functions of two variables; Lagrange's method of undetermined multipliers.

Text Books

1) Higher Engineering Mathematics by B. S. Grewal, Khanna Publishers, NewDelhi.
2) Advanced Engineering Mathematics by Erwin Kreyszig, John Wiley & Sons, NewYork.
3)A Course in Engineering Mathematics (Vol I) by Dr. B. B. Singh, Synergy Knowledgeware, Mumbai.

4) A Text Book of Applied Mathematics (Vol I & II) by P. N. Wartikar and J. N. Wartikar, Pune Vidyarthi Griha Prakashan, Pune.
5) Higher Engineering Mathematics by H. K. Das and Er. RajnishVerma, S. Chand & CO. Pvt.Ltd., New Delhi.

Reference Books

1) Higher Engineering Mathematics by B. V. Ramana, Tata McGraw-Hill Publications, New Delhi.

2) A Text Book of Engineering Mathematics by Peter O' Neil, Thomson Asia Pte Ltd. , Singapore.

3) Advanced Engineering Mathematics by C. R. Wylie & L. C. Barrett, Tata Mcgraw-Hill Publishing Company Ltd., New Delhi.

ET1T005	**Engineering Physics**	**4 Credit**

COURSE OBJECTIVES:-

1. To provide a firm grounding in the basic physics principles and concept to resolve many Engineering and technological problems.
2. To understand and study the Physics principles behind the developments of Engineering materials.

COURSE OUTCOMES

At the end of the course students will be able to

1. Define the concept of laser, optical fiber, Hall effect, electron Ballistics, Bethe's law, Brewster law, polarization, electromagnetic wave.
2. Illustrate different types of laser, and optical fiber, Band-theory, Effect of electric and magnetic fields, Electric and Magnetic focusing, Interference in thin films, Interference in Wedge shape thin film and electromagnetic wave.
3. Apply the concept of Three and four level laser, pumping, population inversion, Numerical aperture, Attenuation and dispersion, V-I characteristics of PN-junction diode, CRO, Interference in thin films and electromagnetic waves.
4. Analyze the different types of laser and optical fiber, semiconductors, Motion of charged particles in uniform electric and magnetic fields, polarization, relation between electric and magnetic fields of an electromagnetic wave.
5. Interpret different types of laser, and optical fiber, PN- junction diode, Bipolar Transistor action, Velocity filter, polarization, wave plate.
6. Develop models based on laser, optical fiber.

Unit-I: Laser & Optical Fibre **[08 Hrs]**

Interaction of radiation with matter, Population Inversion and Optical resonance cavity , Three and four level laser, Ruby laser, He-Ne laser, Semiconductor laser , Properties and engineering applications of laser.

Optical fibers: Propagation by total internal reflection, structure and classification (based on material, refractive index and number of modes), Modes of propagation in fiber, Acceptance angle, Numerical aperture, Attenuation and dispersion.. Applications: I) As a Sensors - i) Temperature Sensor ii) Pollution / Smoke detector iii) Liquid level sensor. II) As a Detectors- i) PIN detector ii) Avalanche Detector.

Unit-II: Semiconductor Physics **[09Hrs]**

Band-theory based classification of solids into insulators, semiconductors and conductors, Fermi-Dirac distribution Function, Intrinsic semiconductors: Germanium and silicon; Fermi- energy, Typical energy band diagram of an intrinsic semi-conductor, Extrinsic semiconductors, Current conduction in semiconductors.

PN- junction diode; Unbiased, Forward biased& Reverse biased mode with Energy band diagram , Diode rectifier equation, Bipolar Transistor action, Hall effect, Hall coefficient & Hall Angle

Unit-III: Electron Ballistics **[08 Hrs]**

Lorentz force, Motion of charged particles in uniform electric and magnetic fields (parallel, perpendicular and at an acute angle), Effect of electric and magnetic fields on kinetic energy of charged particle, Crossed electric and magnetic field configurations, Velocity filter, Electrostatic and magneto static deflection.

Bethe's law, Electric and Magnetic focusing, Construction & working of Electrostatic lens, Devices: CRT, CRO, Block Diagram, Function & working of each block.

Unit-IV: Wave Optics **[08 Hrs]**

Interference in thin films, Interference in Wedge shape thin film, Newton's rings, Anti-reflection coating, advanced applications of interference in thin film.

Polarization by reflection, Brewster's law, polarization by double refraction, Nicol prism, elliptically and circularly polarized light, Quarter wave plate and half wave plate.

Unit-V: Electromagnetic waves **[06 Hrs]**

The wave equation; Plane electromagnetic waves in vacuum, their transverse nature and polarization; relation between electric and magnetic fields of an electromagnetic wave; energy carried by electromagnetic waves and examples.

Text Books:

1. Fundamentals of Physics: David Halliday, Robert Resnick and Jerle Walker, John-WileyIndia (8e, extended)

2. A text book of Engineering Physics: M. N. Avadhanulu, S. Chand & Co.
3. Nano the Essentials: Understanding Nanoscience and Nanotechnology, T.Praddep; TMH Publications.
4. Introduction to Nanotechnology:Pooly& Owens; Willey Publication
5. Text Book of Optics: Brijlal and Subramanyam (S. Chand and Company)
6. Laser: M. N. Avadhanulu, S. Chand & Co.

Reference Books:

1. LASERS: Theory and Applications: Thyagarajan K and Ghatak A.K.
2. Nanomaterials& Nanotechnologies and Design:M.F.Ashby, Paulo Ferreira and Daniel L.Schodek, Elsevier Publications.
3. University Physics: Young and Freedman (Pearson Education).
4. Optics: Jenkins and White (Tata Mcgraw Hill)

ET1L005	Engineering Physics Lab	1 Credit

List of Experiment

2. Newton's rings - Determination of radius of curvature of Plano convex lens / wavelength

of light

3. Wedge Shaped film - Determination of thickness of thin wire
4. Laser - Determination of wavelength of He-Ne laser light
5. Magnetron Tube - Determination of ‘e/m’ of electron
6. Hall Effect - Determination of Hall Coefficient
7. Measurement of Band gap energy of Semiconductors
8. Study of I-V characteristics of P-N junction diode
9. Experiment on fibre optics
10. Input, output and current transfer characteristics of PNP/NPN transistor in CB and CE mode
11. Study of Cathode Ray Oscilloscope

ET1T006	**Energy and Environment Engineering**	**3 Credit**

COURSE OBJECTIVES

1. To understand the importance of Energy and Environment
2. To understand the application of energy saving tool in real life.
3. To investigate the key concepts of Energy and Environment

COURSE OUTCOMES

At the end of the course students will be able to

1) Describe different kind of pollution eg. Water pollution, air pollution, soil pollution etc.

2) Understand the importance of ecosystem for human beings..

3) Discover innovative method of power generation.

4) Correlate the cost of various method of power generation.

5) Judge the quality of air.

Unit 1 [**4 hrs]**

Air Pollution: Environment and Human health - Air pollution, Particulate emission: sources-effects- control measures -, air quality standards, and measurement of air pollution. Disposal of solid wastes, Bio-medical wastes effects- control measures

Unit 2 [**4 hrs]**

Water Pollution and Conservation: Water pollution- types of pollutants, effects- control measures, Water conservation and its methods, rainwater harvesting, methods of rainwater harvesting Surface runoff harvesting, Rooftop rainwater harvesting, Noise pollution –effects and control measures, -Thermal pollution – Soil pollution –Nuclear hazard.

Unit 3 [**4 hrs]**

Conventional Power Generation: Steam power station, Nuclear power plant – Gas turbine power plant- Hydro power station: Schematic arrangement, advantages and disadvantages, Thermo electric and thermionic generators, Environmental aspects for selecting the sites and locations of power plants.

Unit 4 [**4 hrs]**

Renewable Power Generation: Solar, Wind, Biogas and Biomass, Ocean Thermal energy conversion (OTEC), Tidal, Geothermal energy, Magneto Hydro Dynamics (MHD): Schematic arrangement, advantages and disadvantages.

Unit 5 **[4 hrs]**

Energy conservation: Scope for energy conservation and its benefits Energy conservation Principle – Maximum energy efficiency, Maximum cost effectiveness, Methods and techniques of energy conservation in ventilation and air conditioners, refrigerator, compressors, pumps, fans and blowers, Energy conservation in electric furnaces, ovens and boilers, lighting techniques. Tariffs and economic aspects in power generation.

Reference/Text Books:

1. A Chakrabarti, M. L Soni, P. V. Gupta, U. S. Bhatnagar, A Text book of Power System Engineering, DhanpatRai Publication.
2. Rai. G. D., Non-Conventional Energy Sources, Khanna Publishers, Delhi, 2006.
3. Rao S., Parulekar B.B., Energy Technology-Non conventional, Renewable and Conventional, Khanna Publishers, Delhi, 2005.
4. Glynn Henry J., Gary W. Heinke, Environmental Science and Engineering, Pearson Education, Inc, 2004.
5. J. M. Fowler, Energy and the Environment, McGraw-Hill, 2nd Edition, 1984.
6. Gilbert M. Masters, Introduction to Environmental Engineering and Science, 2nd Edition, Prentice Hall, 2003.

HU1L002	**Introduction to Computer Programming Lab**	**2 Credit**

List of Practical:-

1	A simple program to display a message “Hello World” on screen.
2	Write a Program to print addition, subtraction Multiplication and Division of a entered number.
3	Write a Program to LCM of the entered number..

4	Write a program to find GCD of the entered number.
5	Write a program to find the greatest among three number.
6	Write a any menu driven program using if…else statement.
7	Write a any menu driven program using Switch case statement.
8	Write a program to find count of even no ,count of odd number , sum of even no and sum of odd number between 1 to 50.
9	Write a Program to generate prime number up to inputted number.
10	Write a program to check entered no is Armstrong no or not.
11	Write a program to find transpose of a matrix.
12	Write a Program to find multiplication of a two matrix elements.
13	Write a Program to find length of a string.(with and without using a library function)
14	Write a Program to find addition of two numbers using pointer.
15	Open ended Program. (How to execute C program on Linux operating system)
16	Write a Python program to print “Hello World”.
17	Write a Python program to display the current date and time.
18	Write a Python program which accepts the radius of a circle from the user and compute the area.
19	Write a Python program to find reverse of the entered number.
20	Write a Python program to get the Python version you are using

WS1L001	Workshop Practices	2 Credit

Instructions to the student:

Each student is required to maintain a „workshop journal‟ consisting of drawing / sketches of the jobs and a brief description of tools, equipment, and procedure used for doing the job.

Contents:

a**) Carpentry:** Technical Terms related to wood working, Types of wood, Joining materials, Types of joints - Mortise and Tenon, Dovetail, Half Lap, etc., Methods of preparation and applications, Wood working lathe, safety precautions.

b) Welding: Arc welding - welding joints, edge preparation, welding tools and equipment, Gas welding - types of flames, tools and equipment, Resistance welding - Spot welding, joint preparation, tools and equipment, safety precautions.

c) Fitting: Fitting operation like chipping, filing, right angle, marking, drilling, tapping etc., Fitting hand tools like vices, cold chisel, etc. Drilling machine and its operation.

e) Machine shop: Lathe machine, types of lathes, major parts, cutting tool, turning operations (Demo), safety precautions

List of Practical:

1. Wood sizing exercises in planning, marking, sawing, chiselling and grooving to make half lap joint and cross lap joint.
2. A job involving cutting, filing to saw cut, filing all sides and faces, corner rounding, drilling and tapping on M. S. plates.
3. Exercise in Arc welding (MMAW) to make a square butt joint.
4. A demo job on turning of a Mild Steel cylindrical job using centre lathe.

Electrical workshop:-

1) To wire for a stair case arrangement using a two-way switch.

2) To measure electrical quantities-voltage current, power & power factor in RLC circuit.

ET1T007	Basics of Electrical and Electronics Engineering	Audit

COURSE OBJECTIVES

1. To provide a basic information and use of electrical and electronics components.
2. To understand and study the materials used for the preparation of electrical and electronics components.
3. To provide basic knowledge of operation and functionality of electrical and electronics components.

COURSE OUTCOMES:

CO1: Define fundamentals of electrical system and choose measuring instruments for measurement of electrical quantities & describe the concept PN junction diode and its characteristics.

CO2: Classify wiring system and compare energy resources for electrical energy generation & elaborate the transistor configuration in CE, CB & CC mode.

CO3: Plan and organize the utilization of energy resources of electrical system & apply transistor characteristics to construct Amplifier devices.

CO4: Compare different sources of electrical system & distinguish various logic gates and simplify the Boolean's equations.

CO5: Justify the utilization of various electrical and electronics components into electrical and electronics circuitries.

CO6: Construct various circuits using Resistors, capacitors, inductors, PN junction diode, Zener diode, transformers, transistors and logic gates.

Unit 1: Elementary Electrical Concepts and Circuit Components [8 Hrs]

Fundamental of Electrical system: Potential difference, Ohm's law, Effect of temperature on resister, resistance temperature coefficient, **Electrical wiring system**: Study of different wire gauges and their applications in domestic and industry. **Resistors:** colour code, type of resistors, material used for resistors, resistance wires, resistance standards, frequency errors in resistors. **Capacitors:** Capacitance standards, variable capacitors, frequency errors in capacitors. Loss angle and power factor of capacitors. **Inductors:** standards of inductance, mutual inductance, self-inductance, variable inductance, inductors for high and low frequency work, frequency errors in inductors.

Unit 2: Measurement of Electrical Quantities, Measuring Instruments & Energy Resources [7 Hrs]

Measurement of Voltage, Current, and Power (1ph and 3ph), Introduction to PMMC instrument, Ohmmeter, galvanometer, potentiometers, power factor meter and frequency meters. Study of circuit breakers & Actuators (MCB & Fuse, Power Contactors & Aux contactors, Electro-Mechanical & Solid state Relays). **Energy Resources and Utilization**: Conventional and nonconventional energy resources; Introduction to electrical energy generation from different resources, transmission, distribution and utilization, Concept of Supply Demand, Power Factor, Need of unity factor.

Unit3: Introduction to diodes, diode circuit and Transducers [8 Hrs]

The P-N Junction Diode, V-I characteristics, Diode as Rectifier, specifications of Rectifier Diodes, Half Wave, Full wave, Bridge rectifiers, Equations for IDC VDC VRMS, IRMS, Efficiency and Ripple Factor for each configuration. Zener Diode, Characteristics, Specifications, Zener Voltage Regulator, Types of Diodes: LED, Photodiode. Introduction to transducer, Classification of transducers, characteristics and choice of transducers.

Unit 4: Semiconductor Devices and Applications: [7 Hrs]

Transistors: Introduction, Classification, CE, CB, and CC configurations, α, β, concept of gain and bandwidth. Operation of **BJT** in cut-off, saturation and active regions (DC analysis). BJT as an amplifier, biasing techniques of BJT, BJT as a switch.

Introduction to Digital Electronics: Number System, Basic logic Gates, Universal Gates, Boolean

Postulates, De-Morgan Theorems

Reference/Text Books:

1. V. N. Mittal and Arvind Mittal, Basic Electrical Engineering, McGraw-Hill Publication.
2. Brijesh Iyer and S. L. Nalbalwar, A Text book of Basic Electronics, Synergy Knowledgeware Mumbai, 2017. ISBN:978-93-8335-246-3
3. Vincent DelToro, Electrical engineering Fundamentals, PHI Publication, 2nd Edition, 2011.
4. A Textbook of Basic Electrical and Electronics Engineering, J.B.Gupta, Katson Publication.
5. A Textbook of Basic Electrical Engineering by S.B. Bodkhe, N.M.Deskar, Professional Publishing House Pvt. Ltd
6. D. P. Kothari and Nagrath, Theory and Problems in Electrical Engineering, PHI Publication, 2011.

7. B. L. Theraja, Basic Electronics, S. Chand Limited, 2007.
8. Millman Halkias, Integrated Electronics-Analog and Digital Circuits and Systems, McGraw-Hill Publication, 2000.
9. Donald Neaman, Electronic Circuit Analysis and Design, McGraw-Hill Publication, 3rd Edition.
10. Donald Neaman, Electronic Circuit Analysis and Design, McGraw-Hill Publication, 3rd Edition.
11. Printed Circuit Boards Design & Technology, Walter C. Bosshart, McGraw-Hill Publication.

Note: Students are advised to use internet resources whenever required

Curriculum for Semester- II [First Year]

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				Credit
				L	T	P	CA	MSE	ESE/ Ext.	Total	
1	HSMC	HU2T001	Communication Skills	2	0	0	60	0	40	100	2
2	BSC	MA2T001	Engineering Mathematics-II	3	1	0	20	20	60	100	4
3	BSC	CS2T002	Engineering Chemistry	3	1	0	20	20	60	100	4
4	ESC	CS2T003	Engineering Graphics	1	0	0	20	20	60	100	1
5	HSMC	HU2L001	Communication Skills Lab.	0	0	4	60	0	40	100	2
6	BSC	CS2L002	Engineering Chemistry Lab	0	0	2	60	0	40	100	1
7	ESC	CS2L003	Engineering Graphics Lab	0	0	4	60	0	40	100	2
8			Societal Internship/ Field	Report submission						50	1
9	ESC	CS2T004	Basic Civil and Mechanical Engineering	2	0	0	10	15	25	50	Audit
				11	**2**	**10**					**17**
				23							

HU2T001	**Communication Skills**	**4 Credit**

Course Objectives:

The main objective of the subject is to enhance the employability skills of engineering students as well as communication skills at work place.

The sub-objectives are:

1) To develop students' reading skills and pronunciation.
2) To develop technical communication skills through drafting, letter writing, and précis writing.
3) To develop literary skills through essay writing.
4) To develop public speaking skills of the students.
5) To expose the students to the ethics of English language by teaching grammar

Course Outcomes:

At the end of the course students will be able to

1) Better reading comprehension, pronunciation, and functional English grammar.
2) Write letters and resumes
3) Organize their thoughts for effective presentation and writing.
4) Learn skills to present themselves well in an interview, and handle a Group Discussion

Unit 1: Communication and Communication Processes [06 hrs]

Introduction to Communication, Types and functions of Communication, Barriers to Communication and overcoming them, Role of Communication Skills in Society

Reading: Introduction to Reading, Barriers to Reading, Types of Reading: Skimming, Scanning, Intensive and Extensive, Strategies for Reading Comprehension.

Listening: Importance of Listening, Types of Listening, and Barriers to Listening.

Unit 2: Study of Sounds in English and Vocabulary Building [06 hrs]

Introduction to phonetics, Study of Speech Organs, Study of Phonemic Script, Articulation of Different Sounds in English.

Vocabulary Building: The concept of Word Formation, Root words from foreign languages and their use in English, Use of prefixes and suffixes from foreign languages in English to form derivatives, Synonyms, antonyms, and standard abbreviations

Unit 3: English Grammar **[06 hrs]**

Grammar: Forms of Tenses, Articles, Prepositions, Use of Auxiliaries and Modal Auxiliaries, Sentence Structures, Use of phrases and clauses in sentences, Importance of proper punctuation, Common Errors. Misplaced modifiers

Unit 4: Professional Verbal Communication **[06 hrs]**

Components of an effective talk, Idea of space and time in public speaking, Tone of voice, Body language, Timing and duration of speech, Audio-Visual Aids in speech. Presentation Skills, Group Discussion and Job Interviews

Unit 5: Developing Business Writing Skills, Styles and Practice **[06 hrs]**

Writing Emails, Report Writing: Format, Structure and Types, Letter Writing**:** Types, Parts, Layouts, Writing Job Application Letter and Resume.

Nature and Style of sensible Writing and Practice: Describing, Defining, Classifying, Providing examples or evidence, writing introduction and conclusion, Writing Practices: Comprehension, Précis Writing, Essay Writing

Text book:

Mohd. Ashraf Rizvi, Communication Skills for Engineers, Tata McGraw Hill

Reference Books:

1) Sanjay Kumar, PushpLata, Communication Skills, Oxford University Press, 2016

2) Meenakshi Raman, Sangeeta Sharma, Communication Skills, Oxford University Press, 2017

3) Teri Kwal Gamble, Michael Gamble, Communication Works, Tata McGraw Hill Education, 2010

4) Anderson, Kenneth. Joan Maclean and Tossny Lynch. Study Speaking: A Course in Spoken English for Academic Purposes. Cambridge: CUP, 2004.

5) Aswalthapa, K. Organisational Behaviour, Himalayan Publication, Mumbai (1991).
6) Atreya N and Guha, Effective Credit Management, MMC School of Management, Mumbai (1994).
7) Balan, K.R. and Rayudu C.S., Effective Communication, Beacon New Delhi (1996).
8) Bellare, Nirmala. Reading Strategies. Vols. 1 and 2. New Delhi. Oxford University Press, 1998.
9) Bhasker, W. W. S &Prabhu, N. S.: English through Reading, Vols. 1 and 2. Macmillan, 1975.
10) Black, Sam. Practical Public Relations, E.L.B.S. London (1972).
11) Blass, Laurie, Kathy Block and Hannah Friesan. Creating Meaning. Oxford: OUP, 2007.
12) BoveeCourtland,L and Thrill, John V. Business Communication, Today McGraw Hill, New York, Taxman Publication (1989).

MA2T001	Engineering Mathematics-II	4 Credit

COURSE OBJECTIVES

1. To understand the importance of Mathematics
2. To understand the application of Mathematics in engineering and in real life.
3. To investigate the key concepts of Mathematics.
4. To enable students to analyse a problem

COURSE OUTCOMES

At the end of the course students will be able to

1. Describe concept of complex numbers, integral calculus & multiple integrals, Fourier series & transform, vector differential calculus, vector integral calculus.
2. Illustrate the concept of complex numbers, integral calculus & multiple integrals, Fourier series & transform, vector differential calculus, vector integral calculus by using examples.
3. Apply the knowledge of complex numbers, integral calculus & multiple integrals, Fourier series & transform, vector differential calculus, vector integral calculus to solve the engineering problems.
4. Analyse the problems and results of complex numbers, integral calculus & multiple integrals, Fourier series & transform, vector differential calculus, vector integral calculus to solve the engineering problems.
5. Evaluate the problems by using complex numbers, integral calculus & multiple integrals, Fourier series & transform, vector differential calculus, vector integral calculus to solve the engineering problems.
6. Create the methods or model by using complex numbers, integral calculus & multiple integrals, Fourier series & transform, vector differential calculus, vector integral calculus to solve the engineering problems.

Unit 1: Complex Numbers **[09 Hrs]**

Definition and geometrical representation; De-Moivre's theorem (without proof); Roots of Complex numbers by using De-Moivre's theorem; Circular functions of complex variable – definition; Hyperbolic functions; Relations between circular and hyperbolic functions; Real and

Imaginary parts of circular and hyperbolic functions; Logarithm of Complex quantities.

Unit 2: Integral calculus & Multiple Integrals [09 Hrs]

Beta, Gamma functions; tracing of the curves given in Cartesian, parametric & polar forms. Double integration in Cartesian and polar co-ordinates; Evaluation of double integrals by changing the order of integration and changing to polar form; Triple integral

Unit3: Fourier Series & Transform [09 Hrs]

Fourier Series , Definition and Properties (excluding FFT), Fourier Integral Theorem, Relation with Laplace Transform, Applications of Fourier Transform to Solve Integral Equations.

Unit4: Vector Differential Calculus [09 Hrs]

General rules of vector Differentiation; Scalar and vector fields: Gradient, divergence and curl; Solenoidal and irrotational vector fields; Vector identities

Unit5: Vector Integral Calculus [09 Hrs]

Vector Integration: line integral, surface integral and volume integral; Green's lemma, Gauss' divergence theorem and Stokes' theorem (without proofs).

Text Books

1) Higher Engineering Mathematics by B. S. Grewal, Khanna Publishers, NewDelhi.
2) Advanced Engineering Mathematics by Erwin Kreyszig, John Wiley & Sons, NewYork.
3)A Course in Engineering Mathematics (Vol I) by Dr. B. B. Singh, Synergy Knowledgeware, Mumbai.
4) A Text Book of Applied Mathematics (Vol I & II) by P. N. Wartikar and J. N. Wartikar, Pune Vidyarthi Griha Prakashan, Pune.
5) Higher Engineering Mathematics by H. K. Das and Er. RajnishVerma, S. Chand & CO. Pvt.Ltd., New Delhi.

Reference Books

1) Higher Engineering Mathematics by B. V. Ramana, Tata McGraw-Hill Publications, New Delhi.

2) A Text Book of Engineering Mathematics by Peter O’ Neil, Thomson Asia Pte Ltd. , Singapore.

3) Advanced Engineering Mathematics by C. R. Wylie & L. C. Barrett, Tata Mcgraw-Hill Publishing Company Ltd., NewDelhi.

ET2T002	Engineering Chemistry	4 Credit

COURSE OBJECTIVES

1. To understand the importance of Chemistry
2. To understand the application of Chemistry in engineering and in real life.
3. To investigate the key concepts of Chemistry knowledge
4. To enable students to analyse a Chemistry problem so that appropriate problem solving techniques may be applied

COURSE OUTCOMES

At the end of the course students will be able to

1. Describe various properties of water, fuel, transition metal ions and their magnetic properties, Debye-Hückel theory, Quinonoid theory, various electrode, polymer and batteries
2. Illustrate the various types of water, Ostwald's theory of acid-base indicator, polymer, various batteries, and fuel cell.
3. Analyze the question on water characteristics, electrochemistry and various types of instrumental titration, various batteries and fuel cell.
4. Apply the Knowledge of zeolite process, Ion exchange process, Hot Lime –Soda process, acid base concept, fuel cell and batteries..
5. Develop a Modal on softening of water, standardization of acid and base by various instruments, polymers, fuel cell and batteries..
6. Organize water as per quality, and fuel, types of electrodes, polymers and fuel cell and batteries.

Unit-1 **[6 Hrs]**

Water Treatment: Introduction, hard and soft water, softening of water – Zeolite process, Ion exchange process, Hot Lime –Soda process, water characteristics- Hardness, Domestic water treatment

Unit-2 **[6 Hrs]**

Fuels: Introduction, classification of fuel, essential properties of fuel, characteristics of good fuel, solid fuel-Coal, Various types of Coal, Analysis of coal-Proximate and Ultimate analysis, liquid fuel- Refining of Petroleum.

Unit-3 **[8 Hrs]**

Electrochemistry: Introduction-basic concepts, Transport number and its determination by Moving Boundary method, Debye-Hückel theory, Conductometric titrations, Ostwald's theory of acid-base indicator, Quinonoid theory, Electrodes – Glass electrode, Quinhydrone electrode.

Unit-4 **[8 Hrs]**

Advanced Polymeric Materials: Introduction to reactions involving substitution, addition, elimination, cyclization and ring opening. Liquid crystals and liquid crystal polymers (thermotropic and lyotropic), phases of thermotropic polymers: nematic, smectic, cholesteric; advantages, disadvantages and applications

Unit-5Battery Technology: **[6 Hrs]**

Classification of batteries: Primary, Secondary- Electricity storage density, power density, energy efficiency, cycle life, shelf life. Rechargeable alkaline storage batteries, Ni-metal hydride, Lithium ion batteries and H2-O2 Fuel cell.

Text Books:

1. A Text book of Engineering Chemistry, Dr. S. S. Dara, Dr. S. S. Umre, S. Chand and Company Ltd., Twelfth/ 2011
2. Selected Topics in Inorganic Chemistry, Dr. Wahid U. Malik, Dr. G. D. Tuli and Dr. R. D. Madan, S. Chand and Company Ltd., Seventh/2001

Reference Books:

Engineering Chemistry, P. C. Jain and Monika Jain, Dhanpatrai Publishing Company Ltd., 15^{th} Ed/ 2009

Principles of Physical Chemistry, B. R. Puri, L. R. Sharma and Madan S. Pathania, Vishal Publishing Company, First/2002

Chemistry, John E McMurry and Robert C Fay, Pearson, First/2008

ET2T003	**Engineering Graphics**	**3 Credit**

COURSE OBJECTIVES

1. To understand the concepts like dimensioning, conventions and standards related to engineering graphics in order to become professionally efficient
2. To understand theory of projection and simple machine parts in first and third angle of projection systems.
3. To understand the key concepts CAD software.
4. To enable students to analyze a 2-dimensional & 3-dimensional problem.

COURSE OUTCOMES:

1. Define various concepts like dimensioning, conventions and standards related to engineering graphics in order to become professionally efficient.
2. Interpret drawings of simple machine component in first and third angle of projection systems
3. Apply theory of projections in projection of lines, projection of planes and projection of solid.
4. Classify solid geometry in different positions.
5. Assess the two dimensional and three dimensional drawing in CAD software.
6. Create the three dimensional engineering objects into two dimensional drawings and vice versa using CAD software

Unit I Introduction to Computer Aided Drawing [03 Hrs]

Theory of CAD software, Demonstration knowledge, layout of the software, standard tool bar/menus and description of most commonly used tools bars, Navigational tools. Creation of 2D/3D environment. Commands and creation of co-ordinate points, lines, axes, polyline, square, rectangle, polygons, splines, circles, ellipse, text, move, copy, offset, mirror, rotate, trim, extend, break, chamfer, fillet, zoom, pan, curves, constraints viz. tangency, parallelism, inclination and perpendicularity. Dimensioning, line conventions, lettering. Line properties, 3D modeling& topology of engineering component.

Unit II Drawing standards & Orthographic Projections: [03 Hrs]

Drawing standard SP: 46, type of lines, lettering, dimensioning. Basic geometrical construction, drawing of regular polygon, Theory of projection, introduction to orthographic projection, drawing of orthographic views of objects from their isometric views by using first angle method of projection.

Unit III Projections of Points & Projections of Straight Lines: [03 Hrs]

Projection of point lying in four quadrants. Projections of lines parallel and perpendicular to one or both planes, projections of lines inclined to one or both reference planes.

Unit IV Projections of Planes & Projections of Solids: [03 Hrs]

Projections of planes parallel and perpendicular to one or both planes, projection of planes inclined to one or both planes.

Types of solids, Projection of solid when axis is perpendicular to one of the reference planes, when axis is inclined to one and parallel to other reference plane, when axis is inclined to both the reference planes

Unit V Isometric Projections [03 Hrs]

Isometric projections: Isometric scale, drawing of isometric projections from given orthographic views.

Text Books:

1. N. D. Bhatt, Engineering Drawing, Charotar Publishing House, 46th Edition, 2003.

2. Dhananjay A. Jolhe, Engineering Drawing with an Introduction to AutoCAD, McGraw Hill Education, 2017

Reference Books:

1. K. V. Natarajan, A text book of Engineering Graphic, Dhanalakshmi Publishers, Chennai, 2006.

2. K. Venugopal and V. Prabhu Raja, Engineering Graphics, New Age International (P) Ltd, 2008.

3.Engineering Drawing, R. K. Dhawan, S. Chand Publication, 1998.

4. Engineering Graphics, A. R. Bapat, Allied Publishers, 2004.

5. Fundamentals of Engineering Drawing, Luzadder& Duff, Eastern Economy, 11th Edition.

HU2L001	**Communication Skills Lab**	**1 Credit**

List of Practical Sessions (Any 10 PR sessions can be conducted):

1) Pronunciation, Intonation, Stress and Rhythm(02 hrs)
2) Introduction to Phonemic symbols (02 hrs)
3) Articulation of sounds in English with proper manner (02 hrs)
4) Practice and exercises on articulation of sounds (02 hrs)
5) Read Pronunciations/transcriptions from the dictionary (02 hrs)
6) Practice and exercises on pronunciations of words (02 hrs)
7) Introduce yourself (02 hrs)
8) Importance of Business Communication with the help of a case study.(02hrs)
9) Listening Skills/ Comprehension(02 hrs)
10) Common Everyday Situations: Conversations and Dialogues(02 hrs)
11) Communication at Workplace(02 hrs)
12) Rapid reading sessions (02 hrs)
13) Draft Email(02 hrs)
14) Resume Writing(02hrs)
15) Drafting Business Letter(02 hrs)
16) Preparing technical paper using IEEE format(02 hrs)
17) Extempore (02 hrs)
18) Elocution (02 hrs)
19) Group discussion (02 hrs)
20) Participating in a debate (02 hrs)
21) Presentation techniques (02 hrs)
22) Interview techniques – Job Interviews, Telephonic Interviews(02hrs)
23) Mock interviews and practice sessions(02 hrs)

EL2L002	**Engineering Chemistry Lab**	**4 Credit**

List of Experiments: (Perform any 8– 10 Experiments)

1. Determination of Hardness of water sample by EDTA method.
2. Determination of flash point by Pensky Martin Apparatus
3. Determination of Dissolve Oxygen by Iodometric method.
4. Determination of percent purity of Bleaching Powder.
5. pH – metric Titration (any one type of Acid Base titration)
6. Conductometric Titration (any one type of Acid Base titration)
7. Surface tension: Determination of relative surface tension of liquid with respect to water using drop number method.
8. Viscosity:Determination of relative viscosity of liquid with respect to water using Ostwald's viscometer method.
9. To determine the normality in Normal term and Strength in gms/lit of HCl solution by titrating with Na_2CO_3 solution.
10. To find out Morality, Normality and Strength of the given $KMnO_4$ solution by titrating against N/10 Mohr's solution.
11. Determination of Acid value of an oil sample.
12. Determination of Saponification value of an oil sample.

Reference Books:

1. Systematic experiments in Chemistry, A. Sethi, New Age International Publication, New Delhi.
2. Practical Inorganic Chemistry, A. I. Vogel, ELBS Pub.
3. Practical in Engineering Chemistry, S. S. Dara.

ET2L003	**Engineering Graphics Lab**	**1 Credit**

COURSE OBJECTIVES:

The objective of the course is to enable students to

1. Provide basic foundation in CAD software.
2. Understand the fundamentals used to create and manipulate geometric models.
3. Get acquainted with the basic CAD software for to design geometric modeling.

COURSE OUTCOMES:

1. Define basic structure of CAD workstation, CAD commands, Memory types, input/output devices and display devices to become professionally efficient to operate CAD software.
2. Explain drawing of simple machine component in CAD software.
3. Acquire the knowledge of geometric modeling in CAD software.
4. Analyze the steps required in CAD software for 2-dimensional and 3-dimensional models.
5. Assess the two dimensional and three dimensional drawing in CAD software.
6. Create the three dimensional engineering objects into two dimensional drawings and vice versa using CAD software.

List of Practical:

1. Introduction of CAD software and to study and practice basic draw commands exists in the CAD software.
2. Lines, lettering and dimensioning. (Drafting work)
   Identify the different types of Lines in the given object, draw lettering and give the Required dimensions in the given object.
3. Geometric Construction. (Drafting work)
4. Orthographic projections first sheet. (Using CAD software)
5. Orthographic projections second sheet. (Using CAD software)
6. Projections of straight lines. (Drafting work)
7. Projections of planes & solids. (Drafting work)
8. Isometric Projections first sheet. (Using CAD software)
9. Isometric Projections second sheet. (Using CAD software)
10. Design of basic hardware components using CAD Software.
11. Design of advance hardware components using CAD Software.
12. Design of assembly drawing using CAD Software.

13. Design of assembly drawing with animation and rendering using CAD Software.

ET2T004	**Basic Civil and Mechanical Engineering**	**Audit**

COURSE OBJECTIVES (Basic Mechanical Engineering)

1. To understand the basic stream of Mechanical engineering and Civil Engineering.
2. To understand the concepts of product manufacturing, Energy engineering, design engineering, Automobile engineering, construction technique and civil surveying.
3. To have basic knowledge of Casting, Machining, Designing, Manufacturing, different materials for building construction and surveying.

COURSE OUTCOMES: (Basic Mechanical Engineering)

Students would be able to

1. Define basic stream of Mechanical & Civil Engineering.
2. Explain the concepts of product manufacturing, Energy engineering, design engineering, Automobile engineering, construction technique and civil surveying.
3. Apply Basic knowledge of Casting, Machining, Designing, Manufacturing & Civil Construction technique.
4. Analyzed the different mechanical system and properties of construction & surveying material.
5. Interpret the problem in mechanical system and civil structure.
6. Solve the problem in mechanical system and civil structure.

Part I Basic Civil Engineering

Unit 1: Introduction to civil engineering

Various branches introduction to civil engineer in various construction activities basic engineer properties and various materials: earth bricks timber, stone, sand Aggregate cement motor steel bituminous glass FRP composite material.

Unit 2: Building component and planning material

Foundation and superstructure function of foundation type of shallow and deep foundation suitability in different situation plinth wall lintels beam column slab roof staircase floor door window and study of building plans ventilation and basic plumbing and sanitation

Unit 3: Surveying

Principal of surveying element of distance angular measurement plotting of area base line and off set introduction of plane table survey introduction to levelling concept of bench mark reduce level and counting

Part II Basic Mechanical Engineering

Unit 1: Introduction to Mechanical Engineering, Introduction to Laws of Thermodynamics with simple examples pertaining to respective branches, IC Engines: Classification, Applications, Basic terminology, 2 and 4 stroke IC engine working principle, Power Plant: Types of Power plant; Gas power plant, Thermal power plant, Nuclear power plant, Automobiles: Basic definitions and objectives

Unit 2: Design Basics, Machine and Mechanisms, Factor of safety, Engineering Materials: types and applications, basics of fasteners, machining and machinability. Introduction to lathe machine, drilling machine, milling machine, basics of machining processes such as turning, drilling and milling. Introduction to casting

Text Books:

1. Anurag Kandya, "Elements of Civil Engineering", Charotar Publishing, Anand
2. M. S. Palani Gamy, "Basic Civil Engineering", Tata Mc-Graw Hill Publication
3. G. K. Hiraskar, "Basic Civil Engineering", DhanpatRai Publications
4. Gopi Satheesh, "Basic Civil Engineering", Pearson Education

Reference Books:

1. M. G. Shah, C. M. Kale, and S. Y. Patki, "Building Drawing", Tata McGraw Hill
2. Sushil Kumar, "Building Construction", Standard Publishers Distributors
3. Kanetkar T. P. and Kulkarni S. V., "Surveying and Levelling", Vols. I, II and III, Vidyarthi
4. Gruh Prakashan, Pune
5. B. C. Punmia, "Surveying", Vol.- I, Vol.-II, Vol.-III, Laxmi Publications
6. P. K. Nag "Engineering Thermodynamics", Tata McGraw Hill, New Delhi 3rd ed. 2005
7. A. Ghosh, A K Malik, "Theory of Mechanisms and Machines", Affiliated East West Press Pvt. Ltd. New Delhi.

8. Serope Kalpakaji and Steven R Schimd “A manufacturing Engineering and Technology” Addison WsleyLaongman India 6th Edition 200
9. V. B. Bhandari, “Design of Machine Elements”, Tata McGraw Hill Publications, New Delhi.

Curriculum for Semester- III [Second Year]

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				Credit
				L	T	P	CA	MSE	ESE	Total	Credit
1	HSMC	IT3T001	Organization Behavior	2	0	0	20	20	60	100	2
2	BSC	IT3T002	Mathematics-III	3	1	0	20	20	60	100	4
3	ESC	IT3T003	Digital Electronics & Fundamentals of Microprocessor	3	0	0	20	20	60	100	3
4	PCC	IT3T004	Computer Arhcitecture & Organsization	3	0	0	20	20	60	100	3
5	PCC	IT3T005	Data structure using OOPs	2	1	0	20	20	60	100	3
6	PCC	IT3T006	Computer Graphics	3	0	0	20	20	60	100	3
7	PCC	IT3L007	Data structure using OOPs(Lab)	0	0	2	60	0	40	100	1
8	ESC	IT3T008	Digital Electronics & Fundamentals of Microprocessor (Lab)	0	0	2	60	0	40	100	1
9	PCC	IT3L009	Computer Graphics (Lab)	0	0	2	60	0	40	100	1
10	HSMC	IT3T010	Universal Human Values	2	1	0	20	20	60	100	3
				18	3	6	320	140	540	1000	24

IT3T001	Organizational Behaviour	2 Credit

Course Objectives:

1. To help the students to develop cognizance of the importance of human behaviour.

2. To enable students to describe how people behave under different conditions and understand why people behave as they do.

3. To provide the students to analyze specific strategic human resources demands for future action.

4. To enable students to synthesize related information and evaluate options for the most logical and optimal solution such that they would be able to predict and control human behaviour and improve results.

Course outcomes:

Students will be able to:

1. Outline the applicability of the concept of organizational behaviour to understand the behaviour of people in the organization.

2. Categorizing the applicability of analyzing the complexities associated with management of individual behaviour in the organization.

3. Analyze the complexities associated with management of the group behaviour in the organization

4. Validate how the organizational behaviour can integrate in understanding the motivation (why) behind behaviour of people in the organization

Course Contents:

Unit 1:Introduction to organization Behaviour [4Hrs]

Meaning, Fundamental concepts, Definition, Approaches to OB, Characteristics and limitations of OB, Challenges and Opportunities of OB, Models of OB, Impact of technology on organizational behaviour.

Organization Culture: Meaning and dimensions, Role of founders' values and vision in creating and sustaining culture, Types of organizational cultures, Impact of culture on image and performance of the organization.

Unit 2: Organizational Design, Change And Innovation [4 Hrs]

Designing an organizational structure, Division of labour, Delegation of authority, Departmental biases, Span of control, Dimensions of structure, Organizational design models, Multinational Structure and Design, Virtual Organizations.

Communication: The importance of communication, The communication process, Communicating within organizations, Information richness, How technology affects communication, Interpersonal communication, Multicultural communication, Barriers to effective communication, Improving Communication in organizations, Promoting ethical communications

Technical Report Writing : Characteristics of Technical Communication, Types of Technical Documents, Establishing Goals in Technical Writing, Technical Writing Process: Prewriting, writing, rewriting, Examples of Industries user manuals.

Unit3: Personality [4 Hrs]

Meaning of personality, Nature and Determinants of Personality, Personality Traits - Big Five, Locus of Control, Self-esteem, Type A/ Type B Personality, Risk Taking, Machiavellianism, Self-Monitoring, Personality and OB.

Attitude: Attributes of personality- Transactional Analysis – Ego states – Johari window - Nature and dimensions of attitude – Developing the right attitude, ABC model of Attitude, Managerial Implications of Attitude

Unit 4: Groups and Organizations [4 Hrs]

Groups and Teams, Group Dynamics - Groups versus teams, Nature and types of groups and teams, five stages of group/team development, Determinants of group behaviour, Typical teams in organizations.

Leadership: Leadership as a concept and its essence, Leaders versus managers, Blake and Mouton's managerial grid, Hersey and Blanchard's situational leadership, Transactional versus Transformational leadership, Women as leaders, Leadership in entrepreneurial and family business, organizations.

Unit 5: Motivation [4 Hrs]

Power and purpose of motivation, Theories of motivation - Locke's goal setting theory, Vroom's expectancy theory, Porter and Lawler's model, Adam's equity theory, McClelland's theory of needs, Motivational Techniques – Job design/enlargement /enrichment / rotation, Managing rewards - Job status based rewards, Competency based rewards, performance based rewards, Empowerment and Self Managed Teams.

Power and Politics: The concept of power, Sources of power, Interdepartmental power, Illusion of power, Political strategies and tactics, Ethics, power and politics, using power to manage effectively.

Empowerment and Participation: The nature of empowerment and participation, How participation works, Programs for participation, Important considerations in participation.

Unit 6: Conflict Management [4 Hrs]

Definition. Traditional vs Modern view of conflict – Types of conflict – Intrapersonal, Interpersonal, and Organizational, Constructive and Destructive conflict, Conflict management

Stress and Counselling: What is stress? Stress model, Work stressors, Stress outcomes, Stress moderators, Stress prevention and management, Employee counselling, Types of counselling

Text Books:

1. Franklin Kuo, "Network Analysis & Synthesis", Wiley International.
2. Govind Daryanani, "Analysis and Synthesis of Filters".

Reference Books:

1. Kendall Su, "Analog Filters", Kluwer Academic Publisher, 2nd Edition, 2002.

2. John O’ Malley, “Basic Circuit Analysis”, Schaum’s series.

3. Van Valkenberg, “Network Analysis”, Pearson Education.

IT3T002	**Mathematics-III**	**4 Credit**

COURSE OBJECTIVES:

1. To understand the concept of Laplace Transform , Fourier transform, complex variables Numerical Linear algebra, Stochastic calculus, Computational graph theory.
2. To understand the application of Mathematics in engineering and in real life.
3. To enable students to apply mathematical tool to solve problems in real life.
4. To enable students to apply mathematical tool to analyze problems in real life

COURSE OUTCOMES:

1. Describe the concept of Laplace Transform, Fourier transform, complex variables, Numerical Linear Algebra, Stochastic calculus, Computational graph theory
2. Illustrate the concept of Laplace Transform, Fourier transform, complex variables, Numerical Linear Algebra, Stochastic calculus, Computational graph theory by using examples.
3. Apply the concept of Laplace Transform, Fourier transform, complex variables, Numerical Linear Algebra, Stochastic calculus, Computational graph theory to solve the problem.
4. Analyze the problem by using the concept of Laplace Transform, Fourier transform, complex variables, Numerical Linear Algebra, Stochastic calculus, Computational graph theory.
5. Evaluate the problem base on the concept of Laplace Transform, Fourier transform, complex variables, Numerical Linear Algebra, Stochastic calculus, Computational graph theory.
6. Create the new concept by using the theory of Laplace Transform, Fourier transform, complex variables, Numerical Linear Algebra, Stochastic calculus, Computational graph theory.

Unit1 **[6Hrs]**

Laplace transform: Definition ;Transforms of elementary functions; Properties of Laplace transform; Inverse Laplace transform; Convolution Theorem for finding inverse Laplace transforms ; Applications of Laplace transform to find the solutions differential equations. Introduction to Latex. Calculation of Laplace transform by using software.

Unit2 **[6Hrs]**

Fourier transform: Definitions – Fourier transforms ; Properties of Fourier transforms ; Fourier sine and cosine transforms ; Properties of Fourier transforms ; Parseval's identity for Fourier Transforms; Finite Fourier transform.

Unit3

[6Hrs]

Functions of complex variables : Analytic functions; Harmonic functions in Cartesian form; fundamental theorem of algebra; Cauchy's integral theorem; Cauchy's integral formula; Residues; Cauchy's residue theorem.

Unit4

[6Hrs]

Numerical linear algebra: Introduction to linear algebra; condition number of a matrix; sensitivity analysis; Norm ; stability of numerical algorithms; stability of nonlinear system; SVD; Power method; Google page rank algorithm.

Introduction about meta-heuristic method; Nature-inspired method : ant colony optimization .

Unit5

[6Hrs]

Stochastic calculus: Stochastic Processes: Definition and classification of random processes; Discrete-time Markov chains; Poisson process; Continuous-time Markov chains; Stochastic integration, Itôintegral , Itôformula. Stochastic differential equations. Application of stochastic calculus in computer science.

Unit6

[6Hrs]

Computational graph theory : Basic terminology in graph theory; Invariant of a graph; Adjacency matrix of a graph; Laplacian matrix of a graph; Algebraic connectivity of a graph;

Properties of eigenvalues and eigenvectors of an adjacency matrix and Laplacian matrix of a graph.

Text Books:

1. Higher Engineering Mathematics by B. S. Grewal, Khanna Publishers, New Delhi.

2. Advanced Engineering Mathematics by Erwin Kreyszig, John Wiley & Sons, New York.

3. A Course in Engineering Mathematics (Vol III) by Dr. B. B. Singh, Synergy Knowledgeware, Mumbai.

4. A Text Book of Applied Mathematics (Vol I & II) by P. N. Wartikar and J. N. Wartikar, Pune Vidyarthi Griha Prakashan, Pune.

5. Higher Engineering Mathematics by H. K. Das and Er. Rajnish Verma, S. Chand & Co.Pvt. Ltd., New Delhi.

6. D. S. Watkins, Fundamentals of Matrix Computations, John Wiley, 1991.

7. G. H. Golub and C. F. Van Loan, Matrix Computations, 3rd Edition, John Hopkins University Press, 1996.

8**.** S.M. Ross, Stochastic Processes, 2nd Edition, Wiley, 1996.

9. J. Medhi, Stochastic Processes, New Age International, 1994.

10. J. A. Bondy and U. S. R. Murty. Graph Theory with Applications.North-Holland, 1976.

11. J. M. Aldous. Graphs and Applications. Springer, LPE, 2007.

12. D. M. Cvetkovic, M. Doob and H. Sachs, Spectra of Graphs: Theory and Applications, Academic Press, 1980.

13. C. Godsil and G. Royale, Algebraic Graph Theory, Graduate Texts in Mathematics 207, Springer, 2001.

14. R. B. Bapat, Graphs and Matrices, Texts and Readings in Mathematics, Hindustan Book Agency, New Delhi, 2010.

Reference Books:

1. Higher Engineering Mathematics by B. V. Ramana, Tata McGraw-Hill Publications, NewDelhi.

2. A Text Book of Engineering Mathematics by Peter O' Neil, Thomson Asia Pte Ltd.,Singapore.

3. Advanced Engineering Mathematics by C. R. Wylie & L. C. Barrett, Tata Mcgraw-Hill Publishing Company Ltd., New Delhi.

4. Integral Transforms and Their Engineering Applications by Dr. B. B. Singh, Synergy .Knowledge ware, Mumbai.

5. Integral Transforms by I. N. Sneddon, Tata McGraw-Hill, New York.

6. L. N. Trefethen and D. Bau III, Numerical Linear Algebra, SIAM, 1997.

7. J. W. Demmel, Applied Numerical Linear Algebra, SIAM, 1997.

8. S. Shreve, Stochastic Calculus for Finance, Vol. 2, Springer, 2004.

9. J. M. Steele, Stochastic Calculus and Financial Applications, Springer, 2001

10. R. M. Patne, G. R. Avachar, note on an adjacency matrix of a graph G, Advances in Mathematics: Scientific Journal, volume 9(3), 1281–1291,2020

11. D. Lamberton and B. Lapeyre, Introduction to Stochastic Calculus Applied to Finance, Chapmans & Hall/CRC, 2000.

12. M. Baxter and A. Rennie, Financial Calculus, Cambridge University Press, 1996.

13. F. Harary: graph theory, addison-wesley reading, Massachusetts, 1996.

IT3T003	Digital Electronics & Fundamentals of Microprocessor	3 Credit

Course Objectives:

1. Understanding basic knowledge of Boolean algebra and automaton theory as a core of computer science.
2. Theoretical and practical knowledge about synthesis of combinational and sequential circuits, and programmable structures.

Course Outcomes:

Students will be able to:

1. Define basic logical circuits, Boolean algebra, minimization methods, methods for writing Boolean functions, combinational and sequential circuits, flip-flops, digital automaton, and programmable structures.
2. Describe operation methods of combinational and sequential circuits, similarities and differences of writing the Boolean functions and minimizations.
3. Select appropriate methods for realization and circuit minimization.
4. Pattern recognition for specific circuit realization and error discovery during circuit design process.
5. Synthesis of appropriate combinational and sequential logic circuits.
6. Evaluation of own solutions and error discovery.

Course Contents:

Unit 1: Logic Simplification [6 Hrs]

Digital signals, digital circuits, AND, OR, NOT, NAND, NOR and Exclusive-OR operations, Boolean algebra, examples of IC gates, Number Systems: binary, signed binary, octal hexadecimal number, binary arithmetic, one's and two's complements arithmetic, codes, error detecting and correcting codes.

Unit 2: Combinational Digital Circuits [6 Hrs]

Standard representation for logic functions, K-map representation, and simplification of logic functions using K-map, minimization of logical functions. Don't care conditions, Multiplexer, De-Multiplexer/Decoders, Adders, Subtractors, BCD arithmetic, carry look ahead adder, serial adder, ALU, elementary ALU design, parity checker / generator

Unit3: **Sequential circuits and systems** **6 Hrs**

A 1-bit memory, the circuit properties of Bi-stable latch, the clocked SR flip flop, J- K - T and D-types flip flops, applications of flip flops, shift registers, applications of shift registers, serial to parallel converter, parallel to serial converter, ring counter, sequence generator, ripple(Asynchronous) counters, synchronous counters, counters design using flip flops, special counter IC's, asynchronous sequential counters, applications of counters.

Unit4: Fundamentals of Microprocessors **[6 Hrs]**

Fundamentals of Microprocessor, Comparison of 8-bit, (8085) 16-bit (8086), and 32-bitmicroprocessors (80386). The 8086 Architecture: Internal Block Diagram, CPU, ALU, address, data and control bus, Working registers, SFRs, Clock and RESET circuits, Stack and Stack Pointer, Program Counter, I/O ports, Memory Structures, Data and Program Memory, Timing diagrams and Execution Cycles.

Unit 5: Memory Interfacing **[6 Hrs]**

Memory Interfacing. I/O Interfacing. Direct Memory Access. (DMA). Interrupts in 8086.

Unit 6: 8086 Instruction Set and Programming **[6 Hrs]**

Addressing modes: Introduction, Instruction syntax, Data types, Subroutines Immediate addressing, Register addressing, Direct addressing, Indirect addressing, Relative addressing, Indexed addressing, Bit inherent addressing, bit direct addressing. Instruction timings. Data transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Subroutine instructions, Bit manipulation instruction. Assembly language programs, C language programs. Assemblers and compilers. Programming and debugging tools.

Text Books:

1.R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009.

2.M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016.

3.A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.

4.Douglas Hall, Microprocessors and Interfacing, McGraw-Hill Publications

Reference Books:

1. An approach to digital Design: Morris Mano, Pearson Publications.
2. Microprocessor Architecture, Programming and Applications with the 8085:Ramesh Gaonkar, Penram International Publications.
3. Engineering Approach to Digital Design: W. Fletcher, PHI Publications.

IT3T004	Computer Architecture & Organization	3 Credit

Course Objectives:

1. To understand the relationship between instruction set architecture, micro architecture, and system architecture and their roles in the development of the computer.

2. Be aware of the various classes of instruction: data movement, arithmetic, logical and flow control. Explain how interrupts are used to implement I/O control and data transfers.

3. Identify various types of buses in Computer systems.

4. Understand memory hierarchy.

5. Understand various peripheral devices.

Course Outcomes:

At the end of this course, the students should be able to,

1. Outcome- Interpret the functional architecture of computing systems. (Understanding) Classify and compute the performance of machines.

2. Explain addressing modes, instruction formats and program control statements.

3. Relate to arithmetic for ALU implementation. Understand the basics of hardwired and micro-programmed control of the CPU.

4. Build large memories using small memories for better performance. Write ISA level code for RISC and CISC machines.

5. Identify, compare and assess issues related to ISA, memory, control and I/O functions. (Applying, Analyzing, Evaluating)

6. Appreciate advancements to architecture like pipelining and superscalar operation

Course Contents:

Unit 1: Basic Structure of Computers **[6 Hrs]**

Basic Structure of Computers: Functional Units, Basic Operational Concepts, Bus Structures, Software, Multiprocessors and Multicomputer

Machine Instructions: Instruction Sets: Machine Instruction Characteristics, Types of Operands, Intel x86 and ARM Data Types, Types of Operations, Intel x86 and ARM Operation Type, Memory Locations and Addresses, Memory Operations, Machine program sequencing, addressing modes and encoding of information, Assembly Language, Stacks, Queues and Subroutine.

Unit 2: Instruction Sets **[6 Hrs]**

Addressing, x86 and ARM Addressing modes, Instruction Formats, x86 and ARM Instruction Formats, Assembly language.

Unit3: Micro-programmed Control **[6 Hrs]**

Control Unit Operation: Micro-operations, Control of the Processor, Hardwired Implementation, and Micro-programmed control, Basic Concepts, Microinstruction Sequencing & Execution, Microinstructions, grouping of control signals, Micro program sequencing, Micro Instructions with next Address field, Perfecting microinstruction, Emulation, Bit Slices, Introduction to Microprogramming, Macro Processor.

Unit 4: Arithmetic **[6Hrs]**

Number Representation, Addition of Positive numbers, Logic Design for fast adders, Addition and Subtraction, Arithmetic and Branching conditions, Multiplication of positive numbers, Signed Operand multiplication, fast Multiplication, Booth's Algorithm, Integer Division, Floating point numbers and operations. Reduced Instruction Set Computers (RISCs): Instruction Execution Characteristics, the Use of Large Register File, Compiler-Based Register Optimization, RISC Architecture, RISC Pipelining, RISC versus CISC

Unit 5: The Memory System **[6 Hrs]**

Some Basic Concepts, Semiconductor RAM Memories, Memory system considerations, Semiconductor ROM Memories, Memory interleaving, Cache Memory, Mapping techniques, Virtual memory, Memory Management requirements.

Unit 6: Computer Peripherals **[6 Hrs]**

I/O Devices, DMA, Interrupt handling, online storage, File services, Processors: Families of microprocessors Chips, Introduction to RISC & CISC Processors, Introduction to Pipelining. Parallel Processing: The Use of Multiple Processors, Symmetric Multiprocessors, Multithreading and Chip Multiprocessors, Clusters, Multicore Organization, Intel x 86 Multi-Core Organization

Text Books:

1. Computer Organization 4 th Edition, 2001 V. Carl Hamacher, McGraw Hill

2. William Stallings: "Computer Organization and Architecture", (8/e) Pearson Education.

Reference Books:

1. Behrooz Parhami: “Computer Architecture”, Oxford University Press

2. J. P. Hayes: “Computer Architecture and Organization” , McGraw Hill

3. D. A. Patterson, J. L. Hennessy: “Computer Architecture” Morgan Kauffmann, 2002

4. Hwang and Briggs: “Computer Architecture and Parallel Processing” McGraw-Hill

IT3T005	Data structure & OOP’s	4 Credit

Prerequisites: Basic knowledge of ‘C’ Language.

Course Objectives:

1. To understand the concepts of ADTs.

2. To learn linear data structures – lists, stacks, and queues

3. To understand sorting, searching and hashing algorithms.
4. To apply Tree and Graph structures.

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Understand the concept of ADT.
2. Identify data structures suitable to solve problems.
3. Develop and analyze algorithms for stacks, queues.
4. Develop algorithms for binary trees and graphs.
5. Implement sorting and searching algorithms.
6. Implement symbol table using hashing techniques

Course Contents:

Unit 1 **[6 Hrs]**

Complexity Analysis: Time and Space complexity of algorithms, asymptotic analysis, big O and other notations, importance of efficient algorithms, program performance measurement, data structures and algorithms.

Hashing: Implementation of Dictionaries, Hash Function, Collisions in Hashing, Separate Chaining, Open Addressing, Analysis of Search Operations

Unit 2 **[6 Hrs]**

ADT Array-Searching and sorting on arrays: Linear search, binary search on a sorted arrays. Bubble sort, Insertion sort, merge sort and analysis; Emphasis on the comparison based sorting model, Counting sort, Radix sort, and bucket sort

Unit 3 **[6 Hrs]**

Stacks and Queues: Abstract data types, sequential and linked implementations, exception handling in classes, representative applications such as parenthesis matching, towers of Hanoi, wire routing in a circuit, finding path in a maze, simulation of queuing systems, equivalence problem.

Unit 4 **[6 Hrs]**

Linked Lists: Abstract data type, sequential and linked representations, comparison of insertion, deletion and search operations for sequential and linked lists, list and chain classes, exception and iterator classes for lists, doubly linked lists, circular lists, linked lists through simulated pointers, lists in STL, skip lists, applications of lists in bin sort, radix sort, sparse tables.

Unit 5 **[6 Hrs]**

Trees: Binary trees and their properties, terminology, sequential and linked implementations, tree traversal methods and algorithms, heaps as priority queues, heap implementation, insertion and deletion operations, heap sort, heaps in Huffman coding, leftist trees, tournament trees, use of winner trees in merge sort as an external sorting algorithm, bin packing.

Unit 6 **[6 Hrs]**

Graphs: Graph Algorithms: Graphs and their Representations, Graph Traversal Techniques: Breadth First Search (BFS) and Depth First Search (DFS), Applications of BFS and DFS, Minimum Spanning Trees (MST), Prim's and Kruskal's algorithms for MST, Connected Components, Dijkstra's Algorithm for Single Source Shortest Paths, Warshall's Algorithm for finding Transitive Closure of a Graph, Floydd's Algorithm for All-Pairs Shortest Paths Problem.

Text Books:

1. Mark Allen Weiss, ―Data Structures and Algorithm Analysis in C, 2nd Edition, Pearson Education,1997.
2. Reema Thareja, ―Data Structures Using C, Second Edition, Oxford University Press, 2011.

Reference Books.

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest, Clifford Stein, "Introduction to Algorithms", Second Edition, Mcgraw Hill, 2002.
2. Aho, Hopcroft and Ullman, Data Structures and Algorithms‖, Pearson Education,1983.
3. Stephen G. Kochan, :Programming in C‖, 3rd edition, Pearson Education.

4. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, ―Fundamentals of Data Structures in C, Second Edition, University Press, 2008.

IT3T006	Computer Graphics	3 Credit

Course Objective:

1. To introduce the use of the components of a graphics system and become familiar with building approach of graphics system components and algorithms related with them.
2. To learn the basic principles of 3- dimensional computer graphics.

3. Provide an understanding of how to scan convert the basic geometrical primitives, how to transform the shapes to fit them as per the picture definition.
4. Provide an understanding of mapping from a world coordinates to device coordinates, clipping, and projections.

Course outcomes:

Students will be able to:

1. Understand the scope of computer graphics and also identified the field related to computer Graphics
2. Demonstrate on the concepts on transforms including translation, rotation, scaling, shearing and reflection.
3. Design algorithms for different geometric shapes, lines , circle, ellipse.

Course Contents:

Unit -1: Introduction to Computer Graphics [6 Hrs]

Overview of Computer Graphics, Computer Graphics Application and Software, Graphics Areas, Graphics Pipeline, Graphics API's, Numerical issues, Efficiency Display and Hardcopy Technologies, Display Technologies – Raster scan Display System, Video Controller – Vector scan display system, Random Scan Display Processor, Input Devices for Operator Interaction, Image Scanners.

Unit -2: Basic Raster Graphics [6 Hrs]

Algorithms for Drawing 2D primitives, aliasing and ant aliasing, Polygon filling methods: Scan Conversion Algorithms: Simple Ordered edge list, Edge Fill, Fence fill and Edge Flag Algorithm, Seed fill Algorithms: Simple and Scan Line Seed Fill Algorithm, Halftoning techniques.

Unit -3: Graphics Programming using OPENGL [6 Hrs]

Why OpenGL, Features in OpenGL, OpenGL operations, Abstractions in OpenGL – GL, GLU & GLUT, 3D viewing pipeline, viewing matrix specifications, a few examples and demos of OpenGL programs, Animations in open GL.

Unit -4:**2-D geometric transformations** **[6 Hrs]**

Basic transformations, matrix representations, composite transformations, other transformations, transformations between coordinate systems, affine transformations, transformation functions, Raster methods for transformations. Two- Dimensional viewing : viewing coordinates, Window-to viewport coordinate transformation, viewing functions, clipping : point, line, polygon, curve, text, exterior.

Unit -5: **Normalized Device Coordinates and Viewing Transformations** **[6 Hrs]**

3D System Basics and 3D Transformations, 3D graphics projections, parallel, perspective, viewing transformations.3D graphics hidden surfaces and line removal, painter's algorithm, Z -buffers, Warnock's algorithm.

Animations & Realism 10 Animation Graphics: Design of Animation sequences – animation function – raster animation – key frame systems – motion specification –morphing – tweening.

Unit -6: Light sources: **[6 Hrs]**

basic illumination models , halftone patterns and dithering techniques; Properties of light, Standard primaries and chromaticity diagram; Intuitive colour concepts, RGB colour model, YIQ colour model, CMY colour model, HSV colour model, HLS colour model; Colour selection.

Text Books:

1. Fundamentals of Computer Graphics, Peter Shirley and Steve Marschner, Third Edition. (A.K.Peters Publication house)
2. Procedural Elements of Computer Graphics III Edition, Rogers, McGraw Hill.
3. Computer Graphics - Principles and Practice, J. D. Foley, A. Van Dam, S. K. Feiner and J. F. Hughes, Second Edition in C, Pearson Education.

Reference Books:

1. Computer Graphics with OpenGL, Donald D. Hearn, M. Pauline Baker, Warren Carithers, Fourth

Edition, Pearson Education.

2.Computer Graphics, Hearn and Baker, PHI, India.

IT3L007	Data Structure using OOP's (Lab)	2 Credit

Course Objectives:

1. To impart the basic concepts of data structures and algorithms

2. To understand concepts about searching and sorting techniques

3. To Understand basic concepts about stacks, queues, lists, trees and graphs

4. To understanding about writing algorithms and step by step approach in solving problems with the help of fundamental data structures**.**

Course Objectives:

1. Ability to analyze algorithms and algorithm correctness.

2. Ability to summarize searching and sorting techniques.

3. Ability to describe stack, queue and linked list operation.

4. Ability to have knowledge of tree and graphs concepts.

List of Experiments:

1. Write a program to implement stack using arrays.
2. Write a program to evaluate a given postfix expression using stacks.
3. Write a program to convert a given infix expression to postfix form using stacks.
4. Write a program to implement circular queue using arrays.
5. Write a program to implement double ended queue (de queue) using arrays.
6. Write a program to implement a stack using two queues such that the push operation runs in constant time and the pop operation runs in linear time.
7. Write a program to implement a stack using two queues such that the push operation runs in linear time and the pop operation runs in constant time.
8. Write a program to implement a queue using two stacks such that the enqueue operation runs in constant time and the dequeue operation runs in linear time.
9. Write a program to implement a queue using two stacks such that the enqueue operation runs in linear time and the dequeue operation runs in constant time.
10. Write programs to implement the following data structures: (a) Single linked list (b) Double linked list
11. Write a program to implement a stack using a linked list such that the push and pop operations of stack still take O(1) time.
12. Write a program to implement a queue using a linked list such that the enqueue and dequeue operations of queue take O(1) time.
13. Case Study:-

Example (01): Simulation Case Study

Problem definition:

In this case study, consider the situation in which you are waiting in line for a service at a bank. In general, the more clerks there are, the faster the line moves. The bank manager wants to keep his customers happy by reducing their waiting time but at the same time he does not want to employ any more service clerks than he has to. Being able to simulate the effect of adding more clerks during peak business hours allows the manager to plan more effectively.

Example (02): Binary Tree Search ƒ

Problem definition:

a. Write a function binary Tree Search.

b. Attempt to locate a specified value in a binary search tree.
c. Input: a pointer to the root node of the binary tree and a search key to be located
d. Output: a pointer to that node (if found) or NULL (not found)

IT3L008	**Digital Electronics & Fundamentals of Microprocessor (Lab) 1 Credit**

Course Objectives:

1. Provide hands-on experience in digital circuits, which can be constructed by using standard integrated circuits (ICs). Investigate the operation of several digital circuits combinational and sequential.
2. To understand architecture and features of typical Microprocessors.
3. To learn interfacing of real world input and output devices.

Course Outcomes:

Students will be able to:

1. Describe and explain the operation of fundamental digital gates.
2. Analyze the operation of medium complexity standard combinational circuits like the encoder, decoder, multiplexer, de-multiplexer, and adder.
3. Analyze the operation of a flip-flop and examine relevant timing diagrams.
4. Learn importance of Microprocessors in designing real time applications.

5. Describe the 8085, 8086 & 80386 Microprocessors architectures and its feature.
6. Develop interfacing to real world devices.

List of Experiments:

1. .Simplification, realization of Boolean expressions using logic gates/universal gates.
2. Realization of half/full adder & half/full subtractors using logic gates.
3. Realization of parallel adder/subtractors using 7483 chip, BCD to Excess-3codeconversion & vice versa.
4. Realization of binary to gray code conversion & vice versa.
5. MUX/DEMUX – use of 74153, 74139 for arithmetic circuits & code converter.
6. Realization of one/two bit comparator and study of 7485 magnitude comparator.
7. Use of a) Decoder chip to drive LED display & b) Priority encoder.
8. Truth table verification of flip-flops: i) JK Master Slave ii) T type iii) D type.
9. Realization of 3-bit counters as a sequential circuit & MOD-N counter design(7476, 7490, 74192, 74193).
10. Writing& testing of sequence generator.
11. Design of FSM: Moore machine, Mealy machine

IT3L009	**Computer Graphics (Lab)**	**1 Credit**

Course Objective:

1. To introduce the use of the components of a graphics system and become familiar with building approach of graphics system components and algorithms related with them.
2. To learn the basic principles of 3- dimensional computer graphics.
3. Provide an understanding of how to scan convert the basic geometrical primitives, how to transform the shapes to fit them as per the picture definition.
4. Provide an understanding of mapping from a world coordinates to device coordinates, clipping, and projections.
5. To be able to discuss the application of computer graphics concepts in the development of computer games, information visualization, and business applications.

Course Outcomes:

At the end of the laboratory work, students will demonstrate the ability to:

1. To list the basic concepts used in computer graphics.
2. To implement various algorithms to scan, convert the basic geometrical primitives, transformations, Area filling, clipping.
3. To describe the importance of viewing and projections.
4. To understand a typical graphics pipeline.

List of Experiments:

1. Write a program to draw a rectangle using line function.
2. Write a program to draw a line using DDA's line drawing algorithm.
3. Write a program to draw a line using Bresenham'sline drawing algorithm.
4. Write a program to draw a circle using equation of circle.
5. Write a program to draw a circle using Bresenham's circle drawing algorithm.
6. Write a program to draw a line using Cohen Sutherland algorithm.
7. Write a program to translate triangle about origin.
8. Write a program to fill a circle using flood fill algorithm.
9. To design poster using photoshop software.
10. To create animated video using photoshop software.

IT3T010	**Universal Human Values**	**3Credit**

Course Objective:

The objective of the course is four fold:

1. Development of a holistic perspective based on self-exploration about themselves (humanbeing), family, society and nature/existence.
2. Understanding (or developing clarity) of the harmony in the human being, family, society andnature/existence
3. Strengthening of self-reflection.
4. Development of commitment and courage to act.

Course Contents:

Module 1: Course Introduction - Need, Basic Guidelines, Content and Process for ValueEducation

1. Purpose and motivation for the course, recapitulation from Universal Human Values-I
2. Self-Exploration–what is it? - Its content and process; ‘Natural Acceptance’ and ExperientialValidation- as the process for self-exploration
3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
4. Right understanding, Relationship and Physical Facility- the basic requirements for fulfillmentof aspirations of every human being with their correct priority
5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
6. Method to fulfill the above human aspirations: understanding and living in harmony at variouslevels.

Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking

Module 2: Understanding Harmony in the Human Being - Harmony in Myself!

7. Understanding human being as a co-existence of the sentient ‘I’ and the material ‘Body’
8. Understanding the needs of Self (‘I’) and ‘Body’ - happiness and physical facility
9. Understanding the Body as an instrument of ‘I’ (I being the doer, seer and enjoyer)
10. Understanding the characteristics and activities of ‘I’ and harmony in ‘I’
11. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal ofPhysical needs, meaning of Prosperity in detail
12. Programs to ensure Sanyam and Health. Include practice sessions to discuss the role othershave played in making material goods available to me.

Identifying from one’s own life. Differentiate between prosperity and accumulation. Discussprogram for ensuring health vs dealing with disease

Module 3: Understanding Harmony in the Family and Society- Harmony in Human-HumanRelationship

13. Understanding values in human-human relationship; meaning of Justice (nine universal valuesin relationships) and program for its fulfillment to ensure mutual happiness; Trust and Respect as the foundational values of relationship
14. Understanding the meaning of Trust; Difference between intention and competence

15. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship

16. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals

17. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives

Module 4: Understanding Harmony in the Nature and Existence - Whole existence as Coexistence

18. Understanding the harmony in the Nature

19. Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self regulation in nature

20. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space

21. Holistic perception of harmony at all levels of existence. Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

Module 5: Implications of the above Holistic Understanding of Harmony on Professional Ethics

22. Natural acceptance of human values

23. Definitiveness of Ethical Human Conduct

24. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order

25. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.

26. Case studies of typical holistic technologies, management models and production systems

27. Strategy for transition from the present state to Universal Human Order: a. At the level of

individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations

28. Sum up. Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. to discuss the conduct as an engineer or scientist etc.

Text Books:

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books,New Delhi, 2010

Reference Books:

1. JeevanVidya: EkParichaya, ANagaraj, JeevanVidyaPrakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj - PanditSunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

Curriculum for Semester- IV [Second Year]

Sr. No.	Category of	Course Code	Course Name	Tea chin			Evalu ation				
				L	T	P	CA	MSE	ESE	Total	Credit
1	PCC	IT4T001	Theory of Computation	3	1	0	20	20	60	100	4
2	PCC	IT4T002	Java Programming	3	0	0	20	20	60	100	3
3	PCC	IT4T003	Operating System	3	0	0	20	20	60	100	3
4	PCC	IT4T004	Computer Networks	2	1	0	20	20	60	100	3
5	PCC	IT4T005	DBMS	3	0	0	20	20	60	100	3
6	PCC	IT4T006	Discrete Mathematics & Graph Theory	3	0	0	20	20	60	100	3
7	PCC	IT4L007	DBMS(Lab)	0	0	2	60	0	40	100	1
8	PCC	IT4L008	Computer Networks(Lab)	0	0	2	60	0	40	100	1
9	PCC	IT4L009	Java Programming(Lab)	0	0	2	60	0	40	100	1
10	MC	IT4L010	Consumer Affairs	2	0	0	15	10	25	50	Audit
				19	2	6	300	120	530	950	22

IT4T001	Theory of Computation	4 Credit

Course Objective:

1. To introduce students to the mathematical foundations of computation including automata theory; the theory of formal languages and grammars; the notions of algorithm, decidability, complexity, and computability.
2. To Enhance/develop students' ability to understand and conduct mathematical proofs for computation and algorithms

Course outcomes:

Students will be able to:

1. Students shall able to define the mathematical principles behind theoretical computer science.
2. Students shall able to Differentiate and give examples for the different types of automata like finite automata, push down automata, linear bounded automata and turing machine.
3. Students shall able to correlate the different types of automata to real world applications.
4. Students shall able to Choose and design appropriate automata for the different requirements outlined by theoretical computer science.

5. Students shall able to identify the different computational problems and their associated complexity.

Unit 1

[10Hrs]

Fundamentals : Strings, Alphabet, Language, Operations, Finite state machine, definitions, finite automaton model, acceptance of strings, and languages, deterministic finite automaton and nondeterministic finite automaton, transition diagrams and Language recognizers.

Finite Automata: Introduction to Finite Automata, Structural Representations, Automata and Complexity, Central Concepts of Automata Theory, DFA, NFA, and NFA & epsilon Machine. Conversions and Equivalence: Equivalence between NFA with and without epsilon transitions, NFA to DFA conversion, minimization of FSM, equivalence between two FSM's, Finite Automata with output- Moore and Melay machines.

Unit 2 **[10Hrs]**

Regular Languages : Regular Expressions, Finite Automata and Regular Expressions, Applications of Regular Expressions, Algebraic Laws for Regular Expressions, Properties of Regular Languages, Constructing finite Automata for a given regular expressions, Conversion of Finite Automata to Regular expressions, Pumping Lemma for Regular Languages, Applications of the Pumping Lemma, Closure Properties of Regular Languages, Decision Properties of Regular Languages.

Grammar Formalism: Regular grammars-right linear and left linear grammars, equivalence between regular linear grammar and FA, inter conversion, Context free grammar, derivation trees, sentential forms, Right most and leftmost derivation of strings.

Unit 3 **[10Hrs]**

Context Free Grammars: Context-Free Grammars: Definition of Context-Free Grammars, Derivations Using a Grammar, Leftmost and Rightmost Derivations, the Language of a Grammar, Sentential Forms, Parse Tress, Applications of Context-Free Grammars, Ambiguity in Grammars and Languages.

Push-Down Automata: Push down automata, definition, model, acceptance of CFL, Acceptance by final state and acceptance by empty state and its equivalence, Equivalence of CFL and PDA, interconversion, Introduction to DCFL and DPDA.

Unit 4: Turing Machine **[9Hrs]**

Definition of Recursive and Recursively Enumerable , Church's Hypothesis , Computable Functions , Methods for Turing Machine Construction, Modifications of the Basic Turing Machine Model, Multiple Tape , Multiple Tracks, Non-determinism, etc. Equivalence of the different TM Models and the Basic TM Model.

Unit 5: Computability Theory **[9 Hrs]**

Chomsky hierarchy of languages, linear bounded automata and context sensitive language, LR(0) grammar, decidability of, problems, Universal Turing Machine, undecidability, Posts Correspondence problem, Turing reducibility, Definition of P and NP problems, NP complete and NP hard problems.

TEXT BOOKS:

1. "Introduction to Automata Theory Languages and Computation". Hopcroft H. E. and Ullman J. D. Pearson Education.
2. Introduction to Theory of Computation – Sipser 2nd edition Thomson.

REFERENCES BOOKS:

1. Introduction to Formal languages Automata Theory and Computation Kamala Krithivasan Rama R.
2. Introduction to Computer Theory, Daniel I.A. Cohen, John Wiley.
3. Theory of Computation: A Problem - Solving Approach, Kavi Mahesh, Wiley India Pvt. Ltd.
4. Elements of Theory of Computation, Lewis H.P. & Papadimition C.H. Pearson /PHI.
5. Theory of Computer Science – Automata languages and computation -Mishra and Chandrashekaran, 2nd edition, PHI.

IT4T002	**JAVA Programming**	**3 Credits**

COURSE OBJECTIVES

1 To learn the Advanced concepts in J2SE

2 To understand Web Application Development, Database Connectivity and itsImplementation using Servlets, JSP and JDBC

3 To introduce advanced Java frameworks for improving the web application design.

COURSE OUTCOMES

1 Student shall be able to Understand and implement advanced Java concepts.

2 Student shall be able to Develop Java based Web applications using Servlets and JSP

3 Student shall be able toIncorporate cutting-edge frameworks in web application development.

Syllabus

[Unit 1] **6 Hrs**

Basics of OOP: Abstraction, Inheritance, Encapsulation, Classes, subclasses and super classes, Polymorphism and Overloading, message communication Procedure-Oriented vs. Object-Oriented Programming concept

Introduction to Java Programming : Basics of Java, Background/History of Java, Java and the Internet, Advantages of Java , Java Virtual Machine & Byte Code , Java Environment Setup ,Java Program Structure

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[Unit 2] 6 Hrs

Primitive Data Types : Integers, Floating Point type, Characters, Booleans , User Defined Data Type , Identifiers & Literals , Declarations of constants & variables , Type Conversion and Casting , Scope of variables & default values of variables declared , Wrapper classes , Comment Syntax , Garbage Collection

Arrays of Primitive Data Types: Types of Arrays, Creation, concatenation and conversion of a string, Decision & Control Statements, Different Operators

[Unit 3] 6 Hrs

Class : Defining classes, fields and methods, creating objects, accessing rules, this keyword, static keyword, method overloading, final keyword

Constructor: Constructors: Default constructors, Parameterized constructors, Copy constructors, Passing object as a parameter, constructor overloading

[Unit 4] 6 Hrs

Basics of Inheritance: Inheritance, Types of inheritance: single, multiple, multilevel, hierarchical and hybrid inheritance, concepts of method overriding, extending class, super class, Abstract Class

Package : Creating package, importing package, access rules for packages, class hiding rules in a package, Defining interface, inheritance on interfaces, implementing interface, multiple inheritance using interface

[Unit 5] 6 Hrs

Exception Handling : Introduction, Built in classes for Exception Handling, Mechanism of Exception Handling in Java, Error Handling Exception Classes

Multithreading : Creating thread, extending Thread class, implementing Runnable interface, life cycle of a thread, Thread priority & thread synchronization, exception handing in threads

[Unit 6] **6 Hrs**

Java Applets Programming : local and remote applets, difference between applet and application, applet life cycle, developing executable applet code

Web Page Design : applet tag, adding applet to HTML file, running the applet, passing parameter to applet, various methods and component classes to develop basic applet

Textbook:

1) Herbert Schildt, The Complete Reference-Java, Tata Mcgraw-Hill Edition, Eighth Edition, 2014.
2) Nicholas S. Williams, Professional Java for Web Applications, Wrox Press, 2014.
3) Complete Reference J2EE by James Keogh mcgraw publication.

Reference Books:

1) Black Book " Java server programming" J2EE, 1st ed., Dream Tech Publishers, 2008. 3. Kathy walrath .
2) Core Java, Volume II: Advanced Features by Cay Horstmann and Gary Cornell Pearson Publication.
3) Spring in Action 3rd edition , Craig walls, Manning Publication.
4) Hibernate 2nd edition, Jeff Linwood and Dave Minter, Beginning Après publication

IT4T003	Operating Systems	3 Credit

Course Objectives:

1. To understand the services provided by and the design of an operating system.
2. To understand the structure and organization of the file system.
3. To understand what a process is and how processes are synchronized and scheduled.
4. To understand different approaches to memory management.
5. Students should be able to use system calls for managing processes, memory and the file system.

6. Students should understand the data structures and algorithms used to implement an OS.

Course outcomes:

Students will be able to:

1. Identify the significance of operating system in computing devices.
2. Exemplify the communication between application programs and hardware devices through system calls.
3. Compare and illustrate various process scheduling algorithms.
4. Apply appropriate memory and file management schemes.
5. Illustrate various disk scheduling algorithms.
6. Understand the need of access control and protection in an operating system.

Course Contents:

Unit 1: Evolution of operating systems **[6 Hrs]**

Evolution of operating systems, Types of operating systems. The process concept, system programmer's view of processes, operating system's views of processes, operating system services for process management.

Unit 2: Processes and Threads **[6Hrs]**

Process Concept, Process Scheduling, Operations on Processes, Cooperating Processes, Inter process Communication, Communication in Client – Server Systems, Multithreading Models, Threading Issues.

Unit -3: CPU Scheduling **[6 Hrs]**

Scheduling concepts, scheduling algorithms, algorithm evaluation, multiple processor scheduling, real time scheduling.

Unit -4: Memory Management **[6 Hrs]**

Memory Management, Contiguous allocation, static-swapping, overlays, dynamic partitioned memory allocation, demand paging, page replacement, segmentation. Non-contiguous allocation, paging, Hardware support, Virtual Memory.

Unit -5: File Systems **[6Hrs]**

A Simple file system, General model of a file system, Symbolic file system, Access control verification, Logical file system, Physical file system, Allocation strategy module, Device strategy module, I/O initiators, Device handlers, Disk scheduling

Unit -6: Networks, Security and Design Principles **[6 Hrs]**

Network operating system, distributed operating system, external security, operational security, password protection, access control, security kernels, hardware security, layered approach, design principle.

Text Books:

1. J.L. Peterson and A. Silberchatz, “Operating System Concepts”, Addison Wesley.
2. Harvey M. Dietel, “An Introduction to Operating System”, Addison Wesley.
3. C. Crowley, “Operating Systems - A Design Oriented Approach”, Irwin Publishing

Reference Books:

1. W. Stallings, “Operating systems”, Prentice Hall.
2. A.S. Tannenbaum, “Modern Operating system”, PHI

IT4T004	Computer Network	3 Credit

Prerequisites:

1. Basic Idea of Transform and its mathematical descriptions (Laplace, Fourier and ZTransform)
2. Differential equations and Integrals (advanced level)
3. Ordinary differential equations
4. Series and expansions
5. Fourier analysis and complex Fourier Series/transform
6. Applications of Fourier series, Fourier Transform to circuits.

Course Objectives:

1. Discuss the physical and logical as well as the electrical characteristics of digital signals and the basic methods of data transmission.
2. Identify the importance of the ISO 7-layer reference model.
3. Identify and requirements hosted in communication protocols and give an overview of data communication standards, how these standards were developed and under which assumptions they were adopted.
4. Establish a solid knowledge of the layered approach that makes design, implementation, and operation of extensive networks possible.
5. Acquire the knowledge of the basic protocols involved in wired/wireless communication process.

Course Outcomes:

At the end of the course the student will be able to:

1. Defining, using and implementing Computer Networks and the basic components of a Network system, explain the importance of data communications, how communication works in data networks.
2. Evaluate data communication link considering elementary concepts of data link layer protocols for error detection and correction.
3. Apply various network layer techniques for designing subnets and supernets and analyse packet flow on basis of routing protocols
4. Estimate the congestion control mechanism to improve quality of service of networking application.
5. Analyze the features and operations of various application layer protocols such as Http, DNS, Telnet, FTP and SMTP.
6. Apply the knowledge for finding security threats and solutions

Course Contents:

Unit-1: Basics of Digital Communications **[6 Hrs]**

Signals, noise, Nyquist's rate, Fourier transform of signals, harmonics. Baseband and broadband transmission: Modulation techniques fundamentals of modems local loop implementation, Introduction, history and development of computer networks, networks topologies. Layering and protocols.

Physical Layer: Different types of transmission media, errors in transmission: attenuation, noise. Repeaters. Encoding (NRZ, NRZI, Manchester, 4B/5B, etc.).

Unit -2: Data Link Layer and Logical Link Control (LLC) sub-layer [6 Hrs]

Framing; Error control including Bit-parity , CRC and Hamming Codes; Reliable transmission and Automatic Repeat Request (ARQ) protocols including Stop-and-Wait, Go-back-N, and Selective Repeat. Performance analysis of ARQ protocols. Example protocols such as HDLC and PPP.

Medium Access Control (MAC) sub-layer: Shared media systems; Bus, Star and Ring topologies; TDMA, FDMA, CSMA, CSMA/CD, Ethernet and IEEE 802.3; IEEE 802.11 including CSMA/CA protocols; Performance analysis; Shared and Switched Ethernet; Related protocols such as ICMP, NAT, ARP and RARP.

Unit -3: Network Layer [6 Hrs]

Design issues, store and forward packet switching connection less and connection oriented networks-routing algorithms-optimality principle, shortest path, flooding, Distance Vector Routing, Control to Infinity Problem, Hierarchical Routing, Congestion control algorithms.

Unit -4: Transport Layer [6 Hrs]

Reliable end-to-end transmission protocols; UDP header; Details of TCP header and operation including options headers, Connection establishment and termination, sliding window revisited, flow and congestion control, timers, retransmission, TCP extensions, etc.

Unit -5: Application Layer [6 Hrs]

Application protocols for email, ftp, web, DNS

Unit -6: Advanced Networking [6 Hrs]

overview to network management systems; security threats and solutions – Firewalls, Access Control Lists, IPSec, IDS

Text Books:

1. Data Communications and Networking - Behrouz A. Forouzan, Fifth Edition TMH, 2013.
2. Computer Networks - Andrew S Tanenbaum, 4th Edition, Pearson Education.
3. Kurose and Ross, "Computer Networking - A top-down approach", Seventh Edition, Pearson, 2017.
4. Peterson and Davie, "Computer Networks, A Systems Approach", 5th ed., Elsevier, 2011

Reference Books:

1. An Engineering Approach to Computer Networks - S. Keshav, 2nd Edition, Pearson Education.
2. Understanding communications and Networks, 3rd Edition, W. A. Shay, Cengage Learning

IT4T005	**Database Management Systems**	**3 Credit**

Course Objectives:

1. To learn and understand fundamentals of database management system 2. To analyze and interpret MOSFET circuits for small signal.
2. To exhibit the query development knowledge.
3. To learn modeling and normalization of databases.
4. To learn query processing and exhibit file organization.
5. To exhibit the knowledge of transaction and concurrency control.
6. To learn and understand Big Data and Hadoop.

Course Outcomes:

At the end of this course students will demonstrate the ability to:

1. Learn and understand fundamentals of database management system.
2. Exhibit the query development knowledge.
3. Learn modeling and normalization of databases.
4. Learn query processing and file organization.
5. Exhibit the knowledge of transaction and concurrency control.

6. Learn Big Data and Hadoop.

Course Contents:

Unit-1: Introduction to Database Systems **[6Hrs]**

Significance and advantages, Types of Databases, Limitations of File processing system, the DBMS Environment, Data Abstraction, Data Independence, Data Definition Language (DDL), Data Manipulation Language (DML).

Data models: Evolution of Data Models, Entity-relationship model, Relational integrity constraints, data manipulation operations.

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Unit-2: Relational query languages **[6 Hrs]**

Relational algebra, Tuple and domain relational calculus, SQL3, DDL and DML constructs, Open source and Commercial DBMS – MYSQL, ORACLE, DB2, SQL server.

Unit -3 Relational database design **[6 Hrs]**

Normalization of Database Tables: Need and Significance, Domain and data dependency, Armstrong's axioms, Normal forms, Dependency preservation, Lossless design.

Unit -4: Query processing **[6 Hrs]**

Evaluation of relational algebra expressions, Query equivalence, Join strategies.

File Organization and Indexing: Indices, B-trees, hashing

Unit -5: Transaction processing **[6Hrs]**

Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp based schedulers, Multi-version and optimistic Concurrency Control schemes, Database recovery.

Unit -6: Big Data and Hadoop **[6 Hrs]**

The rise of Big Data, What is Big Data, Big Data and it’s Challenges, Hadoop as a solution, What is Hadoop, Components of Hadoop, Use case of Hadoop

Text Books:

1. Henry Korth, Abraham Silberschatz & S. Sudarshan, *Database System Concepts*, McGraw-Hill Publication, 6th Edition, 2011.
2. Bipin Desai, An Introduction to Database System, West Publishing Company, College & School Division, 1990.
3. Raghu Ramakrishnan, Johannes Gehrke, *Database Management Systems*, McGraw-Hill Publication, 3rd Edition, 2003.
4. Big Data Simplified, Sourabh Mukherjee, Pearson India

Reference Books:

1. Joel Murach, *Murach's Oracle SQL and PL/SQL for Developers*, Mike Murach & Associates, 2nd Edition, 2014.
2. Wiederhold, *Database Design*, McGraw-Hill Publication, 2nd Edition, 1983.
3. Navathe, *Fundamentals of Database System*, Addison-Wesley Publication, 6th Edition, 2012.
4. J. D. Ullman, "Principles of Database and Knowledge – Base Systems", Vol 1, Computer Science Press.

IT4T006	Discrete Mathematics & Graph Structures	Credit-3

Course Objective:

1.To develop logical thinking and its application to computer science

2. The subject enhances one's ability to reason and ability to present a coherent and mathematically accurate argument

Course Outcomes:

1.Be able to construct simple mathematical proofs and possess the ability to verify them ABET

2. Acquire ability to describe computer programs (e.g. recursive functions) in a formal mathematical manner

3. Be able to apply basic counting techniques to solve combinatorial problems

Course Contents:

Unit 1 **[6 hrs]**

Fundamental Structures and Basic Logic: Sets, Venn diagram, Cartesian product, Power sets, Cardinality and countability, Propositional logic, Logical connectives, Truth tables, Normal forms, Validity, Predicate logic, Limitations of predicate logic, Universal and existential quantification, First order logic.

Principles of Mathematical Induction: The Well-Ordering Principle, Recursive definition, The Division algorithm: Prime Numbers, The Greatest Common Divisor: Euclidean Algorithm, The Fundamental Theorem of Arithmetic.

Unit 2 **[6 hrs]**

Functions and Relations: Subjective, Injective, Bijective and inverse functions, Composition of function, Reflexivity, Symmetry, Transitivity and equivalence relations.

Unit 3 **[6 hrs]**

Combinatorics: Counting, Recurrence relations, generating functions.

Unit 4 **[6 hrs]**

Graph Theory: Basic terminology, Multi graphs and weighted graphs, Paths and circuits, Shortest

path problems, Euler and Hamiltonian paths, Representation of graph, Isomorphic graphs, Planar graphs, Connectivity, Matching Coloring.

Unit 5 **[6 hrs]**

Trees: Rooted trees, Path length in rooted tree, Binary search trees, Spanning trees and cut set, Minimal spanning trees, Kruskal′s and Prim′s algorithms for minimal spanning tree.

Unit 6 **[6 hrs]**

Algebraic Structures and Morphism: Algebraic Structures with one Binary Operation, Semi Groups, Monoids, Groups, Congruence Relation and Quotient79 Structures, Free and Cyclic Monoids and Groups, Permutation Groups, Substructures, Normal Subgroups, Algebraic Structures with two Binary Operation, Rings, Integral Domain and Fields. Boolean Algebra and Boolean Ring, Identities of Boolean Algebra, Duality, Representation of Boolean Function, Disjunctive and Conjunctive Normal Form

Reference Books:

1. Lipschutz, Discrete Mathematics, McGraw-Hill Publication, 3rd Edition, 2009.

2. V. K. Balakrishnan, Schaum's Outline of Graph Theory, McGraw-Hill Publication, 1st Edition, 1997.

3. Eric Gossett, Discrete Mathematics with Proof, Wiley Publication, 2nd Edition, 2009.

Text Books:

1. C. L. Liu, Elements of Discrete Mathematics, McGraw-Hill Publication, 3rd Edition, 2008.

2. Kenneth H. Rosen, Discrete Mathematics and its Applications, McGraw-Hill Publication, 6th Edition, 2010.

3. Y. N. Singh, Discrete Mathematical Structures, Wiley Publication, 1st Edition, 2010.

4. Dr. Sukhendu Dey, Graph Theory with Applications, SPD Publication, 1st Edition, 2012.

IT4L007	Database Management Systems (Lab)	1 Credit

Course Objectives:

1. To explain basic database concepts, applications, data models, schemas and instances.
2. To demonstrate the use of constraints and relational algebra operations. I
3. Describe the basics of SQL and construct queries using SQL.
4. To emphasize the importance of normalization in databases.
5. To facilitate students in Database design.
6. To familiarize issues of concurrency control and transaction management.

Course Outcomes:

The students will be able to

1. Apply the basic concepts of Database Systems and Applications.
2. Use the basics of SQL and construct queries using SQL in database creation and interaction.
3. Design a commercial relational database system (Oracle, MySQL) by writing SQL using the system.
4. Analyze and Select storage and recovery techniques of database system.

List of Experiments:

1. Defining schema for applications.

2. Creating tables, Renaming tables, Data constraints (Primary key, Foreign key, Not Null), Data insertion into a table.
3. Grouping data, aggregate functions, Oracle functions (mathematical, character functions).
4. Sub-queries, Set operations, Joins.
5. Creation of databases, writing SQL and PL/SQL queries to retrieve information from the databases.
6. Assignment on Triggers & Cursors.
7. Normal Forms: First, Second, Third and Boyce Codd Normal Forms.
8. Assignment in Design and Implementation of Database systems or packages for applications such as office automation, hotel management, hospital management.
9. Deployment of Forms, Reports Normalization, Query Processing Algorithms in the above application project.
10. Large objects – CLOB, NCLOB, BLOB and BFILE.
    Distributed data base Management, creating web-page interfaces for database applications using servlet.

IT4L008	**Computer Networks (Lab)**	**1 Credit**

Course Objectives:

1. To understand the working principle of various communication protocols.
2. To analyze the various routing algorithms.
3. To know the concept of data transfer between nodes.

Course Outcomes:

Students will be able to:

1. Understand fundamental underlying principles of computer networking.
2. Understand details and functionality of layered network architecture.
3. Apply mathematical foundations to solve computational problems in computer networking.
4. Analyze performance of various communication protocols.
5. Compare routing algorithms.
6. Practice packet /file transmission between nodes.

List of Experiments:

1. Implement three nodes point – to – point network with duplex links between them. Set the queue size, vary the bandwidth and find the number of packets dropped using NS.
2. Implement transmission of ping messages/trace route over a network topology consisting of 6 nodes and find the number of packets dropped due to congestion using NS.

3. Implement an Ethernet LAN using n nodes and set multiple traffic nodes and plot congestion window for different source / destination using NS.
4. Implement and study the performance of CDMA on NS2/NS3 (Using stack called Call net) or equivalent environment using NS.
5. Write a Program for ERROR detecting code using CRC-CCITT (16bit).
6. Write a program to find the shortest path between vertices using bellman-ford algorithm.
7. Study of Network simulator (NS) and simulation of Congestion Control Algorithms using NS.
8. Configure Host IP, Subnet Mask and Default Gateway in a System in LAN (TCP/IP Configuration).

IT4L009	JAVA Programming (Lab)	1 Credit

Course Objective:

1. Gain knowledge about basic Java language syntax and semantics to write Java programs and use concepts such as variables, conditional and iterative execution methods etc.
2. Understand the fundamentals of object-oriented programming in Java, including defining classes, objects, invoking methods etc and exception handling mechanisms.
3. Understand the principles of inheritance, packages and interfaces.

Course Outcome:

1. Identify classes, objects, members of a class and relationships among them needed for a specific problem
2. Write Java application programs using OOP principles and proper program structuring
3. Demonstrate the concepts of polymorphism and inheritance.
4. Write Java programs to implement error handling techniques using exception handling

List of Experiments

1. Install JDK, write a simple "Hello World" or similar java program, compilation, debugging, executing using java compiler and interpreter
2. Write a Java program that takes a number as input and prints its multiplication table upto 10.

3. Write a program in Java to find second maximum of n numbers without using arrays.
4. Designed a class that demonstrates the use of constructor and destructor.
5. Write a java program to demonstrate the implementation of abstract class.
6. Write a java program to implement single level inheritance.
7. Write a java program to implement method overriding
8. Create a package, Add the necessary classes and import the package in java class.
9. Write a java program to implement thread life cycle.
10. Develop minimum two basic Applets. Display Output with Applet Viewer and Browser

Course Structure and Syllabus

For

B. Tech. Information Technology Programme

Curriculum for Semester- V [Third Year]

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				
				L	T	P	CA	MSE	ESE	Total	Credit
1	ESC	IT5T001	Embedded System & IoT	3	0	0	20	20	60	100	3
2	PCC	IT5T002	Cyber Security & Cryptography	2	1	0	20	20	60	100	3
3	PCC	IT5T003	Design and Analysis of Algorithm	3	1	0	20	20	60	100	4
4	PCC	IT5O001	Open Elective-1	3	1	0	20	20	60	100	4
5	PEC	IT5TE01	Elective -I	3	0	0	20	20	60	100	3
8	ESC	IT5L004	Embedded System & IoT (Lab)	0	0	2	60	20	40	100	1
9	PCC	IT5L005	Cyber Security & Cryptography (Lab)	0	0	2	60	0	40	100	1
10	PCC	IT5L006	Design and Analysis of Algorithm (Lab)	0	0	2	60	0	40	100	1
6	PROJECT	IT5P007	Internship	0	0	0	0	0	0	0	1
7	MC	IT5T008	Innovation and Enterpreneurship Development	2	0	0	15	10	25	50	Audit
				16	3	6	300	120	450	850	21

COURSE OBJECTIVES:

1. To understand fundamentals of IoT and embedded system including essence, basic design strategy and process modelling.

2. To introduce students a set of advanced topics in embedded IoT and lead them to understand research in network
3. To develop comprehensive approach towards building small low cost embeddedIoT system
4. To understand fundamentals of security in IoT
5. To learn to implement secure infrastructure for IoT
6. To learn real world application scenarios of IoT along with its societal and economic impact using case studies

COURSE OUTCOMES:

CO1 : On completion of the course, student will be able to

CO2: Implement an architectural design for IoT for specified requirement

CO3: Solve the given societal challenge using IoT

CO4: Choose between available technologies and devices for stated IoT challenge

Unit 1 : Introduction to Embedded System and Internet of Things: [6Hrs]

Embedded Systems: Application Domain and Characteristic of Embedded System, Real time systems and Real-time scheduling, Processor basics and System-On-Chip, Introduction to ARM processor and its architecture. **IoT:** Definition and characteristics of IoT, Internet of Things: Vision, Emerging Trends, Economic Significance, Technical Building Blocks, Physical design of IoT, Things of IoT, IoTProtocols,Logical design of IoT, IoT functional blocks, IoT communication models, IoT Communication APIs, IoT enabling technologies, IoT levels and deployment templates, IoT Issues and Challenges, Applications

Unit 2 :EmbeddedIoT Platform Design Methodology [6 Hrs]

Purpose and requirement specification, Process specification, Domain model specification, information model specification, Service specifications, IoT level specification, Functional view specification, Operational view specification,Device and component integration, o Application development

Unit 3 :Pillars of Embedded IoT and Physical Devices [6 Hrs]

Horizontal, verticals and four pillars of IoT, M2M: The internet of devices, RFID: The internet of objects, WSN: The internet of transducer, SCADA: The internet of controllers, DCM: Device, Connect and Manage, Device: Things that talk, Connect: Pervasive Network, IoT Physical Devices and Endpoints: Basic building blocks of and IoT device, Exemplary device: Raspberry

Pi, Raspberry Pi interfaces, Programming Raspberry Pi with Python, Beagle board and Other IoT Devices.

Unit 4 :IoT Protocols and Security **[6Hrs]**

Protocol Standardization for IoT, M2M and WSN Protocols, SCADA and RFID Protocols, Issues with IoT Standardization, Unified Data Standards, Protocols – IEEE 802.15.4, BACNet Protocol, Modbus, KNX, Zigbee Architecture, Network layer, APS layer. IoT Security: Vulnerabilities of IoT, Security Requirements, Challenges for Secure IoT, Threat Modeling, Key elements of IoT Security: Identity establishment, Access control, Data and message security, Non-repudiation and availability, Security model for Io

Unit 5 :Web of Things and Cloud of Things **[6Hrs]**

Web of Things and Cloud of Things ▪ Web of Things versus Internet of Things, Two Pillars of the Web, ▪ Architecture Standardization for WoT, Platform Middleware for WoT, Unified Multitier WoT Architecture, WoT Portals and Business Intelligence. Cloud of Things: Grid/SOA and Cloud Computing, Cloud Middleware, Cloud Standards – Cloud Providers and Systems, Mobile Cloud Computing, ▪ The Cloud of Things Architecture.

Unit 6 :Cloud Offerings and IoT Case Studies **[6Hrs]**

IoT Physical Servers, Introduction to Cloud Storage Models, Communication API, WAMP: Autobahn for IoT, Xively Cloud for IoT, Python Web Application Framework: Django, Amazon Web Services for IoT, SkynetIoT Messaging Platform. Case Studies: Home Intrusion Detection, WeatherMonitoring System, Air Pollution Monitoring, Smart Irrigation.

Text Books:

1. Embedded System: Architecture, Programming and Design by Rajkamal,2nd edition,2010,Tata McGraw Hill

2. MSP430 Microcontroller Basics by John H. Davies Elsevier; First edition (2010)

3. Computer as Components: Principles of Embedded Computing System Design, Wayne Wolf,2nd edition,2008, Morgan Kaufmann Publication

Reference Books:

1. Wayne Wolf, “Computer as Components – Principles of Embedded Computing System Design”, Gulf Professional Publishing, 2nd Edition, 2008.
2. David E Simon, “An Embedded Software Primer”, Addison Wesley Publication, 2004.

IT5T002	Cyber Security & Cryptography	4 Credit

COURSE OBJECTIVES:

1. To understand basics of Cryptography and Network Security.

2. To be able to secure a message over insecure channel by various means.

3. To learn about how to maintain the Confidentiality, Integrity and Availability of a data.

4. To understand various protocols for network security to protect against the threats in the networks..

COURSE OUTCOMES:

CO1. Analyze and resolve security issues in networks and computer systems to secure an IT infrastructure.

CO2. Develop policies and procedures to manage enterprise security risks.

CO3. Evaluate and communicate the human role in security systems with an emphasis on ethics, social engineering vulnerabilities and training.

CO4. Interpret and forensically investigate security incidents.

Unit 1: Introduction to Cyber Security& Cryptography [6Hrs]

Overview of Cyber Security, Internet Governance – Challenges and Constraints, Cyber Threats:- Cyber Warfare-Cyber Crime-Cyber terrorism-Cyber Espionage, Need for a Comprehensive Cyber Security Policy, Need for a Nodal Authority,International convention on Cyberspace, Cyber Security Regulations, Roles of International Law.

Overview of Cryptography:Public versus private key cryptography, Stream Ciphers, Digital Signatures, Applications of Cryptography.

Unit 2:Cryptography and Network Security [6Hrs]

Cryptography, Stream Ciphers–One-time Pad(OTP),Perfect secrecy,Pesudo-Random Generators,Attacks on stream ciphers and OTP,Public key cryptosystems: RSA, ElGamal, Rabin,Ellipticcurve cryptosystemsPKC, key exchange, IBE, Lattice based cryptosystem.Authentication and signature protocols,Kerberos.Overview of Firewalls-Types of

Firewalls, Security Protocols: Security at the Application Layer- PGP and S/MIME, Security at Transport Layer- SSL and TLS,PEM and S/MIME, PGP, Security at Network Layer-IPSec,

Unit 3: Cyber Security Vulnerabilities and Cyber Security Safeguards [6Hrs]

Cyber Security Vulnerabilities-Overview, vulnerabilities in software, System administration, Complex Network Architectures, Open Access to Organizational Data, Weak Authentication, Unprotected Broadband communications, Poor Cyber Security Awareness. Cyber Security Safeguards- Overview, Access control, Audit, Authentication, Biometrics, Cryptography, Deception, Ethical Hacking, Threats in network, Security policy, Threat Management

Unit 4: Securing Web Application, Services and Servers [6Hrs]

Introduction, Basic security for HTTP Applications and Services, Basic Security for SOAP Services, Identity Management and Web Services, Authorization Patterns, Security Considerations, Challenges.

Unit 5: Intrusion Detection and Prevention [6Hrs]

Intrusion, Physical Theft, Abuse of Privileges, Unauthorized Access by Outsider, Malware infection, Intrusion detection and Prevention Techniques, Anti-Malware software, Network based Intrusion detection Systems, Network based Intrusion Prevention Systems, Host based Intrusion prevention Systems, Security Information Management, Network Session Analysis, System Integrity Validation.Honeypots, password management.

Unit 6: Cyber Forensics [6Hrs]

Introduction to Cyber Forensics, Handling Preliminary Investigations, Controlling an Investigation, Conducting disk-based analysis, Investigating Information-hiding, Scrutinizing E-mail, Validating E-mail header information, Tracing Internet access, Tracing memory in real-time.

RESOURCES:

Video Lectures

1. http://nptel.ac.in/courses/106105031/lecture by Dr.DebdeepMukhopadhyayIITKharagpur
2.https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-033-computer-system engineering-spring-2009/video-lectures/ lecture by Prof. Robert Morris and Prof. Samuel Madden MIT.

Text Books

1. William Stallings, “Crpyptography and Network security Principles and Practices”, Pearson/PHI.
2. Wade Trappe, Lawrence C Washington, “ Introduction to Cryptography with coding theory”, Pearson.

3.J. Katz and Y. Lindell, Introduction to Modern Cryptography, CRC press, 2008.

Reference Books

1. Charles P. Pfleeger, Shari Lawrence Pfleeger – Security in computing – Prentice Hall of India.
2.Golreich O, Foundations of Cryptography, Vol.1.2, Cambridge University Press, 2004
3.Menezes, et.al, Handbook of Applied Cryptography, CRC Press, 2004.

IT5T003	Design and Analysis of Algorithm	4 Credit

COURSE OBJECTIVES:

1. To learn fundamentals of algorithms design techniques.
2. To understand basic knowledge of computational complexity, approximation and randomized algorithms, selection of the best algorithm to solve a problem.
3. To analyze the performance of algorithms, to compare algorithms with respect to time and space complexity.
4. To develop proficiency in problem solving and programming.

COURSE OUTCOMES:

After learning the course the students should be able:

CO1. Develop efficient algorithms for simple computational tasks.

CO2 Gain understanding of concepts of time and space complexity, worst case, average case and best case complexities and the big-O notation.

CO3.Design standard algorithms such as sorting, searching, and problems involving graphs

CO4.Compute complexity measures of algorithms, including recursive algorithms using recurrence relations

Course Contents:

Unit 1 : [6 Hrs]

Introduction to Algorithm, Iterative Algorithm Design and Issue, Use of Loops, Efficiency of Algorithm, Estimating & Specifying Execution Time and Space, Order Notation (O, Θ, Ω Notations), Algorithm Strategies, Mathematical Analysis for Recursive and Non-Recursive algorithm.

Unit 2]6 Hrs]

Introduction to Divide and Conquer, Binary Search, Merge Sort, Quick Sort, Strassen's Matrix Multiplication, Finding median, Closest Pair, Convex Hulls Problem.

Unit 3 [6 Hrs]

Greedy Methods, Fractional Knapsack Problem, Job Sequencing with Deadlines, Optimal Merge Pattern, Huffman Coding, Minimum Spanning Tree – Kruskal's and Prim's Algorithm, Dijkstra's Shortest Path Algorithm.

Unit 4 [6 Hrs]

Introduction to Dynamic Programming, Elements of Dynamic Programming, Multistage Graphs, Traveling Salesman Problem, Matrix-chain multiplication, Optimal Polygon Triangulation, Longest common subsequence, Floyd-Warshall algorithm

Unit 5 [6 Hrs]

Introduction to Backtracking, N-Queen Problem, Combinational Search, Backtracking Strategies, Search & Traversal Techniques – BFS, DFS, Sum of Subsets, Graph coloring, Hamiltonian Circuit Problem, Tower of Hanoi Problem, State Space Tree, Branch & Bound, Least cost (LC) Search, Control Abstractions for LC search, FIFO Branch & Bound..

Unit 6 [6 Hrs]

Efficiency of Algorithms: Polynomial Time & Non-Polynomial Time Algorithms, NP-Complete, NP-Hard, Limitation of Algorithm, Worst and Average Case Behavior, Efficiency of Recursion, Complexity Calculation for Various Sorting Algorithms, Approximation of Algorithms, Time-Space Trade off in algorithms research.

Text Books:

1. Thomas H. Cormen, Charles E Leiserson, Introduction to Algorithms, PHI Publication, 3rd Edition.
2. Parag Dave, Himanshu Dave, Design and Analysis of Algorithm, Pearson Education India, 2nd Edition.
3. S. Sridhar, Design and Analysis of Algorithms, Oxford University Press, India.

Reference Books:

1. Aho, Ullman, Data Structure and Algorithms, Addison-Wesley Publication, 1st Edition, 1983.
2. Michel Goodrich, Roberto Tamassia, Algorithm Design - Foundation, Analysis & Internet Examples, Wiley Publication, 2nd Edition, 2006.
3. George T. Heineman, Gary Pollice, Stanley Selkow, Algorithms in a Nutshell, A Practical Guide, O'Reilly Media, 2nd Edition, 2016.

IT5O001	Open Elective-1 Web Development & Design	4 Credit

COURSE OBJECTIVES:

1. Students will able to understand and illustrate HTML.
2. Students will be able to understand about CSS Properties.
3. Student will able to understand basic of Java Script
4. Student will able to design website

COURSE OUTCOMES: Student will able to

CO1. Remember the basic tags of HTML, CSS, and JavaScript

CO2. Understand thebasic tags of HTML, CSS, and JavaScript

CO3: Execute the different Syntax and Tags present in HTML, CSS, and JavaScript

CO4. Analyze difference between various web design Languages

CO5. Evaluate the design of Different Forms

CO6. Design the web site form

Course Contents:

Unit 1 - Introduction [8Hrs]

Introduction to Internet, World Wide Web Communication& Markup Language, HTTP Request / Response, The HTTP Request Circle.

Unit 2 -HTML Basic Tags [8Hrs]

HTML Basic Examples, HTML Editors, HTML Elements, HTML Attributes, HTML Documents, HTML Document Structure, HTML Headings, HTML Paragraphs, HTML Styles, HTML Text Formatting, HTML Quotation and Citation Elements, HTML Comments

Unit 3 -HTML Table [8 hrs]

HTML Colors, HTML Links, HTML Images, HTML Tables, HTML List, HTML frames, HTML Layout Elements and Techniques

Unit 4 - HTML form & Media [8Hrs]

HTML Form, Attribute, Element, Input Type, Input Attribute, Input Form Attribute

Unit 5 - CSS Introduction [8Hrs]

Concept of CSS: Introduction, Syntax, CSS Border, Background, CSS Text, Font, Link, Table, list ,Align, Creating Style Sheet, CSS Properties, CSS Styling(Background, Text Format, Controlling Fonts)

Unit 6 -Java Script Introduction **[8Hrs]**

JAVAScript Implementation, SyntaxBasics and Variable Types: History of a java script, java script Implementation, The language syntax, The character set, Data Types,

Reference Books:

1. Reference Book: Web Developer's Reference Guide. By: Joshua Johanan, Talha Khan, RicardoZea.

Reference Website:

2. Reference Website: W3 School web Developemt: https://www.w3schools.com/whatis/whatis_icons.asp

IT5TE01A	Semantic Web	3 Credit

COURSE OBJECTIVES :

1. To Understand the concepts of Web Science, semantics of knowledge and resource, ontology.
2. To Describe logic semantics and inference with OWL.
3. To Use ontology engineering approaches in semantic applications
4. To enable students build a applications based on semantic web

COURSE OUTCOMES:

CO1: Understand the fundamentals of Semantic web

CO2: Creating structured web documents in XML

CO3:Apply ontology engineering to various problems.

CO4:Understand Semantic Web query languages (SPARQL)

CO5:Program semantic applications with Java and Jena API.

Unit I: Semantic Web Vision: [6 Hrs]

Todays' web, Examples of semantic web from today's web, Semantic web technologies, layered approach

Structured web documents in XML: The XML language, Structuring, Namespaces, Querying and Addressing XML documents, Processing

Unit II: Describing Web Resources: [6Hrs]

Introduction, RDF: Basic Ideas,RDF: XML-Based Syntax,RDF serialization, RDF Schema: Basic Ideas,RDF Schema: The Language ,RDF and RDF Schema,Querying RQL.Logic and Inference Rules:

Introduction, Monotonic Rules syntax, semantics & examples, Nonmonotonic rules – syntax & examples, Encoding in XML

Unit III: Ontology Engineering: [6 Hrs]

Introduction, Manual construction of Ontology, Reusing existing ontology, using Semi-automatic methods, Knowledge semantic web architecture

Unit IV: SPARQL: [6 Hrs]

SPARQL simple Graph Patterns, Complex Graph Patterns, Group Patterns, Queries with Data Values, Filters OWL Formal Semantics,Emerging Semantic Web Ontology Languages using Protege tool.

Unit V: SchemaWeb Ontology Language: **[6 Hrs]**

SchemaWeb Ontology Language: Introduction, OWL language, Examples, OWL in OWL, Future extensions.

Unit VI: Trust and Applications: **[6 Hrs]**

Digital Signatures and Web of Trust, Applications in E-Commerce and Bio-Informatics, e-Learning, Web Services, Other Scenarios,Linked Open Data Cloud,Research in Semantic Web Mining.

Text Books

1. A Semantic Web Primer: Grigoris Antoniou and Frank Van Hermelen , MIT Press
2. Foundations of Semantic Web Technologies, Pascal Hitzler, Markus Krötzsch, Sebastian Rudolph, CRC Press
3. John Davies, Dieter Fensel and Frank Van Harmelen, "Towards the Semantic Web: Ontology-Driven Knowledge Management", John Wiley and Sons, 2003.
4. Linked Data:Evolving the Web into a Global Data space by Tom Heath, Christian Bizer , Morgan & Claypool publication

Reference Books

1. Michael C. Daconta, Leo J. Obrst, and Kevin T. Smith, "The Semantic Web: A Guide to the Futureof XML, Web Services, and Knowledge Management", Fourth Edition, Wiley Publishing, 2003.
2. John Davies, Rudi Studer, and Paul Warren John, "Semantic Web Technologies: Trends and Research in Ontology-based Systems", Wiley and Son's, 2006.

IT5TE02B	Quantum Computing	3 Credits

COURSE OBJECTIVES:

1. The objective of this course is to provide the students an introduction to quantum computation.
2. Much of the background material related to the algebra of complex vector spaces and quantum mechanics is covered within the course.
3. Analyze the behaviour of basic quantum algorithms.
4. Implement simple quantum algorithms and information channels in the quantum circuit model.
5. Simulate a simple quantum error-correcting code.
6. Prove basic facts about quantum information channels.

COURSE OUTCOMES:

CO1. The basic principles of quantum computing.

CO2. The fundamental differences between conventional computing and quantum computing.

CO3. Several basic quantum computing algorithms.

Co4. The classes of problems that can be expected to be solved well by quantum computers.

CO5.Quantum mechanics as applied in Quantum computing.

CO6. Understand how quantum parallelism is used in the simplest quantum algorithms such as Deutsch, period finding and quantum Fourier transform

Course Contents:

Unit 1 **[6Hrs]**

Introduction to Quantum Computation: Quantum bits, B loch sphere representation of a qubit, multiple qubits.

Unit 2 **[6Hrs]**

Background Mathematics and Physics: Hilber space, Probabilities and measurements, entanglement, density operators and correlation, basics of quantum mechanics, Measurements in bases other than computational basis.

Unit 3 **[6 Hrs]**

Quantum mechanics, Measurements in bases other than computational basis. 083 Quantum Circuits: single qubit gates, multiple qubit gates, design of quantum circuits.

Unit 4 **[6 Hrs]**

Quantum Information and Cryptography: Comparison between classical and quantum information theory. Bell states, Quantum teleportation. Quantum Cryptography, no cloning theorem.

Unit 5 **[6Hrs]**

Quantum Algorithms: Classical computation on quantum computers. Relationship between quantum and classical complexity classes. Deutsch's algorithm, Deutsch's-Jozsa algorithm, Shor factorization, Grover search.

Unit 6 **[6Hrs]**

Noise and error correction: Graph states and codes, Quantum error correction, fault-tolerant computation.

Text Books:

1. Nielsen M. A ., Quantum Computation and Quantum Information, Cambridge University Press.2002
2. Benenti G., Casati G. and Strini G., Principles of Quantum Computation and Information, Vol.I : Basic Concepts, Vol I I: Basic Tools an d Special Topics, World Scientific.2004
3. Pittenger A. O., An Introduction to Quantum Computing Algorithms.2000

Reference Books:

1. Quantum computing explained, David McMahon, Wiley-interscience, John Wiley & Sons, Inc. Publication 2008

2. Quantum computation and quantum information, Michael A. Nielsen and Isaac L. Chuang, Cambridge University Press 2010
3. Introduction to Quantum Mechanics, 2nd Edition, David J. Griffiths, Prentice Hall New Jersey 1995

IT5TE03C	Biomedical Informatics	3 Credit

COURSE OBJECTIVES:

1.Driven by efforts to improvehuman health and healthcare systems, this course will cover relevant topics at the intersection of people, health information, and technology.

2. Specifically, we will survey the field of biomedical informatics that studies the effective uses of biomedical data, information, and knowledge fromindividuals(patients), populations, biomolecules, and cellular processes,forscientific inquiry,problemsolving, and decision making.

3. We will explore foundations and methods from both biomedical and computing perspectives, including hands-on experiences with systems, tools, andtechnologies in the healthcareecosystem.

COURSE OUTCOMES:

CO1. Understand the different sub-disciplines of biomedical informatics (BMI)and identity an area of interestfor further study, research, and/or practice

CO2.Comprehend how to acquire, store and maintain, retrieve, analyse, and meaningfully use biomedical data

CO3.Apply biomedical and computational tools and technologies to solve problems in biomedicine and healthcare

CO4.Understand how technology, including health information systemsand medical devices, can improve or limit the ability to provide clinical care.

CO5.Critically think and develop own perspectives on ethical and legal considerations in use of contemporary technology and informatics in health care.

Course Contents:

Unit 1 **[6 Hrs]**

The Science and Pragmatics of Biomedical Informatics,Acquisition, Storage, and Use of biomedical data (including “big data”),Introduction Categories of Biological Databases, Microarray Technology: A Boon to Biological Sciences Introduction to Microarray Microarray Technique

Unit 2 **[6Hrs]**

Standards in Biomedical Informatics,Biomedical Decision Making,Natural Language Processing in Health care and Biomedicine.

Unit 3 **[6Hrs]**

Sequence alignment,Multiple Sequence Alignment methods (MSA), Scoring of a MSA, Progressive (CLUSTALW and PILEUP), Iterative (Genetic) and Hidden Markov Model (HMM) methods of MSA, Local MSA (Profile and BLOCK analysis, and Pattern searching, and Expectation Maximization (EM) Algorithm (MEME),Ethics in Biomedical and Health Informatics: Users, Standards, and Outcomes

Unit 4 **[6 Hrs]**

Markov Chains and HMM Frequent words in DNA, Consensus word analysis, Transaction and emission matrix, Development of training set, CpG island prediction using HMM, Application of HMM in gene finding, and Multiple sequence alignment by HMM method. Introduction to Methodologies in Biomedical Informatics

IT5L004	Embedded System and IOT-Lab	1 Credit

Unit 5 **[6 Hrs]**

Introduction to Biopython, sequence objects, sequence record objects. Sequence input and output:-parsing sequences, parsing sequences from the net, sequence files as dictionaries, writing sequence files. Multiple Sequence Alignment objects,BLAST using Biopython

Unit 6 **[6 Hrs]**

Phylogenetic analysis: Definition and description of phylogenetic trees, a primer on computational phylogenetic analysis. Computational gene prediction methods, analysis of codon usage bias, computational prediction and analysis of regulatory sites,Human Genome Project Genome Sequenced in the Public (HGP) and Private.

Text Books:

1. Biomedical Informatics: Computer Applications in Health Care and Biomedicine (Health Informatics),
2. Shortliffe EH, Cimino JJ. Fourth edition, 2014.
3. M.J. Bishop and C.J. Rawlings (editors), DNA and Protein Sequence Analysis---A Practical Approach IRL Press at Oxford University Press, ISBN 0 19 963464 7 (Pbk)
4. J. Pevsner (2002) Bioinformatics and Functional Genomics; Cold Spring Harbor Laboratory
   Press, Cold Spring Harbor, New York.
5. Jeff Chang, Brad Chapman, Iddo Friedberg, Thomas Hamelryck, BiopythonTutorial and Cookbook", http://biopython.org/DIST/docs/tutorial/Tutorial.html,2013

Reference Books:

1. Shortliffe, E. H., &Cimino, J. J. (2013). Biomedical Informatics: Computer Applications in Health Care and Biomedicine. Springer Science & Business Media, (4thEdition).
2. Selected readings from peer-reviewed literature in biomedical informatics, translational medicine, and healthcare systems engineering.
3. Lesk, A.M. 2005, 2nd edition, Introduction to Bioinformatics. Oxford University Press

COURSE OBJECTIVES :

To create an environment for research, design, development and testing of IoT solutions, in the field of energy management, communication systems, distributed sensor devices and advanced user interfaces

COURSE OUTCOMES:

Investigate a variety of emerging devices and technologies such as smart sensing, pervasive connectivity, virtual interfaces & ubiquitous computing and their potential applications in consumer, retail, healthcare and industrial contexts

List of Experiments:

1. Study of Raspberry-Pi, Beagle board, Arduino and other micro controller (History& Elevation)

2. Study of different operating systems for Raspberry-Pi /Beagle board. Understanding the process of OS installation on Raspberry-Pi /Beagle board

3. Study of Connectivity and configuration of Raspberry-Pi /Beagle board circuit with basic peripherals, LEDS. Understanding GPIO and its use in program.

4. Understanding the connectivity of Raspberry-Pi /Beagle board circuit with temperature sensor. Write an application to read the environment temperature. If temperature crosses a threshold value, the application indicated user using LEDSs

5) Understanding the connectivity of Raspberry-Pi /Beagle board circuit with IR sensor. Write an application to detect obstacle and notify user using LEDs.

6. Understanding and connectivity of Raspberry-Pi /Beagle board with camera. Write an application to capture and store the image.

7. Understanding and connectivity of Raspberry-Pi /Beagle board with a Zigbee module. Write a network application for communication between two devices using Zigbee.

8. Study of different CPU frequency governors. Write an application to change CPU frequency of Raspberry-Pi /Beagle board

9. Write an application using Raspberry-Pi /Beagle board to control the operation of stepper motor.

10. Write an application using Raspberry-Pi /Beagle board to control the operation of a hardwaresimulated traffic signal.

11. Write an application using Raspberry-Pi /Beagle board to control the operation of a hardwaresimulated lift elevator

12. Write a server application to be deployed on Raspberry-Pi /Beagle board. Write client applications to get services from the server application.

IT5L006	Design and Analysis of Algorithm Lab	1 Credit

COURSE OBJECTIVES :

1. To analyze the running time of asymptotic algorithm.
2. To develop algorithms for sorting, searching, insertion and matching.
3. To identify and apply the concept of computational intractability.
4. To acquire knowledge in NP Hard and complete problem

COURSE OUTCOMES:

CO1. To design new algorithms, prove them correct, and analyze their asymptotic and absolute runtime and memory demands.

CO2.To find an algorithm to solve the problem (create) and prove that the algorithm solves the problem correctly (validate) .

CO3.To apply classical sorting, searching, optimization and graph algorithms Apply classical sorting, searching, optimization and graph algorithms

CO4. To understand basic techniques for designing algorithms, including the techniques of recursion, divide-and-conquer, and greedy.

CO6.To explain NP-Completeness and deal with NP-complete problems.

CO7 To synthesize efficient algorithms in common engineering design situations.

List of Experiments:

1. Introduction of Algorithm (Order Notation , Time & Space Complexity)
2. Write a program to implement Binary Search Algorithm
3. Write a program to implement Merge sort Algorithm

4. Write a program to implement Knapsack problem using greedy method
5. Write a program to implement Prim's Algorithm
6. Write a program to implement Kruskals Algorithm
7. Write a program to implement Dijkstras's algorithm
8. Write a program to implement Travelling Salesman Problem
9. Write a program to implement Tower of Hanoi problem for n number of disks.
10. Write a program to implement Warshall's algorithm.
11. Write a program to implement Quick Sort Algorithm
12. Write a program to implement Depth first Search Algorithm

13. Write a program to implement Spanning tree.
14. Write a program to implement Breath First Search Algorithm
15. Write a program to implement Selection Sort Algorithm
16. Write a program to implement Longest Common Subsequence Algorithm
17. Write a program to implement Bubble Sort algorithm.
18. Write a program to implement Insertion Sort Algorithm
19. Write a Program to Search a number from the given list of numbers using Linear Search
20. Write a program to implement Hamilton Algorithm

IT5T008	**Innovation and Enterpreneurship Development**	**1 Credit**

COURSE OBJECTIVES

1. To understand the importance of Innovation and Idea Generation
2. To understand the concept of entrepreneurship.

COURSE OUTCOMES

At the end of the course students will be able to

1. Identify and validate of ideas.
2. Remember Patent registration of Innovation.
3. Understand roles and responsibilities of Entrepreneurship.

Unit 1: Innovation **[06 Hours]**

Concept of creativity, innovation, invention, discovery. Methods for development of creativity, convergent & divergent thinking etc. Introduction to Intellectual Property Rights (IPR), Patent and laws related to patents.

Unit 2: Entrepreneurship **[06 Hours]**

Concept of entrepreneurship, its relations in economic developments, Eventuation of concept of entrepreneur, characteristics of an Entrepreneur, Types of entrepreneurs, Qualities of entrepreneur, Factors affecting growth of entrepreneurship.

Unit 3: Role of Entrepreneurial Bodies **[06 Hours]**

Theory of achievement, motivation, Medelland’s. experiment, Women entrepreneurship, Role of SSI,
it’s advantages & limitations, policies governing small scale industries, Procedure to set up small
scale industrial unit, Advantages and limitations of SSI.

Unit 4: Role of Entrepreneurial Support **[06 Hours]**

Factors governing project selection, Market survey, Preparation of project report. Financial, technical
& market analysis of project. Entrepreneurial support systems, Role of consultancy organization like,District Industrial Centre, State Industrial Development Corporation, Financial institution, Latest SSI schemes of DIC (to be confirmed from DIC from time to time.

Text Book

1) Entrepreneurship Development, S. S. Khanka, S. Chand Publishers.

Reference Book

1) Creativity Innovation & Entrepreneurship, Zechariah James Blanchard, Needle Rat Business
Publishers.

Course Structure and Syllabus

For

B. Tech. Information Technology Programme

Curriculum for Semester- VI [Third Year]

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				
				L	T	P	CA	MSE	ESE	Total	Credit
1	ESC	IT6T001	Adhoc Wireless Networks	3	0	0	20	20	60	100	3
2	PCC	IT6T002	Machine Learning	2	1	0	20	20	60	100	3
3	PEC	IT6TE02	Elective -II	3	0	0	20	20	60	100	3
4	PEC	IT6TE03	Elective-III	3	0	0	20	20	60	100	3
5	OEC	IT6O002	OPEN Elective 2	3	1	0	20	20	60	100	4
6	ESC	IT6L003	Adhoc Wireless Networks (Lab)	0	0	2	60	0	40	100	1
7	PCC	IT6L004	Machine Learning (Lab)	0	0	2	60	0	40	100	1
8	PCC	IT6L005	Multimedia (Lab)	0	0	2	60	0	40	100	1
9	PROJECT	IT6P006	Mini Project	0	0	4	25	0	25	50	3
10	MC	IT6T007	Intellectual Property Rights	2	0	0	15	10	25	50	Audit
11	PROJECT	IT6P007	CRT(Campus Recruitment Training)	0	0	2	60	0	40	100	1
				16	2	10	320	110	470	900	23

IT6T001	**Adhoc Wireless Network**	**3 Credit**

COURSE OBJECTIVES:

1. Explain fundamental principles of Ad-hoc Networks

2. Discuss a comprehensive understanding of Ad-hoc network protocols
3. Outline current and emerging trends in Ad-hoc Wireless Networks.
4. Analyze energy management in ad-hoc wireless networks.

COURSE OUTCOMES:

CO1. Design their own wireless network

CO2. Evaluate the existing network and improve its quality of service

CO3. Choose appropriate protocol for various applications

CO4. Examine security measures present at different level

CO5. Analyze energy consumption and management

Course Contents:

Unit 1 **[10 Hrs]**

Teaching Hours Ad-hoc Wireless Networks Introduction, Issues in Ad-hoc Wireless Networks, Ad-hoc Wireless Internet; MAC Protocols for Ad-hoc Wireless Networks: Introduction, Issues in Designing a MAC Protocol, Design Goals of MAC Protocols, Classification of MAC protocols, Contention-Based Protocols, Contention-Based Protocols with Reservation Mechanisms, Contention-Based Protocols with Scheduling Mechanisms, MAC Protocols that Use Directional Antennas.

Unit 2 **[8 Hrs]**

Routing Protocols for Ad-hoc Wireless Networks Introduction, Issues in Designing a Routing Protocol for Ad-hoc Wireless Networks; Classification of Routing Protocols; Table Driven Routing Protocols; On-Demand Routing Protocols, Hybrid Routing Protocols, Hierarchical Routing Protocols and Power-Aware Routing Protocols.

Unit 3 **[9 Hrs]**

Multicast Routing in Ad-hoc Wireless Networks Introduction, Issues in Designing a Multicast Routing Protocol, Operation of Multicast Routing Protocols, An Architecture Reference Model for Multicast Routing Protocols, Classifications of Multicast Routing Protocols, Tree-Based Multicast Routing Protocols and Mesh-Based Multicast Routing Protocols.

Unit 4 **[9Hrs]**

Transport Layer and Security Protocols for Ad-hoc Networks: Introduction, Issues in Designing a Transport Layer Protocol; Design Goals of a Transport Layer Protocol; Classification of Transport Layer Solutions; TCP over Transport Layer Solutions; Other Transport Layer Protocols for Ad-hoc Networks; Security in Ad-hoc Wireless Networks, Issues and Challenges in Security Provisioning, Network Security Attacks, Key Management and Secure Touting Ad-hoc Wireless Networks.

Unit 5 **[9 Hrs]**

Quality of Service and Energy Management in Ad-hoc Wireless Networks: Introduction, Issues and Challenges in Providing QoS in Ad-hoc Wireless Networks, Classification of QoS Solutions, MAC Layer Solutions, Network Layer Solutions; Energy Management in Ad-hoc Wireless Networks: Introduction, Need for Energy Management in Ad-hoc Wireless Networks, Classification of Energy Management Schemes, Battery Management Schemes, Transmission Management Schemes, System Power Management Schemes.

Text Books:

1. C. Siva Ram Murthy & B. S. Manoj: Ad-hoc Wireless Networks, 2nd Edition, Pearson Education, 2011

Reference Books:

1. Ozan K. Tonguz and Gianguigi Ferrari: Ad-hoc Wireless Networks, John Wiley, 2007.

2. Xiuzhen Cheng, Xiao Hung, Ding-Zhu Du: Ad-hoc Wireless Networking, Kluwer Academic Publishers, 2004.

IT6T002	Machine Learning	4 Credit

COURSE OBJECTIVES:

1. To understand the basic concepts and methods of machine learning.
2. To make use of some elementary machine learning techniques in the design of computer systems.
3. To develop a broad perspective about the applicability of ML algorithms in different fields.
4. To understand the major machine learning algorithms, the problem settings and assumptionsthat underlies them.
5. To possess insights, concerning the relative strengths and weaknesses of various commonmachine learning methods.

COURSE OUTCOMES:

After learning the course the student will be able:

CO1. To demonstrate knowledge of the machine learning literature.

CO2. To describe how and why machine learning methods work.

CO3. To demonstrate results of parameter selection.

CO5. To select and apply appropriate machine learning methods to a selected problem.

CO6. Toimplement machine learning algorithms on real datasets.

Course Contents:

Unit 1 **[6 Hrs]**

Introduction: Well-posed learning problems, Designing a Learning System, Perspectives and Issues in Machine learning, Concept Learning and General-to-specific Ordering: A concept learning task, Concept learning as Search, Finding a maximally specific hypothesis, Version Spaces and Candidate elimination algorithm, Inductive Bias.

Unit 2 **[6 Hrs]**

Decision Tree Learning: Decision tree learning algorithm, Hypothesis space search in decision tree Evaluating Hypothesis: Estimating Hypothesis accuracy, Basics of sampling theory, Deriving confidence intervals, Hypothesis testing, comparing learning algorithms.

Unit 3 **[6 Hrs]**

Bayesian Learning: Bayes theorem and concept learning, Maximum likelihood and least square error hypotheses, Minimum description length principle, Bayes optimal classifier, Gibbs algorithm, Naive Bayes classifier, Computational Learning Theory: Probably learning an approximately correct hypothesis, PAC learnability, The VC dimension, the mistake bound model for learning.

Unit 4 **[6 Hrs]**

Linear Models for Regression: Linear basis function models, The Bias-Variance decomposition, Bayesian Linear Regression, Bayesian Model comparison, Kernel Methods: Constructing kernels, Radial basis function networks, Gaussian Processes, Ensemble Learning: Bagging, boosting, and DECORATE. Active learning with ensembles.

Unit 5 **[6 Hrs]**

Unsupervised Learning: Clustering:Learning from unclassified data, Hierarchical Aglomerative Clustering, k-means partitional clustering, Batchler and Wilkin's algorithm.

Reinforcement Learning: The learning task, Q learning, Non-deterministic rewards and action, Temporal difference learning, Generalizing from examples.

Text Books:

1. Mitchell, Tom. M., “Machine Learning”, McGraw-Hill Education, 1st Edition, May 2013.
2. Segaran, Toby. “Programming Collective Intelligence- Building Smart Web 2.0 Applications”, O’Reilly Media, August 2007.

Reference Books:

1. Miroslav, Kubat. “An Introduction to Machine Learning”, Springer Publishing.
2. Bishop, C. M., “Pattern Recognition and Machine Learning”, Springer Publishing.
3. Conway, Drew and White, John Myles, “Machine Learning for Hackers”, O'Reilly Media, February 2012.

IT6TE02A	**Elective II- Cloud Computing and Storage Management Semester**	**Credit:3**

Course Objectives:

1. To learn the concept of cloud computing.
2. To understand the trade-off between deploying applications in the cloud over local infrastructure.
3. To identify different storage virtualization technologies and their benefits.
4. To understand and articulate business continuity solutions including backup and recovery technologies, local and remote replication solutions.

Course Outcomes:

After learning the course, the student will be able:

1. To understand the key dimensions of the challenge of Cloud Computing.
2. To assess the economics, financial and technological implications for selecting cloud Computing for organization.
3. To describe and apply storage technologies.
4. To identify leading storage technologies that provide cost-effective IT solutions for medium to large scale businesses and data centres.
5. To describe important storage technology features such as availability, replication,

scalability and performance.

Course Content:

UNIT I

Introduction: Distributed Computing and Enabling Technologies, Cloud Fundamentals: Cloud Definition, Evolution, Architecture, Applications, Deployment models and service models.

UNIT II

Virtualization: Issues with virtualization, Virtualization technologies and architectures, Internals of virtual machine monitors/hypervisors, Virtualization of data centres and Issues with Multi-tenancy.

UNIT III

Implementation: Study of Cloud computing Systems like Amazon EC2 and S3, Google App Engine and Microsoft Azure, Build Private/Hybrid Cloud using open source tools, Deployment of Web Services from inside and outside a Cloud Architecture, MapReduce and its extensions to Cloud Computing, HDFS and GFS.

UNIT IV

Storage virtualization: Fixed Content and Archives, Types, Features, Benefits, CAS Architecture, Object storage and retrieval, Examples: Storage Virtualization-forms of virtualization, SNIA Taxonomy – Storage virtualization configurations,Challenges, Types of storage virtualization - Business Continuity- Overview of emerging technologies such as Cloud storage, Virtual provisioning, Unified Storage, FCOE, FAST.

UNIT V

Business Continuity and Recovery: Information Availability, BC Terminology, Life cycle, Failure analysis: Backup and Recovery- Backup purpose, considerations, Backup Granularity, Recovery considerations- Backup methods, Process, backup
and restore operations, Overview of emerging technologies: Duplication, Off site backup.

UNIT VI

Storage security and Management: Storage security framework, Securing the Storage infrastructure, Risk triad: Managing the storage infrastructure, Monitoring the storage infrastructure, identify key parameters and components to monitor in a storage infrastructure, List key management activities and examples, Define storage management standards and initiative-Industry trend

Text Books:

1. RajkumarBuyya, James Broberg, AndrzejGoscinski, “Cloud Computing Principles and Paradigms”, Wiley Publishers, 2011.
2. Barrie Sosinsky, “Cloud Computing Bible”, Wiley Publishers 2010.
3. Tim Mather, SubraKumaraswamy, ShahedLatif, “Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance”, O’Reilly 2010.
4. EMC Corporation, “Information Storage and Management”, 1st Edition, Wiley India 2009.

Reference Books:

1. RajkumarBuyya, Christian Vacchiola, S ThamaraiSelvi, “Mastering Cloud Computing”, McGraw Hill, 2013
2. Michael Miller, “Cloud Computing : Web-based Applications that change the way you work and collaborate online”, Pearson Education, 2008
3. IBM, “Introduction to Storage Area Networks and System Networking”, 5th Edition, November 2012.
4. Robert Spalding, “Storage Networks: The Complete Reference”, Tata McGraw Hill, Osborne, 6th reprint 2003.
5. Marc Farley, “Building Storage Networks”, Tata McGraw Hill, Osborne, 1st Edition, 2001.

IT6TE02B	**Expert Systems**	**3 Credit**

COURSE OBJECTIVES:

1. Students will be introduced to what is an Expert System.
2. Students will be able to understand First and Second Generation Expert Systems.
3. Students will study Artificial Intelligence.
4. Students will study Artificial Intelligence.
5. Students will study Different approaches to gain knowledge with different perspectives.

6. Students will study about Machine Learning and its importance.

COURSE OUTCOMES:

CO1. Students will be able to understand Knowledge Representation.

CO2. Students will be able to understand what is Machine Learning.

CO3. Students will be able to analyse a Hybrid Expert System for Insurance Policy.

CO4. Students will illustrate the Frame Problem.

CO5. Students will be Understand what is Neural Network

CO6. Students will be introduced with Machine learning concepts.

Course Contents:

Unit 1 **[6 Hrs]**

Introduction to Expert System: Artificial Intelligence, Basic expert System concepts, Knowledge Engineering, First and second Generation Expert Systems, Advantages and disadvantages of Expert Systems, Expert System applications.

Unit 2 **[6 Hrs]**

Theoretical Foundations : Introduction, Propositional Logic, First order predicate calculus and Predicate Logic, Inference, Proof by Refutation Resolution, Green's Answer Terms, Knowledge Acquisition Bottleneck, Search Strategies, Non Monotonic Reasoning, Forward Backward Chaining.

Knowledge Representation: Presentation of Knowledge, Rules, Semantic Networks, Frames, Object Oriented Systems, Hybrid Representation, The Frame problem, Semantic Primitives..

Unit 3 **[6 Hrs]**

Knowledge Acquisition, Verification and Validation: The Expert System Development Process, Knowledge Elicitation, The Knowledge Level, Explanation in Second Generation Expert System, The Problem Solving Methods and Generic Tasks Approach, Verification and Validation.

Unit 4 **[6 Hrs]**

Uncertainty: Uncertainty in Expert Systems, The Bayesian Approach, Certainty Factors, Dempster Shafer Theory of Evidence, Fuzzy Sets and Fuzzy Logic, Bayesian Belief Networks.

Machine Learning: Introduction, Decision Trees and The ID3 Algorithm, Learning From Noisy Data, Version Space Search and Conceptual Clustering, Case Based Reasoning, Evolutionary Machine Learning.

Unit 5 **[6 Hrs]**

Neural Networks: Introduction, Artificial Neural Network, Perceptron, Hidden Layers, Multi layerPerceptrons, Hopfield Networks, Multilayered Nets AndBackpropagation.

Unit 6 **[6 Hrs]**

Hybrid Expert System: Introduction, Macie: A Connectionist Expert System, Generating Rules from Neural Nets, A Hybrid expert system for Investment Advising, A Hybrid Expert System for Insurance Policy.

Reference Book:

1. Nikolopoulos "Expert Systems" 1997

2. J. Giarratano and G. Riley, "Expert Systems -- Principles and Programming". 4th Edition, PWS Publishing Company, 2004

3. Peter J. Lucas "Principles of Expert Systems" January 1991

4. Joseph C. Giarratano "Expert systems"

IT5TE01A	Blockchain	3 Credit

COURSE OBJECTIVES:

1. To understand the concepts of blockchain
2. To understand various cryptocurrency and their working
3. To Use various algorithms for distributed consensus
4. To enable students build a applications based on blockchain technology

COURSE OUTCOMES:

CO1: Understand emerging abstract models for Blockchain Technology.

CO2: Identify major research challenges and technical gaps existing between theory and practice in crypto currency domain.

CO3: It provides conceptual understanding of the function of Blockchain as a method of securing distributed ledgers, how consensus on their contents is achieved, and the new applications that they enable.

CO4: Apply hyperledger Fabric and Etherum platform to implement the Block chain Application

Unit I: Introduction : [6 Hrs]

Blockchain-History,Myths,Benefits,Limitations and Challenges of Blockchain, Structure of Blocks, Miners,Working of Blockchain,Types of Blockchain,Blockchain as Public Ledgers-Bitcoin, Blockchain 2.0, Smart Contracts, Transactions-Distributed Consensus, The Chain and the Longest Chain -Cryptocurrency to Blockchain 2.0 - Permissioned Model of Blockchain,

Unit II: Blockchain Architecture and Cryptographic**:** **[6Hrs]**

Crypto Primitives, Permissioned Blockchain,Consensusmechanism **,**Cryptographic -Hash Function,Properties of a hash function-pointer and Merkle tree. Public key cryptosystems, private vs public blockchain. Introduction to cryptographic concepts required,Hashing, public key cryptosystems, private vs public blockchain and use cases,

Unit III: Bitcoin Consensus: [6 Hrs]

Introduction to BitcoinBlockchain,Transactions,Bitcoin limitations, Bitcoin Consensus, Proof of Work (PoW)- HashcashPoW , BitcoinPoW, Attacks on PoW ,monopoly problem- Proof of Stake- Proof of Burn - Proof of Elapsed Time - Bitcoin Miner, Mining Difficulty, Mining Pool-Permissioned model and use cases.

Unit IV:Cryptocurrency and Smart Contracts **[6 Hrs]**

Introduction, Ethereumblockchain, Elements of the Ethereumblockchain, IOTA,Namecoin.Legal Aspects Cryptocurrency Exchange, Black Market and Global Economy.Smart Contracts: Definition, DAO,Ricardian contracts,Precompiled contracts.

Unit V: HyperledgerFabric: [6 Hrs]

Architecture of Hyperledger fabric v1.1-Introduction to hyperledger fabric v1.1, chain code- Ethereum:Ethereum network, EVM, Transaction fee, Mist Browser, Ether, Gas, Solidity, TruffleDesign and issue Crypto currency, Mining, DApps, DAO

Unit VI: BlockchainApplications : [6 Hrs]

Uses of Blockchain in E-Governance, Land Registration, Medical Information Systems, Finance, and others

Text Books

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016

2. Draft version of “S. Shukla, M. Dhawan, S. Sharma, S. Venkatesan, ‘Blockchain Technology: Cryptocurrency and Applications’, Oxford University Press, 2019.

3. Josh Thompson, ‘Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming’, Create Space Independent Publishing Platform, 2017.

Reference Books

1. Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popularBlockchain frameworks by Bashir, Imran,2017.
2. Joseph Bonneau et al, SoK: Research perspectives and challenges for Bitcoinandcryptocurrency, IEEE Symposium on security and Privacy, 2015.

IT6TE02D	Big Data Analytic Technique	3 Credit

COURSE OBJECTIVES:

1. Design applications using R, HADOOP.
2. Design applications using RHADOOP
3. Develop analytic applications for data Streams.
4. Develop Pig scripts for Big data applications.
5. Design Big data applications schema

COURSE OUTCOMES:

CO1. Understand basic concepts and techniques of Hadoop ecosystem and Big data.

CO2.Design different component of Hadoop ecosystem.

CO3. Understand the domain of data science and analysis of big data.

Course Contents:

Unit 1 : [6 Hrs]

What is big data, why big data, convergence of key trends, unstructured data, industry examples of big data, web analytics, big data and marketing, fraud and big data, risk and big data, credit risk management, big data and algorithmic trading, big data and healthcare, big data in medicine, advertising and big data, big data technologies.

Unit 2 : [7 Hrs]

Introduction to NoSQL, aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schemaless databases, materialized views, distribution models, master-slave replication, peer-peer replication, consistency, relaxing consistency, version stamps, map-reduce, partitioning andcombining, composing map-reduce calculations.

Unit 3 : **[7 Hrs]**

Data format, analyzing data with Hadoop, scaling out, Hadoop streaming, Hadoop pipes, design of Hadoop distributed file system (HDFS), HDFS concepts, Java interface, data flow, Hadoop I/O, data integrity, compression, serialization, Avro, file-based data structures

Unit 4 : **[7 Hrs]**

Map Reduce workflows, unit tests with MR Unit, test data and local tests, anatomy of Map Reduce job run, classic Map-reduce, YARN, failures in classic Map-reduce and YARN, job scheduling, shuffle and sort, task execution, Map Reduce types, input formats, output formats.

Unit 5 : **[7 Hrs]**

H base, data model and implementations, H base clients, H base examples, praxis. Cassandra, Cassandra data model, Cassandra examples, Cassandra clients, Hadoop integration, Hive, data types and file formats, HiveQL data definition, Hive QL data manipulation, HiveQL queries.

Unit 6 : **[6Hrs]**

Big Data Issues: Privacy, Visualization, Compliance and Security,Structuredvs Unstructured Data.

Text Books:

1. Big Data Analytics, Introduction to Hadoop, Spark, and Machine-Learning, Raj kamal, PreetiSaxena, McGraw Hill, 2018.

2. Big Data, Big Analytics: Emerging Business intelligence and Analytic trends for Today's Business, Michael Minelli, Michelle Chambers, and AmbigaDhiraj, John Wiley & Sons, 2013

Reference Books:

1. Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013

2. Hadoop: The Definitive Guide, Tom White ,Third Edition, O'Reilley, 2012.

3. Hadoop Operations, Eric Sammer, O'Reilley, 2012.

4. Programming Hive, E. Capriolo, D. Wampler, and J. Rutherglen, O'Reilley, 2012.

5. H Base: The Definitive Guide, Lars George, O'Reilley, 2011.

6. Cassandra: The Definitive Guide, Eben Hewitt, O'Reilley, 2010.

IT6TE03A	Graph Analytic for Big data	3 Credit

COURSE OBJECTIVES:

1.To understand the concept of Big Data

2.To learn Big Data file systems and their storage methods

3.To understand the algorithms and

4.To learn to process Big Data information for analytics

5.To discuss and understand Big Data implementations within large corporations like Google and Facebook

COURSE OUTCOMES:

CO1.To model and implement efficient big data solutions for various application areas using appropriately selected algorithms and data structures.

CO2.To analyze methods and algorithms, to compare and evaluate them with respect to time and space requirements, and make appropriate design choices when solving real-world problems.

CO3.To explain trade-offs in big data processing technique design and analysis in written and oral form.

CO4.To explain the Big Data Fundamentals, including the evolution of Big Data, the characteristics of Big Data and the challenges introduced.

CO5.To apply non-relational databases, the techniques for storing and processing large volumes of structured and unstructured data, as well as streaming data.

Course Contents:

Unit 1 **[6 Hrs]**

What is big data?, the four V's of big data, Distributed File System, functional programming vsobject oriented programming, advantages of scala, spark streaming

Unit 2 **[7 Hrs]**

Introduction, Parallel processing using Pig, Pig Architecture, Grunt, Pig Data Model-scalar and complex types. Pig Latin-Input and output, Relational operators, User defined functions. Working with scripts

Unit 3 **[7 Hrs]**

Big Data Storage Models: Distributed Hash-table, Key-Value Storage Model (Amazon's Dynamo), Document Storage Model(Facebook's Cassandra), Graph storage models

Unit 4 **[7 Hrs]**

Scalable Algorithms: Mining large graphs, with focus on social networks and web graphs. Centrality, similarity, all-distances sketches, community detection, link analysis, spectral techniques. Map-reduce, Pig Latin, and No SQL, Algorithms for detecting similaritems, Recommendation systems, Data stream analysis algorithms, Clustering algorithms, Detecting frequent items.

Unit 5 **[7 Hrs]**

Big Data Applications: Advertising on the Web, Web Page Quality Ranking, Mining Social-Networking Group, Human Interaction with Big-Data. Recommendation systems with case studies of Amazon's Item-to-Item recommendation and Net fix Prize, Link Analysis with case studies of the PageRank algorithm and the Spam farm analysis, Crowd Sourcing

Unit 6 **[6 Hrs]**

Big graph Analytic Approaches: In memory big graph analytics, SSD-based big graph analytics, Disk based big graph analytics, centrality analysis: Degree, eignvectorkatz, page rank.

Text Books:

1. Big Data Analytics, Introduction to Hadoop, Spark, and Machine-Learning, Raj kamal, PreetiSaxena, McGraw Hill, 2018.
2. Big Data, Big Analytics: Emerging Business intelligence and Analytic trends for Today's Business, Michael Minelli, Michelle Chambers, and AmbigaDhiraj, John Wiley & Sons, 2013**.**

Reference Books:

1. An Introduction to Information Retrieval, Christopher D. Manning, PrabhakarRaghavan, HinrichSchütze
2. Data-Intensive Text Processing with Map Reduce, Jimmy Lin and Chris Dyer.

IT6TE03B	**Smart Sensors for Robotics**	**3 Credit**

COURSE OBJECTIVES:

1. To understand the different sesnsors used in robotics
2. To learn kinematics of robotics
3. To understand sensors used in industries

COURSE OUTCOMES:

CO1.Student shall be able to differentiate sensors uses..
CO2.Student shall be able to apply the knowledge of different sensors in different area of robotics.
CO3.Students shall able to understand the robotics assembly

Course Contents:

UNIT I: Introduction **[6 Hrs]**

An Introduction to sensors and Transducers, History and definitions, Smart Sensing, AI sensing, Need of sensors in Robotics.

UNIT II: Sensors In Robotics [**7 Hrs]**

Position sensors -optical, non-optical, Velocitysensors, Accelerometers, Proximity Sensors - Contact, non-contact, Range Sensing, touch and Slip Sensors, Force and Torque Sensors

UNIT III: Miscellaneous Sensors In Robotics [**8Hrs]**

Different sensing variables -smell, Heat or Temperature, Humidity, Light, Speech or Voice recognition Systems, Telepresence and related technologies. Range detectors, assembly aid devices,force and torque sensors, machine vision, ranging, laser, acoustic, magnetic, fiberopticand tactile sensors.

UNIT IV: Vision Sensors InRobtics [**6Hrs]**

Robot Control through Vision sensors, Robot vision locating position, Robot guidance with vision system, End effector camera Sensor

UNIT V: Multisensor Controlled Robot Assembly
[**7Hrs]**

Control Computer, Vision Sensor modules, Software Structure, Vision Sensor software, Robot programming, Handling, Gripper and Gripping methods, accuracy .

UNIT VI: Case Study [**6Hrs]**

Case Studies: Multiple robots, machine interface, robots in manufacturing and non-manufacturing applications, robot cell design, selection of robot.

Text Books:

1.Mikell P. Weiss G.M., Nagel R.N., Odraj N.G., "Industrial Robotics", McGraw-Hill, Singapore, 1996.
2.Ghosh, "Control in Robotics and Automation: Sensor Based Integration", Allied Publishers, Chennai, 1998.
3.Paul W Chapman, "Smart Sensors", an Independent Learning Module Series, 1996
4.Richard D. Klafer, Thomas a. Chmielewski; Michael Negin, "Robotic Engineering -An integrated approach", Prentice Hall of India Private Limited, 1989

Reference Books:

1.K.S. Fu, R.C. Gonzalez, C.S.G. Lee, "Robotics -Control Sensing, Vision and Intelligence", McGraw Hill InternationalEditions, 1987
2.Mikell P. Groover, Mitchell Weiss, Roger N Nagel, Nicholas G. Odrey, "Industrial Robotics -Technology, Programming and Applications", McGraw Hill, International Editions, 1986
3.SabricSoloman, "Sensors and Control Systems in Manufacturing", McGraw Hill, International Editions, 1994
4.Julian W Gardner, Micro Sensor MEMS and Smart Devices, John Wiley & Sons, 2001
5.Bijay K. Ghosh, Ning Xi, T.J. Tarn, Control in Robtics and Automation Sensor -Based integration, Academic Press, 1999
6.K.S. Fu, R.C. Gonzalez, C.S.G. Lee, Robotics Control, Sensing Vision and Intelligence, McGraw Hill Book Company, 1987

IT6TE03C	**Human Computing Interface**	**3 Credit**

COURSE OBJECTIVES

The student should be made to:

1. Learn the foundations of Human Computer Interaction
2. Be familiar with the design technologies for individuals and persons with disabilities
3. Gain an understanding and articulate the fundamental design concepts and practices associated with the design of human-computer interactions.

4. Analyze human factors such as cognition, affect and behaviour as they relate to the human-computer interaction and apply them in the development of human-computer interactions.
5. Evaluate the impact of new and emerging technology trends on human computer interactions and the user experience.
6. Synthesize sound (solid) design principles and aesthetics as they apply to the design of innovative interfaces.

COURSE OUTCOMES

Upon completion of the course, the student should be able to:

CO1. Design effective dialog for HCI.
CO2.Design effective HCI for individuals and persons with disabilities.
CO3.Assess the importance of user feedback.
CO4 Explain the HCI implications for designing multimedia/ ecommerce/ e-learning Web sites.
CO5 Develop meaningful user interface.

Unit 1: FOUNDATIONS OF HCI **[6 Hrs]**

The Human: I/O channels – Memory – Reasoning and problem solving; The computer: Devices – Memory – processing and networks.

Unit 2 :INTERACTIVE SYSTEM DESIGN **[6 Hrs]**

Interaction: Models – frameworks – Ergonomics – styles – elements – interactivity- Paradigms.

Interactive Design basics – process – scenarios – navigation – screen design – Iteration and prototyping. HCI in software process – software life cycle – usability engineering .

Unit 3 : MODELS AND THEORIES **[6 Hrs]**

Cognitive models –Socio-Organizational issues and stake holder requirements –Communication and collaboration models-Hypertext, Multimedia and WWW.

Unit 4: MODEL BASED DESIGN AND EVALUATION **[6 Hrs]**

Basic idea, introduction to different types of models, GOMS family of models (KLM and CMN-GOMS), Fitts' law and HickHyman's law.

Unit 5: GUIDELINES IN HCI **[6 Hrs]**

Shneiderman's eight golden rules, Norman's seven principles, Norman's model of interaction, Nielsen's ten heuristics with example of its use, Heuristic evaluation, Cognitive walkthrough.

Unit 6: TASK MODELING AND ANALYSIS **[6 Hrs]**

Hierarchical task analysis (HTA), Engineering task models and Concur Task Tree (CTT), Introduction to formalism in dialog design, design using FSM (finite state machines), State charts and (classical) Petri Nets in dialog design.

TEXTBOOK:

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, "Human Computer Interaction", 3rd Edition, Pearson Education, 2004 (UNIT I , II & III)
2. Brian Fling, "Mobile Design and Development", First Edition , O‟Reilly Media Inc., 2009 (UNIT –IV)
3. Bill Scott and Theresa Neil, "Designing Web Interfaces", First Edition, O‟Reilly, 2009.(UNIT-V)

REFERENCE BOOK:

1. Preece J., Rogers Y.,Sharp H.,Baniyon D., Holland S. and Carey T. Human Computer Interaction,Addison-Wesley, 1994.
2. B.Shneiderman; Designing the User Interface,Addison Wesley 2000 (Indian Reprint).

IT6TE03D	Machine Learning with Big Data	3 Credits

COURSE OBJECTIVES:

1. Understand the Big Data Platform and its Use cases.
2. Apply analytics on Structured, Unstructured Data.
3. Acquire a sharp understanding of how big data can be applied to concrete environments/sectors.
4. Approach dissemination actions targeting different stakeholders.
5. The student will learn to use tools to develop systems using machine-learning algorithms in big data.
6. The student will learn about problems and industrial challenges through domain-based case studies.

COURSE OUTCOMES:

CO1. Ability to identify the characteristics of datasets and compare the trivial data and big data for various applications.

CO2. Ability to select and implement machine learning techniques and computing environment that are suitable for the applications under consideration.

CO3. Ability to solve problems associated with batch learning and online learning, and the big data characteristics such as high dimensionality, dynamically growing data and in particular scalability issues.

CO4. Ability to understand and apply scaling up machine learning techniques and associated computing techniques and technologies.

CO5. Ability to recognize and implement various ways of selecting suitable model parameters for different machine learning techniques.

CO6. Ability to integrate machine learning libraries and mathematical and statistical tools with modern technologies like hadoop and mapreduce.

Course Contents:

Unit 1 **[6 Hrs]**

Introduction: Types of Machine Learning , Machine Learning process, preliminaries, testing Machine Learning algorithms, turning data into probabilities, and Statistics for Machine Learning, Probability theory ,Probability Distributions ,Decision Theory.

Unit 2 **[6 Hrs]**

Supervised Learning: Linear Models for Regression , Classification, Discriminant Functions, Probabilistic Generative Models, Probabilistic Discriminative Models , Decision Tree Learning , Bayesian Learning, Naïve Bayes , Ensemble Methods, Bagging, Boosting, Neural Networks , Multilayer Perception, Feed-forward Network, Error Back propagation ,Support Vector Machines.

Unit 3 **[6 Hrs]**

Unsupervised Learning: Clustering-K-means , EM Algorithm, Mixtures of Gaussians , Dimensionality Reduction, Linear Discriminant Analysis, Factor Analysis, Principal Components Analysis, Independent Components Analysis.

Unit 4 **[6 Hrs]**

Discriminative Models: Least Square Regression, Gradient Descent Algorithm, Univariate and Multivariate Linear Regression, Prediction Model, probabilistic interpretation, Regularization, Logistic regression, multi class classification, Support Vector Machines- Large margin classifiers, Nonlinear SVM, kernel functions, SMO algorithm.

Unit 5 **[6 Hrs]**

Introduction to Big Data Analytics: Big Data Overview, State of the Practice in Analytics, Data Analytics Lifecycle, data analytics problems. Understanding features of R language, Understanding different Hadoop modes, Understanding Hadoop features, The HDFS and MapReduce architecture.

Unit 6 **[6 Hrs]**

Understanding the basics of MapReduce, The HadoopMapReduce, The HadoopMapReduce fundamentals, writing a HadoopMapReduce example, learning the different ways to write MapReduce in R. Integrating R and Hadoop – the RHIPE architecture and RHadoop.

Text Books:

1. Kevin P. Murphy, “Machine Learning: A Probabilistic Perspective”, MIT Press, 2016.
2. EthemAlpaydin, “Introduction to Machine Learning”, MIT Press, Third Edition, 2014.
3. Tom Mitchell, “Machine Learning”, McGraw-Hill, 1997.
4. Big Data Analytics with R and Hadoop, VigneshPrajapati, PACKT Publishing, 2013.
5. Fundamentals of Business Analytics, R N Prasad and S Acharya, Wiley India, 2011

Reference Books:

1. Christopher Bishop, “Pattern Recognition and Machine Learning” Springer, 2007.
2. Stephen Marsland, “Machine Learning –An Algorithmic Perspective”, Chapman andHall, CRC Press, Second Edition, 2014.
3. Randal S, “Python Machine Learning, PACKT Publishing, 2016

IT6L003	**AD-HOC WIRELESS NETWORKS**	**LAB**	**Credit 1**

1. To be able to understand importance of ad-hoc network, NS3 and assembly programming languages.

2. To be able to understand about importance of various Interfaces.

List of Experiments:

1. Program in NS 3 to connect WIFI TO BUS(CSMA)

2. Program in NS 3 to create WIFI SIMPLE INFRASTUCTURE MODE 3. Program in NS

3 To create WIFI SIMPLE ADHOC MODE

4. Program in NS 3 to connect WIFI TO WIRED BRIDGING

5. Program in NS 3 to create WIFI TO LTE(4G) CONNECTION

6. Create a simple dumbbell topology, two client Node1 and Node2 on the left side of the dumbbell and server nodes Node3 and Node4 on the right side of the dumbbell. Let Node5 and Node6 form the bridge of the dumbbell. Use point to point links.

7. Program in NS3 for CREATING A SIMPLE WIFI ADHOC GRID

8. Create a wireless mobile ad-hoc network with three nodes Node1, Node2 and Node3. Install the OLSR routing protocol on these nodes

9. Setup a 5x5 wireless adhoc network with a grid. You may use examples/wireless/wifi-simple-adhoc-grid.cc as a base

10. Setup a 2-nodes wireless adhoc network. Place the nodes at a fixed distance in a 3d scenario

IT6L004	**Machine Learning Lab**	**Credit 1**

COURSE OBJECTIVES:

1. To understand the basic concepts and methods of machine learning.
2. To make use of some elementary machine learning techniques in the design of computer systems.
3. To develop a broad perspective about the applicability of ML algorithms in different fields.
4. To understand the major machine learning algorithms, the problem settings and assumptions that underlies them.
5. To possess insights, concerning the relative strengths and weaknesses of various common machine learning methods.

COURSE OUTCOMES:

After learning the course the student will be able:

1. To demonstrate knowledge of the machine learning literature.
2. To describe how and why machine learning methods work.

3. To demonstrate results of parameter selection.

4. To explain relative strengths and weaknesses of different machine learning methods.

5. To select and apply appropriate machine learning methods to a selected problem. 6. To implement machine learning algorithms on real datasets.

List of Experiments:

1. Implement and demonstratethe FIND-Salgorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.

2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithmto output a description of the set of all hypotheses consistent with the training examples. 3. Write a program to demonstrate the working of the decision tree based ID

3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge toclassify a new sample.

4. Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same.

5. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.

6. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.

IT6L005	**Multimedia (Lab)**	**Credit 1**

COURSE OBJECTIVES:

1. Students will Gain an understanding of how to use Multimedia Software's.
2. Students will Understandhow to create an Animation.
3. Students will study Animation Techniques.
4. Students will Study Animation Software.

COURSE OUTCOMES:

1. Students will be able to understand how to create their own Animations by using different Multimedia software.
2. Students will understand Flash8 software.
3. Students will understand background given techniques while creating Animation.
4. Students will understand how to simulate movement.

List of Practicals:

1. Create an Animation to Represent the Growing Moon.

2. Create an Animation to Indicate a Ball Bouncing on Steps.

3. Create an Animation to Simulate Movement of a Cloud.

4. Create Procedure to Draw the Fan Blades and to Give Proper Animation.

5. Create an Animation to Display the Background Given(Filename: Tulip.jpg) Through Your Name.

6. Create an Animation to Simulate a Ball Hitting Another Ball.

7. Create an Animation to Create an Animated Cursor UsingStartdrag("Ss", True); Mouse.hide();

8. Design a Visiting Card Containing At Least One Graphic and Text Information.

9. Take a Photographic Image. Give a Title for the Image. Put the Border. Write Your Names. Write the Name of Institution and Place.

10. Prepare Cover Page for The book in Your Subject Area. Plan Your Own Design.

11.Software: Flash8, adobe Photoshop 7.0

IT6P006	Mini Project	Credit 1

Evaluation Criteria: The total term work shall be of 50 marks. The 30 marks shall be distributed over internal assessments / reviews (at least 02 reviews) during the semester by a review

committee. The remaining 5 marks shall be distributed for attendance. The Head of the Department shall constitute the review committee. The student shall make presentation on the progress made before the committee. The 20marks of the practical will be awarded based on
the performance in the practical exam conducted by the University at the end of the semester.
General Suggestions and Expectations / Guidelines

• The project shall be developed in C++/JAVA/PYTHON
• The students may choose the theory concepts they studied in different subjects as project topic.
• Interdisciplinary project proposals and innovative projects are encouraged and more appreciable.
• The project topic can be suggested by the staff member or it can be proposed by the students.
• The project topic shall be approved by the project in-charge.
• The Guides are advised to give projects and suggest project titles focusing more on the current field ofresearch and ensure the level of innovation.
• A project team shall contain a maximum of 2 members.
• The project work should be properly distributed among the team members.
• Students should submit the project documentation at the beginning of the semester consisting of: Title, AbstractModules Split-upDeliverables for each reviewData Model (If Any)Details of Team Members
• Reviews for the project work will be conducted at regular intervals by the panel of examiners formed by theHead of the Department.
• The student failing to attend the project review will be subject to strict action as decided by the Head of theDepartment.
• Throughout the semester at any point of time if students are found to be involved in any of the following:

Using project codes available on the Internet
Using project codes developed by someone elseUsing project work which is already submitted in other institute or university Such students shall bedeclared failed or penalized as decided by the Examiners.

• The students must arrange regular meetings with the guide and present progress of project work.
• A Spiral bound Project report to be prepared as per the guidelines and format given by the Department
• The guides are advised to check for the formatting of the presentation and project report.

- Students must submit a report well before the end of the semester.

IT6T007	Intellectual Property Right (IPR)	1 Credit

Course Objectives :

1. To introduce fundamental aspects of Intellectual property Rights to students who are going to play a major role in development and management of innovative projects in industries.
2. To disseminate knowledge on patents, patent regime in India and abroad and registration aspects
3. To disseminate knowledge on copyrights and its related rights and registration aspects
4. To aware about current trends in IPR and Govt. steps in fostering IPR

Course Outcome :

CO 1: To provide an understanding of the law relating to Intellectual Property and Competition in India.

CO2: To understand the concept of Intellectual Property and Intellectual Property Rights with special reference to India.

CO3:To appreciate the significance of Intellectual Property in modern times, in the light of its international legal regime.

CO4:To study the important Agreements, Treaties and Conventions relating to Intellectual Property Rights.

CO5:To understand the intricacies of grant of Patent, Patentability, Licensing and Revocation at National and International levels.

Course Contents :

UNIT1: Introduction to IPRs, Basic concepts and need for Intellectual Property - Patents, Copyrights, Geographical Indications, IPR in India and Abroad Function of IPR. Public good, Incentive theory, different forms of IPR , Industrial Property, technological Research, Inventions and Innovations – Important examples of IPR.

UNIT 2: Practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad .Introduction to competition Law, Anti-competitive agreements, Abuse of dominance, Regulation of combinations,

UNIT3: International Treaties and Conventions on IPRs, TRIPS Agreement, PCT Agreement, Patent Act of India, Patent Amendment Act, Design Act, Trademark Act, Geographical Indication Act.

UNIT 4: The relationship and Interaction between IPR and competition law The economics of US Anti trustlaw,IP and competition issues,Technology transfer agreements. The EU experience with IP and Competition Law

UNIT5: Market allocation, Horizontal agreements, Vertical agreements, licensing issues.Indian Competition Act and IPR protection. Digital Innovations and Developments as Knowledge Assets – IP Laws, Cyber Law and Digital Content Protection – Unfair Competition – Meaning and Relationship between Unfair Competition and IP Laws – Case Studies.

Text Books :

1. Fundamentals ofIP for Engineers: K.Bansl&P.Bansal

2. Intellectual property right, Deborah, E. BoDcboux, Cengageleam'ng.

3. Inrelletul property right - Unleasbing the knowledgeconomy, PmbuddhaGanguli, Tata MccrawHiU Publishing Company Ltd.

Refrence Books:

1. Eleclronic resource guide ERc published online by the American Society of Intellectual Propery Rights md Develolment Policy: Repod of rhe

2. Commission on InrellectualPrcpertyRidls, London Sepiedber 2002

IT6P007	Campus Recruitment Training	1 Credit

About CRT Training Campus Recruitment training (CRT) at is designed to aid candidates in their preparation for Recruitment through Campuses or outside campuses (i.e On campus or off campus). Students in their final step of graduation looking for placement in reputed organizations can make use of this training to get trained to deliver their best in the selection processes of organizations.

COURSE OBJECTIVES

1. To enhance the problem solving skills, to improve the basic mathematical skills and to help students who are preparing for any type of campus recruitment drive.
2. To groom the students to the corporate level
3. To ensure that all eligible students are employed by the end of the final year of study.

COURSE OUTCOMES

At the end of the course students will be able to

1. Solve the problems easily by using Short-cut method with time management which will be helpful to them to clear the competitive exams for better job opportunity.
2. Analyze the Problems logically and approach the problems in a different manner.
3. Students will be able to apply mathematical analysis of data to make connections, draw conclusions and solve problems.
4. Students will learn a series of techniques through practical activities to develop presenting skills and enhance confidence to expand the potential of the individual.
5. Students can produce a resume that describes their education, skills, experiences and measurable achievements with proper grammar, format and brevity.
6. Students demonstrate an ability to target the resume to the presenting purpose
7. Demonstrate professional behavior(s) including preparedness, professional attire, and respectful presentation during interviews.

PART I: - QUANTITATIVE ABILITY

Unit 1: - 03 hrs

Speed Maths Calculation, Number Systems, Ratio & Proportion, Percentage

Unit 2: - 03 hrs

Profit – Loss & Discount, Simple Interest & Compound Interest, Simple Equation and Age's

Unit 3:- 03 hrs

Averages Mixture & Allegation, Time and work, Time Speed & Distance, Permutation – Combination & Probability

PART II: - REASONING ABILITY

Unit 1: - 03 hrs

Coding Decoding, Blood Relation, Direction sense, Number Series, Analogy

Unit 2: - 03 hrs

Sitting Arrangement, Puzzles.

Unit 3:- 03 hrs

Syllogism, Statement course of action, Statement arguments, Statement Assumptions, Miscellaneous Type of Reasoning

PART III: - Employability Skills

Unit 1: - Presentation Skills (02 hrs)

What is a presentation? Essential characteristics of Good presentation.

Preparation of presentation: Identify the purpose, Analyze the audience, Design and organize the information, Medium of presentation and Visual aids

Delivering Presentation: rehearsal, body Language, Handling questions, Tips to fight stage fear.

Unit 2: - Job Interview Skills (02 hrs)

Types of interviews, Focus of interview, dress code, importance of body language.

Probable interview questions, Telephonic and video interview, Strategies for success at interview.

Unit 3: - Resume Building (02 hrs)

Meaning, Difference among Bio-data, Curriculum vitae and Resume.

CV writing tips, The content of Resume, Structure of Resume

Books

1. Prashant Sharma, SOFT SKILLS PERSONALITY DEVELOPMENT FOR LIFE SUCCESS. BPB Publication.
2. P. D. Chaturvedi & Mukesh Chaturvedi, Business Communication: Concepts, Cases, and Applications 2nd Edition. Pearson Education.
3. Barun Mitra, Personality Development and Soft Skills. Oxford University Press.
4. Dr.K.Alex, *Soft Skills Know yourself and Know the World*. S.ChandPublishing, 2014
5. R.S Agrawal, Quantitative Aptitude.
6. Arun Sharma, How to Prepare for Quantitative Aptitude.
7. R. S Agrawal, Verbal and Non Verbal Reasoning.
8. R.V.Praveen,Quantitative Aptitude and Reasoning, 2nd Revised Edition 2013, Prentice-Hall of India Pvt.Ltd.
9. G. K. Ranganath, C. S. Sampangiram and Y. Rajaram, A text Book of business Mathematics, 2008, Himalaya Publishing House

JAIDEV EDUCATION SOCIETY'S

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Department of Information Technology

"Progress Beyond Excellence"

Session: 20220-23

Course Structure and Syllabus (Autonomous)

For

B. Tech. Information Technology Programme

Course Structure and Syllabus

For

B. Tech. Information Technology Programme

Curriculum for Semester- VII [Fourth Year]

7th Semester

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				Credit
				L	T	P	CA	MSE	ESE	Total	
1	ESC	IT7T001	Data Science	2	1	0	20	20	60	100	3
2	PCC	IT7T002	Artificial Intelligence & Cognitive Robotics	3	0	0	20	20	60	100	3
2	PEC	IT7TE04	Elective-IV	2	1	0	20	20	60	100	3
3	PEC	IT7TE05	Elective -V	2	1	0	20	20	60	100	3
5	OEC	IT7O003	OPEN Elective -III	3	0	0	20	20	60	100	4
6	ESC	IT7L002	Data Science using R (Lab)	0	0	2	60	0	40	100	1
7	PEC	IT7L003	Middleware Technolgies(Lab)	0	0	2	60	0	40	100	1
8	PROJECT	IT7P004	Project Phase I	0	0	6	50	0	50	100	3
9	MC	IT7T005	Research Methodology	2	0	0	15	10	25	50	Audit
				14	**3**	**10**	**285**	**110**	**455**	**850**	**21**

Open Elective-3 : Cloud Computing & Storage Management

IT7T001	Data Science	3 Credit

COURSE OBJECTIVES:

1. To Understand the basic concepts used in data Science

2. To Understand data collection and pre-processing

3. To Understand problems solving using data science

4 To Introduce concepts of Data Collection and Data Pre-Processing

5. To develop skills in students to solve applications based problems on Data Science

COURSE OUTCOMES:

After learning the course the student will be able:

1. To build the fundamentals of Data Science.

2. To apply Data Collection and Data Preprocessing Strategies.

3. To compare and choose data visualization method for effective visualization of data

4. To implement regression models, model evaluation and validation

5. To test Multiple Parameters by using Grid Search

Course Contents:

Unit 1 **[7 Hrs]**

Introduction to Data Science : What is Data Science, importance of data science, Big data and data Science, The current Scenario, Industry Perspective Types of Data: Structured vs. Unstructured Data, Quantitative vs. Categorical Data, Big Data vs. Little Data, Data science process, Role Data Scientist.

Unit 2 **[7 Hrs]**

Data Collection and Data Pre-Processing : Data Collection Strategies, Data Pre-Processing Overview, Data Cleaning, Data Integration and Transformation, Data Reduction, Data Discretization.

Unit 3 **[7 Hrs]**

Exploratory Data Analytics : Descriptive Statistics, Mean, Standard Deviation, Skewness and Kurtosis, Box Plots, Pivot Table, Heat Map, Correlation Statistics.

Unit 4 **[8 Hrs]**

Model Development : Simple and Multiple Regression, Model Evaluation using Visualization, Residual Plot, Distribution Plot, Polynomial Regression and Pipelines, Measures for In-sample Evaluation, Prediction and Decision Making, Feature Engineering

Unit 5 **[7 Hrs]**

Model Evaluation : Generalization Error, Out-of-Sample Evaluation Metrics, Cross Validation, Overfitting, Under Fitting and Model Selection, Prediction by using Ridge Regression, Testing Multiple Parameters by using Grid Search

Text Books:

1. JojoMoolayil, “Smarter Decisions: The Intersection of IoT and Data Science”, PACKT, 2016.
2. Cathy O’Neil and Rachel Schutt , “Doing Data Science”, O'Reilly, 2015
3. David Dietrich, Barry Heller, Beibei Yang, “Data Science and Big data Analytics”, EMC 2013
4. Raj, Pethuru, “Handbook of Research on Cloud Infrastructures for Big Data Analytics”, IGI Global.

Reference Books:

1. Cathy O’Neil and Rachel Schutt. Doing Data Science, Straight Talk From The Frontline. O’Reilly.
2. Jure Leskovek, Anand Rajaraman and Jeffrey Ullman. Mining of Massive Datasets. v2.1,Cambridge University Press.
3. Laura Igual and Santi Segui, Introduction to Data Science: A Python Approach to Concepts, Techniques

IT7T002	Artificial Intelligence and Cognitive Robotics	3 Credit

Course Objective:

1. Learn about knowledge for the design of robotics.
2. Understand robot kinematics and robot programming.
3. Understand application of Robots.
4. Learn about force and torque sensing.
5. To learn about application of robot.

Course Outcomes:

Upon Completion of this course the student will be able to:

1. List the objectives and functions of modern Artificial Intelligence.
2. Categorize an AI problem based on its characteristics and its constraints.
3. Have a glance at machine learning algorithms and extracting knowledge models from data.
4. Learn different logic formalisms and decision taking in planning problems.
5. Learn how to analyze the complexity of a given problem and come with suitable optimizations.

Unit -I: Introduction to Artificial Intelligence ,Features of AI , Agents and Environments, structure of agents, problem solving agents, problem formulation, AI techniques- search knowledge.

[7 Hrs]

Unit- II: Searching- Searching for solutions, uniformed search strategies – Breadth first search, depth first Search. Search with partial information (Heuristic search) Hill climbing, A* ,AO* Algorithms, Problem reduction, Game Playing-Adversial search, Games, mini-max algorithm, optimal decisions in multiplayer games, Problem in Game playing, Alpha-Beta pruning, Evaluation functions.

[7 Hrs]

Unit -III: Knowledge Representation& Learning, Uncertainty, probabilistic reasoning-Bayesian Network, probabilistic reasoning over time-Inference in temporal Model, Hidden Markov models-Kalman filters, Dynamic Bayesian Network, speech recognition **[8 Hrs]**

Unit IV: Learning: Concept of learning, learning automation, genetic algorithm, learning by inductions, neural nets. Programming Language: Introduction to programming Language. Handling Uncertainties: Non-monotonic reasoning, Probabilistic reasoning, use of certainty factors, Fuzzy logic

[7 Hrs]

Unit -V: AI in Cognitive Robotics: Robotic perception, localization, mapping- configuring space, planning uncertain movements, dynamics and control of movement, Ethics and risks of artificial intelligence in robotics. Case study of AI in robotics. **[7 Hrs]**

References:

1. Stuart Russell, Peter Norvig, Artificial Intelligence: A modern approach, Pearson Education, India.

2. Negnevitsky, M, Artificial Intelligence: A guide to Intelligent Systems,. Harlow: Addison-Wesley,2002.

3. E. Rich and K. Knight, “Artificial intelligence”, TMH, 2nd ed..

4. Nilsson, N. J. (1986). Principles of artificial intelligence. Morgan Kaufmann.

5. Craig, J. J. (2009). Introduction to robotics: mechanics and control, 3/E. Pearson Education India.

6. D.W. Patterson, “Introduction to AI and Expert Systems”, PHI, 1992.

7. Peter Jackson, “Introduction to Expert Systems”, AWP, M.A., 1992.

8. R.J. Schalkoff, “Artificial Intelligence - an Engineering Approach”,

IT7TE04A	Computational Intelligence	3 Credit

Course Objectives:

1. Understand the basic techniques, theory and computational models of Fuzzy and Soft computing.

2. Understand several neural network algorithms over real-time problems to get optimized outcome

Course Outcomes: After completing the course, the students will be able to

CO1: To provide a strong foundation on fundamental concepts in Computational Intelligence.
CO2: To enable Problem-solving through various searching techniques.
CO3: To apply these techniques in applications which involve perception, reasoning and learning.
CO4: To apply Computational Intelligence techniques for information retrieval
CO5: To apply Computational Intelligence techniques primarily for machine learning.
CO6: To Apply fuzzy principles and thinking to deal with vulnerability and tackle realtime issues

Unit 1 **[7 Hrs]**

Introduction to Computational Intelligence:
Computational Intelligence Paradigms, Introduction to Fuzzy logic, Fuzzy sets and membership functions, Operations on Fuzzy sets, Fuzzy relations, rules, propositions, implications and inferences, Defuzzification techniques, Fuzzy logic controller design.

Unit 2 **[7 Hrs]**

Artificial Neural Networks:

Artificial Neuron, Supervised Learning Neural Networks, Unsupervised Learning Neural Networks, Performance Issues (Supervised Learning), Performance Measures, Accuracy, Complexity, Convergence.

Unit 3 **[7 Hrs]**

Evolutionary Computation:

Introduction to Evolutionary Computation, Genetic Algorithms: Crossover, mutation, selection, Differential evolution algorithm, Hybrid Differential Evolution Strategies, Differential Evolution for Discrete-Valued Problems.

Unit 4 **[7 Hrs]**

Multi-objective Optimization Problem Solving:

Concept of multi-objective optimization problems (MOOPs) and issues of solving them, MultiObjective Evolutionary Algorithm (MOEA), Non-Pareto approaches to solve MOOPs, Paretobased approaches to solve MOOPs, Some applications with MOEAs.

Unit 5 **[8 Hrs]**

Applications of Computational Intelligent Techniques:

In solving single- objective and multi-objective optimization, scheduling problem, Parameter Estimation for Frequency-Modulated (FM) Sound Waves, Lennard-Jones Potential Problem, Gear Train Problem, Pressure vessel optimization problem, Welded beam design optimization problem

Text Books:
1. A. P. Engelbrecht, Computational Intelligence: An Introduction, John Wiley & Sons, 2007.

2. Fuzzy Logic with Engineering Applications (3rd Edn.), Timothy J. Ross, Willey, 2010.

Reference-Books:
1. NeuralNetworks: A Comprehensive Foundation, SimonHaykin. Prentice Hall

2. Neural Network Design, M. T. Hagan, H. B. Demuth, Mark Beale, Thomson Learning, Vikash Publishing House.

IT7TE04B	Computer Forensics	3 Credit

Course Objectives:

• To study the fundamentals of Computer Forensics

• To learn, analyze and validate Forensics Data

Course Outcomes:

Upon completion of the course students would be able to:

1. Conduct a computer forensics investigation, including the concept of the chain of evidence.
2. Report findings from digital forensic investigations.
3. Perform recovery of digital evidence from various digital devices using a variety of software utilities.
4. To explain the tools and tactics associated with Cyber Forensics

Unit-1 **[7 Hrs]**

Digital forensic Computer forensics and investigations as a profession, Understanding computer forensics, computer forensics versus other related disciplines, History of computer Forensics, Understanding case laws, Developing computer forensics resources, Preparing for computer investigations, Understanding law enforcement agency investigations and legal process, Understanding corporate investigations, Establishing company policies, Displaying warning Banners.

UNIT – 2 **[7 Hrs]**

Windows Systems and artifacts Windows Systems and Artifacts: Introduction, Windows File Systems, File Allocation Table, New Technology File System, File System Summary, Registry, Event Logs, Prefetch Files, Shortcut Files, Windows Executables.

UNIT – 3 **[7 Hrs]**

Linux Systems and artifacts Linux Systems and Artifacts: Introduction, Linux File Systems, File System Layer, File Name Layer , Metadata Layer, Data Unit Layer, Journal Tools, Deleted Data, Linux Logical Volume Manager, Linux Boot Process and Services, System V , BSD, Linux System Organization and

Artifacts, Partitioning, File system Hierarchy, Ownership and Permissions, File Attributes, Hidden Files, User Accounts , Home Directories.

UNIT – 4 **[7 Hrs]**

Current Computer Forensics Tools Evaluating Computer Forensics Tool Needs, Types of Computer Forensics Tools, Tasks Performed by Computer Forensics Tools, Tool Comparisons, Command-Line Forensics Tools, UNIX/Linux Forensics Tools, Other GUI Forensics Tools, Computer Forensics Hardware Tools, Forensic Workstations, Write-Blocker, Cyber forensics tools and case studies.

Unit-5 **[8 Hrs]**

Identification of data: Timekeeping, Forensic Identification and Analysis of Technical Surveillance Devices, Reconstructing Past Events: Digital Detective, Types of File Formats, Converting Files, Investigating Network Intrusions and Cyber Crime, Network Forensics and Investigating logs, Investigating network Traffic, Investigating Web attacks ,Router Forensics.

Text book:

Davis, Philipp, and Cowen, Hacking Exposed: Computer Forensics, McGraw-Hill Education

References:

1. Cory Altheide, Harlan Carvey, Digital Forensics with Open Source Tools, Syngress imprint of Elsevier.

2. Bill Nelson, Amelia Phillips, Christopher Steuart, “Guide to Computer Forensics and Investigations”, Fourth Edition, Course Technology.

3. Angus M.Marshall, “Digital forensics: Digital evidence in criminal investigation”, John – Wiley and Sons, 2008.

IT7TE04C	Robotics & Automation	3 Credit

Course Learning Objectives:

The students will be able to
1. Understand the concepts of robotics and automation.
2. Impart the knowledge of robotic programming and robotic operation control
3. Selection and analysis of robot configuration and kinematics
4. Importance of automation manufacturing techniques and processing industries
5. Development of automation system for manufacturing and processing industries

Course Outcomes:

After completing the course, the students will be able to
CO1: Understand the characteristics and working principle of robots.
CO2: Apply the related mathematical model to formulate the kinematics and trajectory planning of industrial robot.
CO3: Analyse the machine vision for effective Flexible Manufacturing Systems.
CO4: Develop model and integrate drives for industrial robots and automation systems.
CO5: Understand distributed data processing in FSM.
CO6: Work on the robotic automation.

Unit 1 **[6Hrs]**

Introduction:
Basics of kinematics, Anatomy of robot, Robot configuration, Robot joints, Sensors and drive system, Control modes, Specification of robots, Robot programming methods.

Unit 2 **[7Hrs]**

Robot-Kinematics :
Position and orientation of objects, Objects coordinate frame, Rotation matrix, Euler angles roll, pitch and yaw angles coordinate transformations, Joint variables and position of end effector, Homogeneous transformation. D-H parameters and conventions, D-H matrix, Direct kinematic and inverse analysis of planar and 3 DoF robots.

Unit 3 **[8Hrs]**

Trajectory planning:
Introduction, Path versus trajectory, Joint-space versus Cartesian-space descriptions, Basics of trajectory planning, Joint-space trajectory planning, Third-order and Fifth-order polynomial trajectory planning.
Automation in Production Systems - Manufacturing support systems, Automation principles and strategies, Levels of Automation, Production Concepts and Mathematical models, Numericals

Unit 4 **[8Hrs]**

Machine Vision:
Object recognition by features, Basic features used for object identification, Moments, Template matching,Discrete Fourier descriptors, Computed Tomography (CT), Depth measurement with vision systems, Scene analysis versus mapping, Range detection and Depth analysis, Stereo imaging, Scene analysis with shading and sizes, Specialized lighting, Image data compression, Intraframe spatial

domain techniques, Interframe coding, Compression techniques, Colour images, Heuristics, Applications of vision systems.

Unit 5 **[7 Hrs]**

Robotics Hands on :- Design of Robotics Arm in proteus using Arduino programming , Line following robot using Arduino in proteus with Arduino code, Design of robotic car using Proteus.

Text Books:

1 Mohsen Shahinpoor, "A Robot Engineering Textbook", Harper & Row Publishers, 3rd Edition, New York, ISBN:006045931X

2 John J. Craig, "Introduction to Robotics", Pearson Education International, 3rd Edition, ISBN:109876543, 1-13-123629-6

Reference-Books:

1. Mikell P Groover, "Automation, Production Systems, and Computer-integrated Manufacturing", Pearson Publishing, 3rd Edition, 2014, ISBN 978 81 203 3418 2

2. Joseph Talavage, "Flexible Manufacturing Systems in Practice Design: Analysis and Simulation", CRC Press, 1987, ISBN 9780824777180

IT7TE04D	Natural Language Processing	3 Credit

Course Learning Objectives:

1. To familiarize the concepts and techniques of Natural language Processing for analyzing words based on Morphology and CORPUS.
2. To relate mathematical foundations, Probability theory with Linguistic essentials such as syntactic and semantic analysis of text.
3. To apply the Statistical learning methods and cutting-edge research models from deep learning.

Course Outcomes:
After completing the course, the students will be able to

1. Apply the principles and Process of Human Languages such as English and other Indian Languages using computers.
2. Realize semantics and pragmatics of English language for text processing.
3. Create CORPUS linguistics based on digestive approach (Text Corpus method)
4. Check a current methods for statistical approaches to machine translation.
5. Perform POS tagging for a given natural language and Select a suitable language modelling technique based on the structure of the language.
6. Demonstrate the state-of-the-art algorithms and techniques for text-based processing of natural language with respect to morphology

Unit 1: Introduction to NLP **[7 Hrs]**

Introduction to NLP - Various stages of NLP –The Ambiguity of Language: Why NLP Is DifficultParts of Speech: Nouns and Pronouns, Words: Determiners and adjectives, verbs, Phrase Structure. Statistics Essential Information Theory : Entropy, perplexity, The relation to language, Cross entropy.

Unit 2: Text Preprocessing and Morphology **[7 Hrs]**

Character Encoding, Word Segmentation, Sentence Segmentation, Introduction to Corpora, Corpora Analysis. Inflectional and Derivation Morphology, Morphological analysis and generation using Finite State Automata and Finite State transducer.

Unit 3: Language Modelling **[7 Hrs]**

N gram models, Smoothing, Part of speech tagging, Hidden Markov models, Viterbi algorithm, Forward - backward algorithm, EM training, Models for Named Entity Recognition, Neural Language Models - Recurrent Neural Networks and Long Short term Memory networks

Unit 4: Word Sense Disambiguation **[8 Hrs]**

Methodological Preliminaries, Supervised Disambiguation: Bayesian classification, An informationtheoretic approach, Dictionary-Based Disambiguation: Disambiguation based on sense, Thesaurusbased disambiguation, Disambiguation based on translations in a second-language corpus.

Unit 5: Markov Model and POS Tagging **[7 Hrs]**

Markov Model: Hidden Markov model, Fundamentals, Probability of properties, Parameter estimation, Variants, Multiple input observation. The Information Sources in Tagging: Markov model taggers, Viterbi algorithm, Applying HMMs to POS tagging, Applications of Tagging

Text Books:

1. Christopher D. Manning and Hinrich Schutze, " Foundations of Natural Language Processing" , 6 th Edition, The MIT Press Cambridge, Massachusetts London, England, 2003
2. Daniel Jurafsky and James H. Martin "Speech and Language Processing", 3rd edition, Prentice Hall, 2009.

References:

1. NitinIndurkhya, Fred J. Damerau "Handbook of Natural Language Processing", Second Edition, CRC Press, 2010.
2. James Allen "Natural Language Understanding", Pearson Publication 8th Edition. 2012..
3. Chris Manning and HinrichSchütze, "Foundations of Statistical Natural Language Processing", 2nd edition, MITPress Cambridge, MA, 2003.
4. Hobson lane, Cole Howard, Hannes Hapke, "Natural language processing in action" MANNING Publications, 2019.

IT7TE05A	Advanced Computer Vision	3 Credit

Course Learning Objectives:

1. To build an understanding on detailed models of image formation.
2. To expose the students to image feature detection and matching.
3. To introduce fundamental algorithms for pattern recognition.
4. To introduce various classification techniques.
5. To expose the students to various structural pattern recognition and feature extraction techniques.

Course Outcomes:

After completing the course, the students will be able to

1. Appreciate the detailed models of image formation.
2. Analyse the techniques for image feature detection and matching.
3. Apply various algorithms for pattern recognition.
4. Examine various clustering algorithms.
5. Analyze structural pattern recognition and feature extraction techniques.
6. Explain various image models

Unit 1 **[6 Hrs]**

Image formation and Image model- Components of a vision system- Cameras- camera model and camera calibration- Radiometry- Light in space- Light in surface - Sources, shadows and shading **.**

Unit 2 **[7 Hrs]**

Multiple images-The Geometry of multiple views- Stereopsis- Affine structure from motion- Elements of Affine Geometry Affine structure and motion from two images- Affine structure and motion from multiple images- From Affine to Euclidean images.

Unit 3 **[7 Hrs]**

High level vision- Geometric methods- Model based vision- Obtaining hypothesis by pose consistency, pose clustering and using Invariants, Verification.

Unit 4 **[8 Hrs]**

Introduction to pattern and classification, supervised and unsupervised learning, Clustering Vs classification, Bayesian Decision Theory- Minimum error rate classification Classifiers, discriminant functions, decision surfaces- The normal density and discriminant-functions for the Normal density.

Unit 5 **[8 Hrs]**

Linear discriminant based classifiers and tree classifiers

Linear discriminant function based classifiers- Perceptron- Minimum Mean Squared Error (MME) method, Support Vector machine, Decision Trees: CART, ID3.

Text Books:

1. Bernd Jahne and Horst HauBecker, Computer vision and Applications, Academic press, 2000.
2. David A. Forsyth & Jean Ponce, Computer vision – A Modern Approach, Prentice Hall, 2002.

References

1. C. M. Bishop, Pattern Recognition and Machine Learning, Springer, 2006.
2. R. O. Duda, P. E. Hart and D. G. Stork, Pattern Classification, John Wiley, 2001.
3. Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, 2004.
4. S. Theodoridis and K. Koutroumbas, Pattern Recognition, 4th Ed., Academic Press, 2009.

IT7TE05B	AI in Digital Forensic	3 Credit

Course Objective:

On completion of the course, Students will be able to–

1. Understand the basic digital forensics concepts and techniques for conducting the forensic examination on different digital devices.
2. Understand how to examine digital evidences gathered through such as the data acquisition, identification analysis.
3. Understand the basics of Computer forensics and cyber forensics, mobile phone forensics, network forensics, Email forensics and web forensics etc.

Course Outcomes: Student will be able to

1. Describe digital forensics and relate it to an investigative process.
2. Explain the legal issues of preparing for and performing digital forensic analysis based on the investigator's position and duty.
3. Perform basic digital forensics.
4. Demonstrate use of digital forensics tools.
5. Guide a digital forensics exercise.
6. Recognize the state of the practice and the gaps in technology, policy, and legal issues.

Unit I **[7 hrs]**

Basic Definitions and terminology of AI:, Foundation and History of AI, Overview of AI problems, Evolution of AI,- Applications of AI, Classification/Types of AI. Artificial Intelligence vs Machine learning. Intelligent Agent: Types of AI Agent, Concept of Rationality, nature of environment, structure of agents. Turing Test in AI.

Unit II **[7 hrs]**

Search Algorithms in Artificial Intelligence: Terminologies, Properties of search Algorithms, Types of search algorithms: uninformed search and informed search, State Space search Heuristic Search Techniques: Generate-and-Test; Hill Climbing; Properties of A* algorithm, Best-first Search; Problem Reduction. Constraint Satisfaction problem: Interference in CSPs; Back tracking search for CSPs; Local Search for CSPs; structure of CSP Problem.

Unit III **[8 hrs]**

Knowledge-Based Agent in Artificial intelligence: Architecture, Approaches to designing a knowledge- based agent, knowledge representation: Techniques of knowledge representation, Propositional logic, Fundamentals of Digital Forensics Foundations of Digital Forensic: Digital evidence, Awareness, Principles of Digital Forensic, Challenging aspects of digital evidence, Cybertrail. Language of Computer Crime Investigation: Role of Computers in crime, Cybercrime law, offenses, jurisdiction. Traffic analysis, Fraud, IT Act.

Unit IV **[7 hrs]**

Processing Computer Crime : Introduction to Crime Scenes, Seizing and storing digital evidence at scene, Documenting the Scene and the Evidence , Dealing with Live Systems and Dead Systems, Using Hashing to Verify the Integrity of Evidence

Unit V **[7 hrs]**

Data Acquisition and Data Recovery - Understanding storage formats and digital evidence, determining the best acquisition method, acquisition tools, validating data acquisitions, performing RAID data acquisitions, remote network acquisition tools, other forensics acquisitions tools Data Recovery : Data Backup and Recovery, The Role of Backup in Data Recovery, The Data-Recovery Solution Hiding and Recovering Hidden Data , Data Handling tools

Textbooks:

1. Digital Evidence Computer Crime – Forensic science, Computers & The Internet', Eoghan Casey, 3rd edition
2. 'Computer Forensics Computer Crime scene investigation', 2nd edition, Johm R. Vacca
3. Russell, S. and Norvig, P. 2015. Artificial Intelligence - A Modern Approach, 3rd edition, Prentice Hall

Reference Books:

1. 'Computer Forensics Investigating Network Intrusions & Cybercrime', EC–Council press, Cengage Learning
2. Guide to Computer Forensics & Investigations, 4th edition, Bill Nelson, Amelia Phillips & Christopher Steuart, Cengage Learning
3. Introduction to Artificial Intelligence & Expert Systems, Dan W Patterson, PHI., 2010 2. S Kaushik, Artificial Intelligence, Cengage Learning, 1st ed.2011.

IT7TE05C	Brain Machine Interface & Interaction	3 Credit

Course Learning Objectives:
1. Understand the basic concepts of brain computer interface, interface types, EEG signals.
2. Study the state of art in neuroimaging-based approaches and their related applications and Brain Computer Interface system.
3. Analyse the different Non-invasive Electromagnetic Methods.
4. Demonstrate the concept of Data Streaming and Data Processing using suitable tool.
5. Understand the ethical issues pertaining to the development and use of Brain Computer Interface technology.
6. Understand the brain interactive system and techniques.

Course Outcomes: After completing the course, the students will be able to
CO1: Study the utilization of drives system related to the electroencephalogram (EEG) signals for neuro rehabilitation.
CO2: Understand the concept of Brain Computer Interface Systems that can be designed and developed with the overall goal of supporting a wide range of users for a wide range of applications.
CO3: Process multi-channel EEG data using a suitable tool in the computing environment which will be helpful for developing, prototyping and testing Brain Computer Interface approaches.
CO4: Solve the interoperability and standardization issues of Brain Computer Interface software platforms.
CO5: To identify and design new applications of Brain Computer Interface.
CO6: Understand the brain interactive system and techniques.

Unit 1 **[7 Hrs]**

Basics of Brain Computer Interface: Introduction, Brain Anatomy, Brain Computer Interface Types, Types of BCI Signals, Components of Interest, Monitoring Brain Activity Using EEG, BCI System, BCI Monitoring Hardware and Software, Brain Computer Interface applications, BCI Trends.

Unit 2 **[7 Hrs]**

Brain Computer Interface: A Review: Introduction, Neuroimaging-Based Approaches in the BCI, Control Signals in BCI Systems- EEG Signal Processing for BCI, Pre-processing Techniques, Feature Extraction, Classification Methods and Post-processing, Classification Performance Metrics.

Unit 3 **[7 Hrs]**

Non-invasive Electromagnetic Methods for Brain Monitoring: A Technical Review Introduction, Human Brain Anatomy, Brain Diseases, Non-invasive Brain Monitoring, Electromagnetic Brain Monitoring Methods.

Unit 4 **[8 Hrs]**

Tools for BCI Research: Introduction, Data Streaming- Field-Trip, Data-Suite: Data-River and Mat-River, Data River, Mat River, EEG LAB, Online Data Processing-A Minimalistic BCI Script, BCI LAB, Other Classification Tools, Other existing, Paradigms of interaction for BCIs Tools.

Unit 5 **[7 Hrs]**

Applications for Brain-Computer Interfaces: Introduction, BCIs for Assistive Technology, BCIs for Recreation, BCIs for Cognitive Diagnostics and Augmented Cognition, Rehabilitation and Prosthetics.

Text Books:

1. Brain-Machine Interfaces Methods and Perspectives, **Maureen Clerc,Laurent Bougrain, Fabien Lotte**, ISBN: 978-1-848-21826-0, Wiley-ISTE.
2. Brain-Computer Interfaces Current Trends and Applications, Aboul Ella Hassanien, Ahmad Taher Azar,Volume 74, Springer International Publishing2015, ISBN: 978-3-319-10977-0, DOI:10.1007/978-3-319-10978-7
3. Brain Computer Interfaces-Applying Your Minds to Human-Computer Interaction, Desney S. Tan,Anton Nijholt, ISBN: 978-1-84996-271-1, DOI: 10.1007/978-1-84996-272-8

ReferenceBooks:

1.Brain–Computer Interfaces Handbook-Technological and Theoretical Advances, Chang S. Nam,AntonNijholt, Fabien Lotte, Taylor & Francis 2018, ISBN: 13: 978-1-4987-7343-0
2. Brain-Computer Interfacing -an Introduction, Rajesh P.N.Rao,2013, ISBN: 978-0-521-76941-9

IT7TE05D	Virtual Reality	3 Credit

Course Objective:

1. Understand how the design of VR technology relates to human perception and cognition.
2. Discuss applications of VR to the conduct of scientific research, training, and industrial design.
3. Gain first-hand experience with using virtual environment technology, including 3D rendering software, tracking hardware, and input/output functions for capturing user data.
4. Learn the fundamental aspects of designing and implementing rigorous empirical experiments using VR.
5. Learn about multimodal virtual displays for conveying and presenting information and techniques for evaluating good and bad virtual interfaces.

Course Outcomes:

CO1:Describe how VR systems work and list the applications of VR.
CO2:Understand the design and implementation of the hardware that enables VR systems tobe built.
CO3:Understand the system of human vision and its implication on perception and rendering.
CO4: Explain the concepts of motion and tracking in VR systems.
CO5:Describe the importance of interaction and audio in VR systems.

Course Contents:

Unit I: Introduction to Virtual Reality **[8 Hrs]**

Defining Virtual Reality, History of VR, Human Physiology and Perception, Key Elements of Virtual Reality Experience, Virtual Reality System, Interface to the Virtual World-Input & output- Visual, Aural & Haptic Displays, Applications of Virtual Reality.

Unit II:Representing the Virtual World **[7 Hrs]**

Representation of the Virtual World, Visual Representation in VR, Aural Representation in VR and Haptic Representation in VR

Unit III: The Geometry of Virtual Worlds &The Physiology of Human Vision **[7 Hrs]**

Geometric Models, Changing Position and Orientation, Axis-Angle Representations of Rotation, Viewing Transformations, Chaining the Transformations, Human Eye, eye movements & implications for VR.
7

Unit IV: Visual Perception & Rendering **[7 Hrs]**

Visual Perception - Perception of Depth, Perception of Motion, Perception of Color, Combining Sources of Information Visual Rendering -Ray Tracing and Shading Models, Rasterization, Correcting Optical Distortions, Improving Latency and Frame Rates

Unit V:- Motion & Tracking **[7 Hrs]**

Motion in Real and Virtual Worlds- Velocities and Accelerations, The Vestibular System, Physics in the Virtual World, Mismatched Motion and Vection Tracking- Tracking 2D & 3D Orientation, Tracking Position and Orientation, Tracking Attached Bodies

Text Books:

1. Virtual Reality, Steven M. LaValle, Cambridge University Press, 2016
2. Understanding Virtual Reality: Interface, Application and Design, William R Sherman and Alan B Craig, (The Morgan Kaufmann Series in Computer Graphics)". Morgan Kaufmann Publishers, San Francisco, CA, 2002
3. Developing Virtual Reality Applications: Foundations of Effective Design, Alan B Craig, William R Sherman and Jeffrey D Will, Morgan Kaufmann, 2009.

Reference Books:

1. Gerard Jounghyun Kim, "Designing Virtual Systems: The Structured Approach", 2005.
2. Doug A Bowman, Ernest Kuijff, Joseph J LaViola, Jr and Ivan Poupyrev, "3D User Interfaces, Theory and Practice", Addison Wesley, USA, 2005.
3. Oliver Bimber and Ramesh Raskar, "Spatial Augmented Reality: Meging Real and Virtual Worlds", 2005.
4. Burdea, Grigore C and Philippe Coiffet, "Virtual Reality Technology", Wiley Interscience, India, 2003.

IT7O003	Cloud Storage Management-III(Open Elective)	4 Credit

Course Objectives:
1. To learn the concept of cloud Computing and Storage Management.
2. To understand the trade-off between deploying applications in the cloud over local infrastructure.
3. To identify different storage virtualization technologies and their benefits.
4. To understand and articulate business continuity solutions including backup and recovery technologies, local and remote replication solutions.

Course Outcomes:
After learning the course the student will be able:
1. To understand the key dimensions of the challenge of Cloud Computing.
2. To assess the economics, financial and technological implications for selecting Cloud Computing for organization.
3. To describe and apply storage technologies.
4. To identify leading storage technologies that provide cost-effective IT solutions for medium to large scale businesses and data centers.
5. To describe important storage technology features such as availability, replication, scalability and performance.

Course Content:

UNIT I Introduction: [9 Hrs]
Distributed Computing and Enabling Technologies, Cloud Fundamentals: Cloud Definition, Evolution, Architecture, Applications, Deployment models and service models, Cloud Storage Virtualization technologies and architectures, Cloud Storage Virtualization of data centers and Issues with Multi-tenancy.

UNIT II Implementation: [10 Hrs]
Study of Cloud computing Systems like Amazon EC2 and S3, Google App Engine and Microsoft Azure,Build Private/Hybrid Cloud using open source tools, Deployment of Web Services from inside and outside a Cloud Architecture, MapReduce and its extensions to Cloud Computing, HDFS and GFS.

UNIT III Storage Virtualization: [10 Hrs]
Fixed Content and Archives, Types, Features, Benefits, CAS Architecture, Object storage and retrieval, Examples: Storage Virtualization-forms of virtualization, SNIA Taxonomy – Storage virtualization configurations,Challenges, Types of storage virtualization - Business Continuity- Overview of emerging technologies such as Cloud storage, Virtual provisioning, Unified Storage, FCOE, FAST.

UNIT IV Cloud Business Storage Continuity and Recovery: [9 Hrs]
Information Availability, BC Terminology, Life cycle, Failure analysis: Backup and Recovery- Backup purpose, considerations, Backup Granularity, Recovery considerations- Backup methods, Process, backup and restore operations, Overview of emerging technologies: Duplication, Off site backup

UNIT V. Cloud Storage Security and Management: [10 Hrs]

Storage security framework, Securing the Storage infrastructure, Risk triad: Managing the storage infrastructure, Monitoring the storage infrastructure, identify key parameters and components to monitor in a storage infrastructure, List key management activities and examples, Define storage management standards and initiative-Industry trend.

Text Books:

1. Rajkumar Buyya, James Broberg, Andrzej Goscinski, "Cloud Computing Principles and Paradigms", Wiley Publishers, 2011.

2. Barrie Sosinsky, "Cloud Computing Bible", Wiley Publishers 2010.

3. Tim Mather, Subra Kumaraswamy, Shahed Latif, "Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance", O'Reilly 2010.

4. EMC Corporation, "Information Storage and Management", 1st Edition, Wiley India 2009.

Reference Books:

1. Rajkumar Buyya, Christian Vacchiola, S Thamarai Selvi, "Mastering Cloud Computing", McGraw Hill, 2013

2. Michael Miller, "Cloud Computing : Web-based Applications that change the way you work and collaborate online", Pearson Education, 2008

3. IBM, "Introduction to Storage Area Networks and System Networking", 5th Edition, November 2012.

4. Robert Spalding, "Storage Networks: The Complete Reference", Tata McGraw Hill, Osborne, 6th reprint 2003. 5. Marc Farley, "Building Storage Networks", Tata McGraw Hill, Osborne, 1st Edition, 2001

IT7L002	**Data Science using R(Lab)**	**1 Credit**

COURSE OBJECTIVES:

The course should enable the students to:

1. Understand the R Programming Language.

2. Exposure on Solving of data science problems.

3.. Understand The classification and Regression Model.

COURSE OUTCOMES:

After learning the course the student will be able:

1. To Apply Data Collection and Data Preprocessing Strategies.

2.To Compare and choose data visualization method for effective visualization of data

3. To Implement regression models, model evaluation and validation

List of Experiments:

1. R AS CALCULATOR APPLICATION

a. Using with and without R objects on console

b. Using mathematical functions on console

c. Write an R script, to create R objects for calculator application and save in a specified location in disk

2. DESCRIPTIVE STATISTICS IN R

a. Write an R script to find basic descriptive statistics using summary, str, quartile function on mtcars& cars datasets.

b. Write an R script to find subset of dataset by using subset (), aggregate () functions on iris dataset.

3. READING AND WRITING DIFFERENT TYPES OF DATASETS

a. Reading different types of data sets (.txt, .csv) from Web and disk and writing in file in specific disk location.

b. Reading Excel data sheet in R.

4. VISUALIZATIONS

a. Find the data distributions using box and scatter plot.

b. Find the outliers using plot.

c. Plot the histogram, bar chart and pie chart on sample data.

5. REGRESSION MODEL

Import a data from web storage. Name the dataset and now do Logistic Regression to find out relation between variables that are affecting the admission of a student in a institute based on his or her GRE score, GPA obtained and rank of the student. Also check the model is fit or not. Require (foreign), require (MASS).

6. MULTIPLE REGRESSION MODEL

Apply multiple regressions, if data have a continuous independent variable. Apply on above dataset.

Reference Books:

Yanchang Zhao, “R and Data Mining: Examples and Case Studies”, Elsevier, 1st Edition, 2012

Web References:

1.http://www.r-bloggers.com/how-to-perform-a-logistic-regression-in-r/

2.http://www.ats.ucla.edu/stat/r/dae/rreg.htm

3.http://www.coastal.edu/kingw/statistics/R-tutorials/logistic.html

4. http://www.ats.ucla.edu/stat/r/data/binary.csv

SOFTWARE: R Software , R Studio Software

IT7L003	**Middleware Technolgies(Lab)**	**1 Credit**

Course Outcomes:

1. To study how to create distributed server
2. To understand how to create a Java Bean.
3. To understand how to develop an enterprise.
4. To study how to develop a component.
5. To understand how to create a control.

Syllabus:

Program 1: Create a distributed name server (like DNS) RMI.

Program 2: Create a Java Bean to draw various graphical shapes and display it using or without using BDK.

Program 3: Develop an Enterprise Java Bean for student Information System.

Program 4: Develop an Enterprise Java Bean for Library operations.

Program 5: Create an Active-X control for Timetable.

Program 6: Develop a component for converting the currency values using COM / .NET

Program 7: Develop a component for browsing CD catalogue using COM / .NET

Program 8: Develop a component for retrieving information from message box using DCOM/.NET

Program 9: Develop a middleware component for retrieving Stock Market Exchange information using CORBA

Program 10: Develop a middleware component for retrieving Bank Balance using CORBA.

IT7P004	Project Phase I	3 Credit

The project should enable the students to combine the theoretical and practical concepts studied in his/her academics. The project work should enable the students to exhibit their ability to work in a team, develop planning and execute skills and perform analyzing and trouble shooting of their respective problem chosen for the project. The students should be able to write technical report, understand the importance of teamwork and group task. The students will get knowledge about literature survey, problem definition, its solution, and method of calculation, trouble shooting, costing, application and scope for future development.

Project work

The project work is an implementation of learned technology. The knowledge gained by studying various subjects separately supposed to utilize as a single task. A group of 03/04 students will have to work on assigned work. The topic could be a product design, specific equipment, live industrial problem etc. The project work involves experimental/theoretical/computational work. It is expected to do necessary literature survey by referring current journals belonging to Information Technology reference books and internet. After finalization of project, requisites like equipments, data, tools etc. should be arranged.

Project Activity

The project groups should interact with guide, who in turn advises the group to carry various activities regarding project work on individual and group basis. The group should discuss the progress every week in the project hours and follow further advice of the guide to continue progress. Guide should closely monitor the work and help the students from time to time. The guide should also maintain a record of continuous assessment of project work progress on weekly basis.

Phase I

1. Submission of project/problem abstract containing problem in brief, requirements, broad area, applications, approximate expenditure if required etc.
2. Problem definition in detail.
3. Literature survey.
4. Requirement analysis.
5. System analysis (Draw DFD up to level 2, at least).
6. System design, Coding/Implementation (20 to 30%).

IT7T005	Research Methodology	Audit

Course Objectives:

1. To know the basic data collection methods with emphasis on secondary and survey research.
2. To understand the format of primary data collection instruments.
3. To understand and use basic data analysis techniques.
4. To familiar with ethical issues in educational research, including those issues that arise in using quantitative and qualitative research.
5. To identify the overall process of designing a research study from its inception to its report.

Course Outcomes:

1. Identify a research problem stated in a study
2. Obtain skills to identify a business problem/ need, translate it into a research question, and design an appropriate way to answer it.
3. Develop skills to design a research project and collect data.
4. Develop skills to critically evaluate the quality of other researchers' findings and the process used to obtain them.
5. Identify the overall process of designing a research study from its inception to its report.

Unit-I Fundamentals of research;

Meaning, Objectives, Research process, Methods and Methodology, Criteria of good research, Review of literatures: Primary source, Secondary source, Identifying gap areas from literature review, Searching e- resources, using search engines, Searching data base.

Unit-II

Types of Research; Pure research, applied research, Exploratory Research, Descriptive research, Diagnostic research, Quantitative and Qualitative research etc.

Unit-III

Research Sampling and Design: Sampling of data: Concept of sampling, Probability sampling techniques , Non probability sampling techniques , Sampling error, Research Design: Meaning, Need, Types of research design-Exploratory Research Design, components of research design and features of good research design,

Unit-IV

Methods, Collection and Analysis of Data: Types of data, Methods of data collection- Interview Method, Mailing Method, Observation Method, Survey Method etc.; Primary and secondary sources of data, Sampling- meaning and methods, Classification and Tabulation, Graphical presentation, Application of computer in research data analysis.

Unit-V

Presentation of Research: Citation Styles- APA, MLA etc., Research ethics and Plagiarism, Indexing of journal and research output, Report writing steps in report writing, layout of report writing, reference and bibliography.

Text Books:

1. Research Methodology, Methods and Techniques by C.R Kothari, 2nd Edition.
2. Sinha, S.C. and Dhiman, A.K., 2002. Research Methodology, Ess Ess Publications. 2 volumes. 4. Trochim, W.M.K., 2005. Research Methods: the concise knowledge base, Atomic Dog Publishing. 270p.

Reference Books:

3. The Science of Education Research, Eurasia Publishing House, New Delhi by George J. (1964),
4. Advanced focus Group Research, Sage Publication, India Ltd, New Delhi by Fern Edward F. (2001)
5. Research Methodology in Management, Himalaya Publishing House, New Delhi by Michael V.P.

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Course Structure and Syllabus

For

B. Tech. Information Technology Programme

Curriculum for Semester- VIII [Fourth Year]

8th Semester

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				Credit
				L	T	P	CA	MSE	ESE	Total	
1	PEC	IT8TE06	Elective –VI	3	0	0	20	20	60	100	3
2	OEC	IT8O004	OPEN Elective - IV	3	1	0	60	20	40	100	4
3	PROJECT	IT8P001	Project Phase II	0	0	6	75	0	75	150	5
4	PCC	IT8T002	NPTEL Courses	0	0	0					2
				6	**1**	**6**	**155**	**40**	**175**	**350**	**14**

Open Elective-4 : Big Data Analytics

IT8TE06A	BITCOIN AND CRYPTOCURRENCY	3 Credit

Course Objectives:

1. To Understand the concepts of blockchain
2. Understand the core functionality and utility of Bitcoin and Cryptocurrency technologies.
3. To Understand various cryptocurrency and their working
4. To use various algorithms for distributed consensus
5. To Build a applications based on blockchain technology

Course Outcomes:

1. Understand how Bitcoin and Cryptocurrency work,
2. Understand how securely interact with them,
3. Design, build, and deploy smart contracts and distributed applications
4. Identify major research challenges and technical gaps existing between theory and practice in crypto currency domain.
5. Analyze the conceptual understanding of the function of Blockchain as a method of securing distributed ledgers.

UNIT I- **[7 Hrs]**

INTRODUCTION Basic of Blockchain Architecture – Challenges – Applications – Block chain Design Principles -The Blockchain Ecosystem - The consensus problem - Asynchronous Byzantine Agreement - AAP protocol and its analysis - Nakamoto Consensus on permission-less, nameless, peer-to-peer network - Proof of Work (PoW) - Proof of Stake (PoS) based Chains - Hybrid models (PoW + PoS), Proof of Burn, Difficulty Level, Sybil Attack.

UNIT II- **[7 Hrs]**

BITCOIN MECHANICS: Cryptographic basics for crypto currency - a short overview of Hashing, cryptographic algorithm – SHA 256,signature schemes, encryption schemes and elliptic curve cryptography- Introduction to Hyperledger- Hyperledger framework - Public and Private Ledgers.

UNIT III- **[7 Hrs]**

BIT COIN: How Does Bitcoin Work,Bitcoin's Ecosystem,Bitcoin in Practice

Bitcoin's Predecessors, Bitcoin's Early History, Bitcoin's Price, Storing Bitcoins:

Software Wallets, Hardware Wallets,Buying and Selling Bitcoins Exchanges,Merkley Tree - hardness of mining - transaction verifiability - anonymity - forks - double spending - mathematical analysis of properties of Bit coin. Bitcoin blockchain, the challenges, and solutions, alternatives to Bitcoin consensus, Bitcoin scripting language and their uses.

UNIT IV- **[8 Hrs]**

Cryptocurrency: History, Distributed Ledger, Bitcoin protocols - Mining strategy and rewards, Ethereum - Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Sidechain, Namecoin, Cryptocurrency Regulation: Stakeholders, Roots of Bit coin, Legal Aspects-Crypto currency Exchange, Black Market and Global Economy

UNIT V- **[7 Hrs]**

ETHEREUM Ethereum - Ethereum Virtual Machine (EVM) - Wallets for Ethereum - Solidity - Smart Contracts - some attacks on smart contracts. Ethereum and Smart Contracts- The Turing Completeness of Smart Contract Languages and verification challenges- comparing Bitcoin scripting vs. Ethereum Smart Contracts

Text Books:

1. Melanie Swan, “Block Chain: Blueprint for a New Economy”, O‟Reilly, first edition – 2015.

2. Daniel Drescher, “Block Chain Basics”, Apress; 1stedition, 2017

3. Anshul Kaushik, “Block Chain and Crypto Currencies”, Khanna Publishing House, Delhi.

4. Imran Bashir, “Mastering Block Chain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained”, Packt Publishing, first edition – 2012.

Websites:

1. https://developer.ibm.com/patterns/create-and-deploy-block chain-network-usingfabric-sdk-java/

2.https://docs.docker.com/get-started/https:/console.ng.bluemix.net/docs/services/block%2520chain/index. html

IT8TE06B	Full Stack Development	3 Credit

Course Learning Objectives:

1. Use their learned skills, knowledge and abilities to develop web sites for the internet.
2. Apply basic design principles to present ideas, information, products, and services on Websites.
3. Apply basic programming principles to the construction of websites.
4. Effectively manage website projects using available resources.
5. Create visualizations in accordance with UI/UX theories.
6. Develop a fully functioning website and deploy on a web server.

Course Outcomes: After completing the course, the students will be able to

CO1: Understand the formalistic (aesthetic) aspects of design and visual communication.

CO2: Develope cross-platform (web, mobile, broadcast, print) storytelling skills.

CO3: Become familiar with graphic design and/or game theory and be able to apply this theory to real world projects.

CO4:Develop and understand information design and usability as it applies to interactive media projects.

CO5: Utilize coding and software tools to analyze and present data in a professional manner that could be translated to web-based or app-based media.

Unit 1 **[7 Hrs]**

Basic HTML, Advanced HTML :

HTML-Introduction , HTML-Basic Formatting Tags , HTML-Grouping Using Div Span, HTML-Lists , HTML-Images , HTML-Hyperlink , HTML-Table, HTML-Iframe , HTML-Form, Adding audio, Drag & drop, User location: geolocation, Saving ,information - localStorage, Saving information - sessionStorage.

Unit 2 **[8 Hrs]**

CSS

What Is CSS? How to write CSS: syntax, Using style sheets, Using external style sheets, Identities and classes, Style entire elements, CSS Comments, Change background colors, Setting background images, Change text color, Text formatting using CSS, Font Properties, Text Properties, Styling hyperlinks using CSS, Styling lists using CSS, Setting element width and height, Adding borders, Spacing: margin & padding, Change the mouse type: cursor, Hide, show and display elements,

What to do with overflowing content.

CSS Advanced: Grouping & Nesting, Maximum & Minimum Dimensions, Move an element from its default position, Relative location & layering, Floating, Clear, Pseudos, Alignment Sprites: the most efficient way to load images, Make elements translucent: opacity, Different media types, Style elements based on their attributes, Browser prefixes.

Unit 3 **[7 Hrs]**

Javascript Basics

JavaScript Essentials, What is JavaScript?, JavaScript: Internal vs. External, JavaScript comments, document.write(); Display info from the browser: alert & confirm, Prompting the user for Information, Programming fundamentals: Variables, Add two sentences together: concatenation, Basic math in JavaScript, Redirecting users and opening ne6w windows, creating empty hyperlinks, String Manipulation, Comparing variables and values, Programming fundamentals: If...Else Statements, Else...If Statements, Switch Statements, Functions; JavaScript Events, Selecting HTML Elements using getElementById(), Escaping content, Programming fundamentals: Arrays, For Loops, While Loops, Breaking Out Of Loops, Skipping A Loop Cycle.

Unit 4 **[7 Hrs]**

ReactJS

Introduction , Templating using JSX ,Components, State and Props , Lifecycle of Components ,Components, State and Props , Lifecycle of Components ,Rendering List and Portals ,Error Handling ,Routers , Redux and Redux Saga , Immutable.js , Service Side Rendering ,Unit Testing , Webpack .

Unit 5 **[7 Hrs]**

PHP

Overview Of PHP, Basic Scripting and Looping Constructs Conditional Constructs, Modularity through Include Files, PHP Operators, PHP Functions, New Features, Arrays in PHP,Basic OOP in PHP,Writing OOP PHP

Text Books:

1. Web Development for beginners: Learn HTML/CSS/Javascript step by step with this Coding uide, Programming Guide for beginners, Website development, White Belt Mastery, ISBN 9781667003771.
2. The Road to React: Your journey to master React.js in JavaScript (2021 Edition), Kindle Edition.

3. Learning PHP, MySQL & JavaScript with j Query, CSS & HTML5, Publisher Shroff Publishers & Distributers, ISBN-13 978-9352130153

ReferenceBooks:

1.Mastering Html, Css & Javascript Web Publishing , BPB Publications , ISBN-13 978-8183335157
2. A Complete Overview On: Web-development, Notion Press, ISBN-13978-1685098407.

IT8TE06C	Advance Tools for Software	3 Credit

COURSE OUTCOMES:

CO1. Ability to understand Cyber Security Tools concepts.
CO2. Ability to understand and apply Business Management Strategy.
CO3. Ability to understand and use automated test generation techniques
CO4. Ability to use various Business analaysis tools/frameworks.
CO 5 Ability to understand various CRM Software Tools,

Unit 1: Cyber Security Software Tools **[7 Hrs]**
Introduction, How Important Is Cybersecurity , Types of CyberSecurity Tools , Comparison of Top CyberSecurity Software List of Best CyberSecurity Tools SolarWinds Security Event Manager Syxsense System Mechanic Ultimate Defense Acunetix Netsparker

Unit 2: Business Management Software **[7 Hrs]**
What Is Business Management Software?, Benefits of Business Management Software, List of Best Business Management Software, Comparison of Top Business Management Software monday.com , Studio Creatio, Oracle NetSuite, Keap , Process Bliss, HubSpot ,Additional Business Management Tools
,

Unit 3: CRM Software Tools **[7 Hrs]**
Introduction to CRM Tool , Features of CRM System, Benefits:, several famous CRM toolslike Salesforce CRM, SAP CRM, ZOHO CRM, Oracle CRM, Microsoft Dynamics CRM, Nimble CRM, Sugar CRM, Hubspot CRM, PIPEDRIVE CRM, CRM Creatio **,**

Unit 4: Business Analysis Tools **[8 Hrs]**
Introduction, Importance of Business Analysis , Business Analysis Techniques , Business Analysis Process – Sequentially , How Do Business Analysts Analyze BusinessRequirements? , Most Popular Business Analysis Tools :- Pipedrive (CRM) , Oracle NetSuit, Xplenty , Wrike, Business Process Diagramming, Wire framing, Flowcharts, Model Building Designing , Requirements Management**.**

Unit 5: Test Tools and Automation Testing Tools **[7 Hrs]**
Introduction, Tool Selection, . Tool Lifecycle, Tool Metrics, Automation testing Tools :-Selenium Webdriver Tools ,QTP/UFT,Load Runner & QC AutoIT, Rest Assured Framework,Agile Scrum Methodology, Appium. Framework TestNG ,POM .

Text Books:

1. Advanced Software Testing - Vol. 2, 2nd Edition, 2nd Edition. O'REILLY MEDIA, INC
2. Paul C. Jorgensen, Software Testing: A Craftsman‟s Approach, 3rd Edition, CRC Press, 2007.
3. Learning Path Learn Selenium , O'Reilly Media, INC.

Reference Books

1. Boris Beizer, Software Testing Techniques, Dreamtech, 2009

IT8TE06D	Advanced Distributed Database System	3 Credit

Course Outcomes:

1. Understand theoretical and practical aspects of distributed database systems.

2. Study and identify various issues related to the development of distributed database system.

3. Understand the design aspects of object-oriented database system and related development.

4. To understand the difference between the centralized and distributed database systems.

5. To introduce the students to the needed techniques that are used to design and manage a distributed database, such as fragmentation, query processing, recovery and replication.

Course Objectives:

1 .The aim of this module is to build on the previous background of database systems by deepening the understanding of the theoretical and practical aspects of the database technologies.

2 The need for distributed database technology to tackle deficiencies of the centralized database systems.

3 Introducing the concepts and techniques of distributed database including principles, architectures, design, implementation and major domain of application.

Unit 1 **[7Hrs]**

Introduction:

Introduction: Distributed Data Processing, Distributed Database System, Promises of DDBSs, Problem areas.
Distributed DBMS Architecture:
Architectural Models for Distributed DBMS, DDMBS Architecture.
Distributed Database Design:
Alternative Design Strategies, Distribution Design issues, Fragmentation, Allocation.

Unit 2

Query processing and decomposition **[7Hrs]**

Query processing and decomposition:
Query processing objectives, characterization of query processors, layers of query processing, query decomposition, localization of distributed data.
Distributed query Optimization:
Query optimization, centralized query optimization, distributed query optimization algorithms.

Unit 3 **[7 Hrs]**

Transaction Management

Transaction Management:

Definition, properties of transaction, types of transactions, distributed concurrency control: serializability, concurrency control mechanisms & algorithms, time - stamped & optimistic concurrency control Algorithms, deadlock Management.

Unit 4 **[7 Hrs]**

Distributed DBMS Reliability:

Reliability concepts and measures, fault-tolerance in distributed systems, failures in Distributed DBMS, local & distributed reliability protocols, site failures and network partitioning.

Parallel Database Systems:

Parallel database system architectures, parallel data placement, parallel query processing, load balancing, database clusters.

Unit 5 **[8 Hrs]**

Distributed object Database Management Systems:

Fundamental object concepts and models, object distributed design, architectural issues, object management, distributed object storage, object query Processing.

Object Oriented Data Model:

Inheritance, object identity, persistent programming languages, persistence of objects, comparison OODBMS and ORDBMS

TEXT BOOKS:

1. M. Tamer OZSU and Patuck Valduriez: Principles of Distributed Database Systems, Pearson Edn. Asia, 2001.

2. Stefano Ceri and Giuseppe Pelagatti: Distributed Databases, McGraw Hill.

REFERENCE BOOKS:

1. Hector Garcia-Molina, Jeffrey D. Ullman, Jennifer Widom: "Database Systems: The Complete Book", Second Edition, Pearson International Edition

IT8P001	Project Phase II	5 Credit

This is continuous work to the project phase I. Every students will have to submit a completed report (3 copies)* of the project work. Report preparation guidelines should be followed as per given format. The students will prepare a power point presentation of the work. Panel of examiners comprising of guide, internal examiner, senior faculty, external examiner, etc. will assess the performance of the students considering their quality of work.

Phase II

1. Coding/Implementation.
2. Use cases.
3. Testing/Trouble shooting.
4. Data dictionary/ Documentation.
5. Finalization of project in all respect.

*(For guide, Personal copy, Departmental library.)

In a presentation, the students should focus to clarify problem definition and analysis of the problem.

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Education to Eternity

SESSION 2020-21

1st Semester (AI)

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				Credit
				L	T	P	CA	MSE	ESE	Total	
1	HSMC	HU1T002	Introduction to Computer programming	2	0	0	20	20	60	100	2
2	BSC	MA1T001	Engineering Mathematics- I	3	1	0	20	20	60	100	4
3	BSC	AI1T005	Engineering Physics	3	1	0	20	20	60	100	4
4	ESC	AI1T006	Energy and Environment Engineering	3	0	0	20	20	60	100	3
5	HSMC	HU1L002	Introduction to Computer programming Lab	0	0	4	60	0	40	100	2
6	ESC	AI1L001	Workshop Practices	0	0	4	60	0	40	100	2
7	BSC	AI1L005	Engineering Physics Lab	0	0	2	60	0	40	100	1
8			Induction Programme	3 Weeks							
9	ESC	AI1T008	Introduction to AI and its Application	2	0	0	10	15	25	50	Audit
				13	2	10					18

2nd Semester (AI)

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				Credit
				L	T	P	CA	MSE	ESE	Total	
1	HSMC	HU2T001	Communication Skills	2	0	0	60	0	40	100	2
2	BSC	MA2T001	Engineering Mathematics- II	3	1	0	20	20	60	100	4
3	BSC	AI2T002	Engineering Chemistry	3	1	0	20	20	60	100	4
4	ESC	AI2T003	Engineering Graphics	1	0	0	20	20	60	100	1
5	HSMC	HU2L001	Communication Skills Lab.	0	0	4	60	0	40	100	2
6	BSC	AI2L002	Engineering Chemistry Lab	0	0	2	60	0	40	100	1
7	ESC	AI2L003	Engineering Graphics Lab	0	0	4	60	0	40	100	2
8			Societal Internship/ Field Training	Report submission						50	1
9	ESC	AI2T009	Introduction to Drones	2	0	0	10	15	25	50	Audit
				11	2	10					17

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SESSION 2021-22

3rd Semester Artificial Intelligence

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				
				L	T	P	CA	MSE	ESE	Total	Credit
1	HSMC	AI3T001	Organization Behaviour	2	0	0	20	20	60	100	2
2	HSMC	AI3T002	Universal Human Rights	2	1	0	20	20	60	100	3
3	BSC	AI3T003	Mathematics-III	2	1	0	20	20	60	100	3
4	ESC	AI3T004	Statistical Data Analysis	3	0	0	20	20	60	100	3
5	PCC	AI3T005	Computer Architecture and Organisation	3	0	0	20	20	60	100	3
6	PCC	AI3T006	Internet of Things	2	1	0	20	20	60	100	3
7	PCC	AI3T007	Data Structure & Algorithm	2	1	0	20	20	60	100	3
8	ESC	AI3L008	Introduction to IoT (Lab)	0	0	2	60	0	40	100	1
9	ESC	AI3L009	DSA (Lab)	0	0	2	60	0	40	100	1
10	ESC	AI3L010	Data Analytics (Lab)	0	0	2	60	0	40	100	1
				16	**4**	**6**	**320**	**140**	**540**	**1000**	**23**

4th Semester Artificial Intelligence

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				Credit
				L	T	P	CA	MSE	ESE	Total	
1	PCC	AI4T001	Theory of Computation	2	1	0	20	20	60	100	3
2	PCC	AI4T002	Design & Analysis of Algorithm	2	1	0	20	20	60	100	3
3	PCC	AI4T003	Operating System & Virtualization	3	0	0	20	20	60	100	3
4	PCC	AI4T004	Neural Networks & Fuzzy System	3	0	0	20	20	60	100	3
5	PCC	AI4T005	Discrete Mathematics & Graph Structures	3	0	0	20	20	60	100	3
6	PCC	AI4T006	Database Management Systems	3	0	0	20	20	60	100	3
7	PCC	AI4L007	Introduction to Robotics-(Lab)	0	0	2	60	0	40	100	1
8	PCC	AI4L008	Neural Networks & Fuzzy System (Lab)	0	0	2	60	0	40	100	1
9	PCC	AI4L009	DBMS-(Lab)	0	0	2	60	0	40	100	1
10	MC	AI4T010	Consumer Affairs	2	0	0	10	15	25	50	Audit
11	PROJECT	AI4P011	Field Training/ Industrial Visit	0	0	0	30	0	20	50	1
				18	**2**	**6**	**340**	**135**	**525**	**1000**	**22**

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KATOL ROAD, NAGPUR

SESSION 2022-23

Education to Eternity

5th Semester Artificial Intelligence

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				Credit
				L	T	P	CA	MSE	ESE	Total	
1	PCC	AI5T001	AI & Cognitive Robotics	3	0	0	20	20	60	100	3
2	PCC	AI5T002	Digital Image Techniques and Analysis	2	1	0	20	20	60	100	3
3	PCC	AI5T003	Machine Learning & Deep Learning	2	1	0	20	20	60	100	3
4	PCC	AI5O001	Open Elective -I	3	0	0	20	20	60	100	3
5	PEC	AI5TE01	Elective -I	3	0	0	20	20	60	100	3
6	PCC	AI5L004	Machine Learning & Deep Learning (Lab)	0	0	2	60	0	40	100	1
7	PCC	AI5L005	Digital Image Techniques and Analysis (Lab)	0	0	2	60	0	40	100	1
8	PCC	AI5L006	AI & Cognitive Robotics (Lab)	0	0	2	60	0	40	100	1
9	PROJECT	AI5P007	Mini Project	0	0	2	0	0	50	50	1
10	PROJECT	AI5P008	Field Training/ Industrial Visit	0	0	0	30	0	20	50	1
11	IED	AI5T008	Innovation and Enterprenership Development	2	0	0	10	15	25	50	Audit
				15	**2**	**8**	**290**	**115**	**495**	**900**	**21**

Open Elective 1: Ethics in IT

6th Semester Artificial Intelligence

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				Credit
				L	T	P	CA	MSE	ESE	Total	
1	PCC	AI6T001	Advanced Computer Vision	2	1	0	20	20	60	100	3
2	ESC	AI6T002	Data Science	2	1	0	20	20	60	100	3
3	PEC	AI6TE02	Elective -II	3	0	0	20	20	60	100	3
4	PEC	AI6TE03	Elective-III	3	0	0	20	20	60	100	3
5	OEC	AI6O002	Open Elective-II	3	1	0	20	20	60	100	4
6	PCC	AI6L003	Data Science Using R -Lab	0	0	2	60	0	40	100	1
7	PCC	AI6L004	Advanced Computer Vision (Lab)	0	0	2	60	0	40	100	1
8	PCC	AI6L005	Big Data Tools & Techniques(LAB)	0	0	2	60	0	40	100	1
9	PROJECT	AI6P006	Mini Project	0	0	2	25	0	25	50	1
10	PROJECT	AI6P007	CRT(Campus Recruitment Traini	0	0	2	60	0	40	100	1
11	PROJECT	AI6P008	Skill Development	0	0	2	15	0	35	50	1
12	IPR	AI6T007	Intellectual Property Rights	2	0	0	10	15	25	50	Audit
				15	**3**	**12**	**390**	**115**	**545**	**1050**	**22**

Open Elective 2: Object Oriented Methodology

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SESSION 2023-24

7th Semester Artificial Intelligence

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme L	T	P	Evaluation Scheme CA	MSE	ESE	Total	Credit
1	PCC	AI7T001	AI in Intelligence Systems	3	0	0	20	20	60	100	3
2	PEC	AI7TE04	Elective-IV	3	0	0	20	20	60	100	3
3	PEC	AI7TE05	Elective -V	3	0	0	20	20	60	100	3
4	PCC	AI7T002	Sequential NLP	3	0	0	20	20	60	100	3
5	OEC	AI7O003	Open Elective-III	3	1	0	20	20	60	100	4
6	PCC	AI7L003	AI in Intelligence System-Lab	0	0	2	60	0	40	100	1
7	PCC	AI7L004	Data Security & Privacy (Lab)	0	0	2	60	0	40	100	1
8	PROJECT	AI7P005	Project phase-I	0	0	6	75	0	75	150	5
9	RM	AI7T006	Research Methedology	2	0	0	10	15	25	50	Audit
				17	**1**	**10**	**305**	**115**	**480**	**900**	**23**

8th Semester Artificial Intelligence

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				
				L	T	P	CA	MSE	ESE	Total	Credit
1	PEC	AI8TE06	Elective –VI	3	0	0	20	20	60	100	3
2	OEC	AI8O004	Open Elective -IV	3	1	0	20	20	60	100	4
(Sr. No. 1, 2) OR (3)											
3	PROJECT	AI8P001	Internship	0	0	0	100	0	100	200	7
4	PROJECT	AI8P002	Project phase-II	0	0	4	50	0	50	100	3
5	PEC	AI8P003	NPTEL	0	0	0	25	0	25	50	2
				6	**1**	**4**	**215**	**0**	**175**	**350**	**12**

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Education to Eternity

JAIDEV EDUCATION SOCIETY'S
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KATOL ROAD, NAGPUR

Course Title : **Communication Skills**
Course Code :**HU1T001/ HU2T001**
Pre-requisite : **Basic knowledge of English**
Stream :**Theory subject**

Semester : **I&II**
Course Type : **Compulsory**
L – T – P : **2 – 0 – 0**
Credits : **2**

Course Objectives:

The main objective of the subject is to enhance the employability skills of engineering studentsas well as communication skills at work place.

The sub-objectives are:

1) To develop students' reading skills and pronunciation.
2) To develop technical communication skills through drafting, letter writing, and précis writing.
3) To develop literary skills through essay writing.
4) To develop public speaking skills of the students.

Course Outcomes:

At the end of the course students will be able to

1) to better reading comprehension, pronunciation, and functional English grammar.
2) to write letters and resumes
3) to organize their thoughts for effective presentation and writing.
4) to learn skills to present themselves well in an interview, and handle a Group Discussion

To expose the students to the ethics of English language by teaching grammar

Unit 1: Communication and Communication Processes **(06 hrs)**

Introduction to Communication, Types and functions of Communication, Barriers to Communication and overcoming them, Role of Communication Skills in Society

Reading: Introduction to Reading, Barriers to Reading, Types of Reading: Skimming, Scanning, Intensive and Extensive, Strategies for Reading Comprehension.

Listening : Importance of Listening, Types of Listening, Barriers to Listening.

Unit 2: Study of Sounds in English and Vocabulary Building **(06 hrs)**

Introduction to phonetics, Study of Speech Organs, Study of Phonemic Script, Articulation of Different Sounds in English.

Vocabulary Building: The concept of Word Formation, Root words from foreign languages and their use in English, Use of prefixes and suffixes from foreign languages in English to form derivatives, Synonyms, antonyms, and standard abbreviations

Unit 3: English Grammar **(06 hrs)**

Grammar: Forms of Tenses, Articles, Prepositions, Use of Auxiliaries and Modal Auxiliaries, Sentence Structures, Use of phrases and clauses in sentences, Importance of proper punctuation, Common Errors. Misplaced modifiers

Unit 4: Professional Verbal Communication **(06 hrs)**

Components of an effective talk, Idea of space and time in public speaking, Tone of voice, Body language, Timing and duration of speech, Audio-Visual Aids in speech. Presentation Skills, Group Discussion and Job Interviews

Unit 5: Developing Business Writing Skills, Styles and Practice **(06 hrs)**

Writing Emails, Report Writing: Format, Structure and Types, Letter Writing: Types, Parts, Layouts, Writing Job Application Letter and Resume.

Nature and Style of sensible Writing and Practice: Describing, Defining, Classifying, Providing examples or evidence, writing introduction and conclusion, Writing Practices: Comprehension, Précis Writing, Essay Writing

Text book:

Mohd. Ashraf Rizvi, Communication Skills for Engineers, Tata McGraw Hill

Reference Books:

1) Sanjay Kumar, Pushp Lata, Communication Skills, Oxford University Press, 2016
2) Meenakshi Raman, Sangeeta Sharma, Communication Skills, Oxford University Press, 2017
3) Teri Kwal Gamble, Michael Gamble, Communication Works, Tata McGraw Hill Education, 2010
4) Anderson, Kenneth. Joan Maclean and Tossny Lynch. Study Speaking: A Course in Spoken English for Academic Purposes. Cambridge: CUP, 2004.
5) Aswalthapa, K. Organisational Behaviour, Himalayan Publication, Mumbai (1991).
6) Atreya N and Guha, Effective Credit Management, MMC School of Management, Mumbai (1994).
7) Balan,K.R. and Rayudu C.S., Effective Communication, Beacon New Delhi (1996).
8) Bellare, Nirmala. Reading Strategies. Vols. 1 and 2. New Delhi. Oxford University Press, 1998.
9) Bhasker, W. W. S & Prabhu, N. S.: English through Reading, Vols. 1 and 2. Macmillan,

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Education to Eternity

Course Title : Communication Skills-Lab **Semester : I& II**
Course Code : HU1L001/ HU2L001 **Course Type : Compulsory**
Pre-requisite : Basics of English grammar **L – T – P : 0 – 0– 4**
Stream :Theory subject **Credits : 2**

COURSE OBJECTIVES:

1. Apply appropriate communication skills. Students are able to enhance their employability skills as well as communication skills at work place.
2. Demonstrate knowledge of communication theory and application. Students have better reading comprehension, pronunciation, and functional English grammar.

3.Practice critical thinking to develop innovative and well-founded perspectives related to the students' emphases.
4.Build and maintain healthy and effective relationships. Students are able to write letters and resumes.

5.Use technology to communicate effectively in various settings and contexts. Students are able to organize their thoughts for effective presentation and writing.

6.Demonstrate appropriate and professional ethical behavior. Students are able to learn skills to present themselves well in an interview, and handle a Group Discussion

COURSE OUTCOMES
Students will be able to

CO1.Remember Communication Skills by giving adequate exposure in reading, writing, listening and speaking.
CO2. Understand the communication process by identifying, explaining, and applying current communication theories as they relate to a variety of contexts.
CO3. Apply proficiency, both in spoken and written English.
CO4. Analysing the communication behaviours of others and themselves in a variety of scenario (e.g. interpersonal, intercultural, group, public and professional communication, and mass media).
CO5. Evaluate and organize their thoughts for effective presentation and writing.
CO6. Improve research, organizational, and critical thinking skills by finding and evaluating reference material and organizing and presenting effective messages adapted to specific situations.

List of Practical Sessions (Any 10 PR sessions can be conducted):

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Education to Eternity

1) Pronunciation, Intonation, Stress and Rhythm(02 hrs)
2) Introduction to Phonemic symbols (02 hrs)
3) Articulation of sounds in English with proper manner (02 hrs)
4) Practice and exercises on articulation of sounds (02 hrs)
5) Read Pronunciations/transcriptions from the dictionary (02 hrs)
6) Practice and exercises on pronunciations of words (02 hrs)
7) Introduce yourself (02 hrs)
8) Importance of Business Communication with the help of a case study.(02hrs)
9) Listening Skills/ Comprehension(02 hrs)
10) Common Everyday Situations: Conversations and Dialogues(02 hrs)
11) Communication at Workplace(02 hrs)
12) Rapid reading sessions (02 hrs)
13) Draft Email(02 hrs)
14) Resume Writing(02hrs)
15) Drafting Business Letter(02 hrs)
16) Preparing technical paper using IEEE format(02 hrs)
17) Extempore (02 hrs)
18) Elocution (02 hrs)
19) Group discussion (02 hrs)
20) Participating in a debate (02 hrs)
21) Presentation techniques (02 hrs)
22) Interview techniques – Job Interviews, Telephonic Interviews(02hrs)
23) Mock interviews and practice sessions(02 hrs)

Program: B.Tech. in Artificial Intelligence

Semester	Course Code	Name of the course	L	T	P	Credits
III	AI3T001	Organizational Behaviour	2	0	0	2

Prerequisites for the course	
1.	Communication skills (verbal and written)
2.	Honesty/integrity.
3.	Interpersonal skills (relates well to others)

Prior Reading Material/useful links	
1.	http://catalog.umd.umich.edu/graduate/coursesaz/ob/ob.pdf

Course Outcomes:

Sr. No	Course Outcome number	CO statement
1	CO1	Students will be able to remember various methods and terms used in different organizational behaviour models.
2	CO2	Students will be able to understand Individual as well as Group Behaviour like attitude, perception, motivation, personality, misbehaviour and emotions.
3	CO3	Students will be able to apply the Principles of Organization Behaviour through leadership, Power & Politics.
4	CO4	Students will be able to analyse the dynamics of organizational behaviour and managing change.
5	CO5	Students will be able to evaluate the importance of Advanced Communication tools and Techniques for the decision-making Process.

Syllabus:

	Course Contents	Hours
Unit I	**Introduction to organization Behaviour** Meaning, Fundamental concepts, Definition, Approaches to OB, Characteristics and limitations of OB, Challenges and Opportunities of OB, Models of OB, Impact of technology on organizational behaviour. **Organization Culture** Meaning and dimensions, Role of founders' values and vision in creating and sustaining culture, Types of organizational cultures, Impact of culture on image and performance of the organization. **[7Hrs]**	
Unit II	**Organizational Design, Change and Innovation** Designing an organizational structure, Division of labour, Delegation of authority, Departmental biases, Span of control, Dimensions of structure, Organizational design models, Multinational Structure and Design, Virtual Organizations. **Communication**: The importance of communication, the communication process, communicating within organizations, Information richness, how technology affects communication, Interpersonal communication, Multicultural communication, Barriers	

	to effective communication, Improving Communication in organizations, Promoting ethical communications **Technical Report Writing:** Characteristics of Technical Communication, Types of Technical Documents, Establishing Goals in Technical Writing, Technical Writing Process: Prewriting, writing, rewriting, Examples of Industries user manuals. **[6 Hrs]**
Unit III	**Personality** Meaning of personality, Nature and Determinants of Personality, Personality Traits - Big Five, Locus of Control, Self-esteem, Type A/ Type B Personality, Risk Taking, Machiavellianism, Self-Monitoring, Personality and OB. **Attitude:** Attributes of personality- Transactional Analysis – Ego states – Johari window - Nature and dimensions of attitude – Developing the right attitude, ABC model of Attitude, Managerial Implications of Attitude **[6Hrs]**
Unit IV	**Groups and Organizations** Groups and Teams, Group Dynamics - Groups versus teams, Nature and types of groups and teams, five stages of group/team development, Determinants of group behaviour, Typical teams in organizations. **Leadership:** Leadership as a concept and its essence, Leaders versus managers, Blake and Mouton's managerial grid, Hersey and Blanchard's situational leadership, Transactional versus Transformational leadership, Women as leaders, Leadership in entrepreneurial and family business, organizations. **[7 Hrs]**
Unit V	**Motivation** Power and purpose of motivation, Theories of motivation - Locke's goal setting theory, Vroom's expectancy theory, Porter and Lawler's model, Adam's equity theory, McClelland's theory of needs, Motivational Techniques – Job design/enlargement /enrichment / rotation, Managing rewards - Job status based rewards, Competency based rewards, performance based rewards, Empowerment and Self-Managed Teams. **Power and Politics**: The concept of power, Sources of power, Interdepartmental power, Illusion of power, Political strategies and tactics, Ethics, power and politics, using power to manage effectively. **Empowerment and Participation**: The nature of empowerment and participation, How participation works, Programs for participation, Important considerations in participation. **[6 Hrs]**

Text Books	
1.	V.G.Kondalkar , "Organization Behaviors" , New Age International Publisher,2007.
2.	Uma Sekaran, "Organization Behaviors" , McGraw Hill Company, New Delhi ,2011.
3.	Nair, Banerjee, Agarwal , "Organization Behaviors" , PrgathiPrakashan, New Delhi,2006.

Reference Books

1.	.LM Prasad , “Organization Behavior”, S. Chand and Co. Ltd, New Delhi,2008.
2.	S.S. Khanka , “ Organization Behavior”, S. Chand and Co. Ltd, New Delhi , 2008
3.	Fred Luthans , **“** Organization Behavior”,McGraw Hill Book Co,2005

Useful Links	
1.	http://catalog.umd.umich.edu/graduate/coursesaz/ob/ob.pdf
2.	https://www.investopedia.com/terms/o/organizational-behavior.asp
3.	https://onlinecourses.swayam2.ac.in/cec20_mg03/preview

Semester	Course Code	Name of the course	L	T	P	Credits
4th	AI4T010	Consumer Affairs	2	0	0	2

Prerequisites for the course	
1	A basic concept of Ethics in IT
2	A basic concept of human Universal value

Prior Reading Material/useful links	
1	www.consumeraffairs.nic.in
2	www.consumeraffairs.nic.in
3	www.iso.org

Course Outcomes:

Students will be able to:

Sr. No	Course outcome number	CO statement
1	CO1	The student should be able to comprehend the business firms' interface with consumers
2	CO2	The student should be able to comprehend the consumer related regulatory and business environment.
3	CO3	To provides an understanding of the procedure of redress of consumer complaints,
4	CO4	It Provide different agencies in establishing product and service standards.
5	CO5	To comprehend the social framework of consumer rights and legal framework of protecting consumer rights.

Syllabus:

Course Contents	
Unit I	Consumer and Markets: Concept of Consumer, Nature of markets: Liberalization and Globalization of markets with special reference to Indian Consumer Markets, E-Commerce with reference to Indian Market, GST, and Digital consumer issues. Experiencing and Voicing Dissatisfaction: Consumer buying process, Consumer Satisfaction/Dissatisfaction-Grievances-complaint, Consumer Complaining Behaviour: Alternatives available to Dissatisfied Consumers; Complaint Handling Process: ISO 10000 suite. **[6Hrs]**

Unit II	**Objectives and Basic Concepts**: Consumer rights and UN Guidelines on consumer protection, Consumer goods, defect in goods, spurious goods and services, service, deficiency in service, unfair trade practice, and restrictive trade practice. **[8Hrs]**
Unit III	**Grievance Redressal Mechanism under the Indian Consumer Protection Law** Who can file a complaint? Grounds of filing a complaint; Limitation period; Procedure for filing and hearing of a complaint; Disposal of cases, Relief/Remedy available; Temporary Injunction, Enforcement of order, Appeal, frivolous and vexatious complaints; Offences and penalties. **[8Hrs]**
Unit IV	**Role of Industry Regulators in Consumer Protection** i. Banking: RBI and Banking Ombudsman ii. Insurance: IRDA and Insurance Ombudsman iii. Telecommunication: TRAI iv. Food Products: FSSAI v. Electricity Supply: Electricity Regulatory Commission vi. Real Estate Regulatory Authority **[7Hrs]**
	Text Books
1	Khanna, Sri Ram, Savita Hanspal, Sheetal Kapoor, and H.K. Awasthi. (2007) *ConsumerAffairs*, Universities Press.
2	Choudhary, Ram Naresh Prasad (2005). *Consumer Protection Law Provisions andProcedure*, Deep and Deep Publications Pvt Ltd.
3	Empowering Consumers e-book, ebook, www.bis.org
	Reference Books
1	Misra Suresh, (Aug 2017) “Is the Indian Consumer Protected? One India One People
2	Raman Mittal, Sonkar Sumit and Parineet Kaur (2016) Regulating Unfair Trade Practices: An Analysis of the Past and Present Indian Legislative Models, Journal ofConsumer Policy.
3	Chakravarthy, S. (2014). MRTP Act metamorphoses into Competition Act. CUTSInstitute for Regulation and Competition position paper. Available online at www.cuts-international.org/doc01.doc.
	Useful links
1	www.bis.org
2	www.consumeraffairs.nic.in

Semester	Course Code	Name of the course	L	T	P	Credits
5th	AI5T008	Innovation and Entrepreneurship Development	2	0	0	2

Prerequisites for the course	
1	Business Communication

Prior Reading Material/useful links	
1	https://www.nextiva.com/blog/what-is-business-communication.html

Course Outcomes:
Students will be able to:

Sr. No	Course outcome number	CO statement
1	CO1	To gain an expansive and deep appreciation of entrepreneurship and its pivotal role in the economy.
2	CO2	To approach entrepreneurship with clarity and focus, and an enhanced understanding of the key success factors as well as possible risks and potential mitigation strategies.
3	CO3	To navigate the opportunities and challenges of entrepreneurship more effectively with the additional insights available.
4	CO4	To evaluate the key factors needed to develop a successful business
5	CO5	To recognize the value of problem-solving, effective business management

Syllabus:

Course Contents	
Unit I	Entrepreneurial Journey, Entrepreneurial Discovery, Ideation, and Prototyping **[4hrs]**
Unit II	Testing, Validation, and Commercialisation, Disruption as a Success Driver, Technological Innovation and Entrepreneurship – 1, Technological Innovation and Entrepreneurship – 2 **[6 hrs]**
Unit III	Raising Financial Resources, Education and Entrepreneurship, Beyond Founders and Founder-Families **[4 hrs]**
Unit IV	India as a Start-up Nation, National Entrepreneurial Culture **[4 hrs]**
Unit V	Entrepreneurial Thermodynamics, Entrepreneurship and Employment. Start-up Case Studies. **[6 hrs]**
Text Books	
1	Innovation and Entrepreneurship: Practice and Principles by Peter F Drucker
2	The Innovator's Solution: Creating and Sustaining Successful Growth by Clayton M Christensen
Reference Books	
1	Zero to One: Notes on Startups, or How the Build the Future by Peter Thiel
2	The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses by Eric Ries

Useful links	
1	https://www.lakeforest.edu/academics/majors-and-minors/entrepreneurship-and-innovation/student-learning-
2	https://www.indeed.com/career-advice/career-development/innovative-

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An Autonomous Institute, with NAAC "A" Grade
Department of Electronics and Telecommunication Engineering
"Rectifying Ideas, Amplifying Knowledge"
Session: 2020-21

Course Structure and Syllabus (Autonomous)

For

Third Semester B. Tech. in Electronics and Telecommunication Engineering

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				Credit
				L	T	P	CA	MSE	ESE	Total	
1	BSC	ET3T001	Multivariate Calculus	2	1	0	20	20	60	100	3
2	ESC	ET3T002	Electronic Devices & Circuits-I	3	1	0	20	20	60	100	4
3	PCC	ET3T003	Analog communication system	2	1	0	20	20	60	100	3
4	PCC	ET3T004	Digital Circuits and microprocessor	2	1	0	20	20	60	100	3
5	PCC	ET3T005	Integrated circuit and application	3	1	0	20	20	60	100	4
6	PCC	ET3T006	Network synthesis and analog filter	2	1	0	20	20	60	100	3
7	ESC	ET3L002	Electronic Devices & Circuits-I lab	0	0	2	60	0	40	100	1
8	PCC	ET3L003	Analog communication system lab	0	0	2	60	0	40	100	1
9	PCC	ET3L004	Digital Circuits and microprocessor Lab	0	0	2	60	0	40	100	1
10	Internship	ET3F007	Field Training-1	0	0	0	0	0	50	50	1
11	MC	ET3T008	Innovation and Entrepreneurship Development	2	0	0	10	15	25	50	Audit
			Total	**16**	**6**	**6**	**310**	**135**	**555**	**1000**	**24**

ET3T001	Multivariate Calculus	3 Credit

Course outcomes:

Students will be able to:

1. Describe properties of Laplace transform, Convolution Theorem, Fourier integral theorem, Parseval's identity, Cauchy's integral theorem, Cauchy's residue theorem.
2. Illustrate the examples using Laplace transform, Fourier Transform, Partial differential equation, Function of Complex Variables, Matrices.
3. Apply the knowledge of Laplace transform, Z-transform, function of complex variable, Advance partial differential equation.
4. Analyze the question on Laplace transform, Fourier Transform, Partial differential equation, Function of Complex Variables
5. Create a modal using Laplace transform, Fourier Transform, Theory of probability, Function of Complex Variables, Matrices.

Course Contents:

Module-1: Matrices **[6 Hrs]**

Characteristics equation, Eigen values and Eigen vectors, Statement and Verification of Cayley Hamilton Theorem [without proof], Reduction to Diagonal form, Sylvester's theorem [without proof.]

Module-2: Laplace Transform **[5 Hrs]**

Definition – conditions for existence; Properties of Laplace transforms; Transforms of some special functions- periodic function, Heaviside-unit step function.

Module-3: Inverse Laplace Transform **[5 Hrs]**

Introductory remarks; Inverse transforms of some elementary functions; Partial fraction method and Convolution Theorem for finding inverse Laplace transforms; Applications to find the solutions of differential equations.

Module-4: Z-Transform **[5 Hrs]**

Definition, Convergence of Z-transform and Properties, Inverse Z-transform by PartialFraction Method, Residue Method (Inversion Integral Method), Solutions of DifferenceEquations with Constant Coefficients by Z- transform.

Module-5: Theory of Probability **[6 Hrs]**

Axioms of Probability, Conditional Probability, Baye's Rule, Random variables: Discrete and Continuous random variables, Probability function and Distribution function, Joint distributions, Independent Random Variables, Conditional Distributions.

Module-6: Functions of Complex Variables **[5 Hrs]**

Analytic functions; Conjugate functions; Cauchy- Riemann equations in Cartesian and polarforms; Harmonic functions in Cartesian form, Cauchy's integral theorem; Bilinear transform Cauchy's integral formula; Residues; Cauchy's residue theorem (All theorem without proofs)

Text Books:

1. Higher Engineering Mathematics by B. S. Grewal, Khanna Publishers, NewDelhi.
2. Advanced Engineering Mathematics by Erwin Kreyszig, John Wiley & Sons, NewYork.
3. A Course in Engineering Mathematics (Vol III) by Dr. B. B. Singh, Synergy Knowledgeware, Mumbai.
4. A Text Book of Applied Mathematics (Vol I & II) by P. N. Wartikar and J. N.Wartikar, Pune VidyarthiGriha Prakashan, Pune.
5. Higher Engineering Mathematics by H. K. Das and Er. RajnishVerma, S. Chand & CO.Pvt. Ltd., NewDelhi.

Reference Books:

1. Higher Engineering Mathematics by B. V. Ramana, Tata McGraw-Hill Publications, NewDelhi.
2. A Text Book of Engineering Mathematics by Peter O' Neil, Thomson Asia PteLtd., Singapore.
3. Advanced Engineering Mathematics by C. R. Wylie & L. C. Barrett, TataMcgraw-Hill Publishing Company Ltd., NewDelhi.
4. Integral Transforms and Their Engineering Applications by Dr.B.B.Singh, Synergy. Knowledgeware, Mumbai.
5. Integral Transforms by I. N. Sneddon, Tata McGraw-Hill, NewYork.
6. Advanced Mathematics for Engineers by Chandrika Prasad

ET3T002	Electronics Devices and Circuits-I	4 Credit

Prerequisites: Basic knowledge of Semiconductor Physics (FYT106 and FYT110)

Course Objectives:

1. To understand properties, characteristics and behaviour of basic solid state devices such as PN junction diode/BJT/JFET
2. To know and analyse different amplifier configurations.
3. To introduce concepts of feedback in electronic circuits
4. To design Electronic circuits using diodes and transistors

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Explain the working principle, operation and characteristics of basic solid state devices such as PN junction diode, BJT and JFET.
2. Apply the concept of biasing techniques and feedback to improve stability of circuits.
3. Categorize amplifiers and oscillators based on feedback topology.
4. Analyse different amplifier configurations and DC bias circuitry of BJT.
5. Interpret BJT circuits for small signal at low and high frequencies.
6. Design Electronic circuits using diodes and transistors.

Course Contents:

Module-1: Semiconductor Theory and PN Junction Devices **[5 Hrs]**

Energy bands in silicon, intrinsic and extrinsic silicon, Carrier transport in silicon diffusion current, drift current, mobility, and resistivity. Generation and recombination of carriers. P-N junction diode theory, Zener diode, Zener as a Voltage regulator, Tunnel diode, LED, Schottky diode, Varactor Diode operation, characteristics and applications such as Rectifiers, Filters

Module-2: Bipolar Junction Transistors **[5 Hrs]**

BJT Structure, Operation, Input and Output Characteristics in CE, CB and CC configuration, Comparison of transistor configurations,Ebers-Moll model, BJT biasing techniques, Load line concept, Thermal Runaway, Stability factor, Stabilization Techniques, Ratings and specifications of BJT from data sheet.

Module-3: Single Stage Amplifiers **[5 Hrs]**

BJT small signal model – Analysis of CE, CB, CC amplifiers, Concept of frequency response, Miller's theorem, Effect of coupling, bypass, junction and stray capacitance on frequency response of BJT amplifiers

Module-4: Power Amplifiers **[5 Hrs]**

Classes of Power amplifiers – Class A, Class B, Class AB, Class C and Class D amplifiers, Analysis of Class A, Class B, Class AB amplifiers, Distortions in amplifiers, concept of Total Harmonic Distortion, Comparison of power amplifiers

Module-5: Feedback Amplifiers and Oscillators **[5 Hrs]**

Feedback Concept, Classification of amplifiers based on feedback topology, (Voltage, Current, Transconductance and Transresistance amplifiers), Effect of negative feedback on various performance parameters of an amplifier, Analysis of one circuit for each feedback topology. Oscillators: Condition for oscillations, Phase shift – Wien bridge, Hartley, Colpitts and Crystal oscillators

Module-6: Junction Field Effect Transistors **[5 Hrs]**

JFET:-Structure, Symbol, Basic Operation, Drain and Transfer Characteristics, Biasing arrangements for JFET, Biasing against device variation, biasing for zero current drift.

Universal JFET bias curve, Ratings and specifications of JFET from data sheet.

Text Books:

1. Millman & Halkies, "Electronic Devices and Circuits", Second Edition, Tata McGraw Hill.

2. Boylestead & Nashelsky, "Electronic devices and Circuits Theory" Eighth edition, PHI

3. S. Salivahanan, N.Suresh Kumar,"Electronic devices and Circuits", Fourth Edition ,McGraw Hill Education (India) Private Ltd

4. Donald Neaman, "Electronic Circuit Analysis and Design", Third Edition, Tata McGraw Hill

Reference Books.

1. MillmanHalkies, "Integrated Electronics", Seventh edition,Tata McGraw Hill.

2. David A. Bell,"Electronic Device and Circuits", Fourth Edition, PHI.

3. Gupta.J.B, "Electron Devices and Circuits", Second Edition,S.K.Kataria& Sons,

4. Floyd,"Electronic Devices", Seventh Edition, Pearson.

5. Sedra and Smith, "Microelectronic Circuits", Oxford University Press, 2004.

6. Ben G. Streetman "Solid State Electronic Devices", Sixth Edition ,Pearson

E-Resources:

1. https://nptel.ac.in/courses/122/106/122106025/
2. https://onionesquereality.wordpress.com/.../more-video-lectures-iit-open
3. http://www.nesoacademy.org/electronics-engineering/analog-electronics/analog
4. http://www.electronics-tutorials.ws/transistor/tran_1.html
5. http://www.allaboutcircuits.com/textbook/semiconductors/chpt-1/active-versus-passivedevices/

ET3T003	Analog Communication System	3 Credit

Course Objectives:

1. To introduce the concepts of analog communication systems and to make the students understand the functions of major building blocks of communication system and noise performance.
2. To develop a clear insight into techniques involved in different types of modulation and demodulation of AM & FM signals.
3. To introduce the fundamental concepts of sampling theorem.
4. To describe the effect of noise in analog and pulse modulation systems

Course Outcomes:

At the end of this course, the students should be able to,

1. Explain signal to noise ratio, noise figure and noise temperature for single and cascaded stages in a communication system.
2. Distinguish between different types of analog modulation techniques based on bandwidth Occupied and power transmitted.
3. Analyze the performance of analog communications in the presence of noise by evaluating the figure of merit for different schemes of modulation
4. Evaluate different components of analog communication systems such as modulator, demodulator, mixer, receiver etc in time and frequency domain.
5. Design the modulators, demodulators for amplitude and frequency modulated systems.
6. Develop the ability to compare and contrast the strengths and weaknesses of various communication systems.

Course Contents:

Module-1: AM Transmission **[5 Hrs]**

Introduction Overview: Signals and their classifications, Fourier analysis of Signals and Systems. Elements of a Communication System, Need for modulation, Channel, Noise, and Band pass transmission: Complex low pass representation of narrowband signals and systems,
Equivalent low pass transmission model.

Module-2: AM Reception **[6 Hrs]**

Amplitude modulation DSB-FC, DSB-SC, SSB, VSB and ISB transmissions: mathematical Analysis-time and frequency domain analysis, modulation index, generation and detection methods, power requirement of these systems, Comparison of AM modulation schemes, Quadrature Carrier Multiplexing(QAM), frequency division multiplexing.

Module-3: FM Transmission **[6 Hrs]**

Angle Modulation Frequency Modulation (FM),: Single Tone Frequency Modulation, Spectrum Analysis, Narrowband FM, Wideband FM, Transmission Bandwidth of FM Waves, Generation of FM waves: Direct and Indirect Methods, Demodulation of FM, Phase Locked Loops, Limiting of FM waves, comparison between AM & FM, Phase Modulation, Relation between FM and PM.

Module-4: FM Reception **[5 Hrs]**

Radio Receivers and performance in the noise Basic receiver (TRF), Super heterodyne receiver for AM and FM, performance parameters for receiver such as sensitivity, selectivity, fidelity, image frequency rejection etc., AGC technique, Sources of noise, Signal to Noise Ratios, Figure of Merit Calculations, Noise in AM, Pre emphasis and De-emphasis in FM, Comparison of Noise Performance of different modulation schemes.

Module-5: Applications of AM and FM **[4 Hrs]**

Applications of AM and FM AM Radio, Television: Video Bandwidth, Choice of Modulation, Colour Television, HDTV, FM Radio, FM Stereo Multiplexing.

Module-6: Acoustics **[5 Hrs]**

Acoustics: Introduction to acoustic transducers, microphone and loud speakers, construction, types, characteristics and applications, Block schematic of Public address system, High quality audio such as stereophonic, Dolby, surround, 3-D etc.

Text Books:

1. J. G. Proakis and M. Salehi, "Communication system engineering", 2/e, Pearson Education Asia, 2002.

2. R. E. Ziemer, W. H. Tranter, "Principles of Communications: Systems, Modulation, and Noise", 5/e, John Wiley & Sons, 2001.

3. Simon Haykins and Michael Moher,"Communication Systems", 5th Edition, John Wiley and sons, 201

4. Communication Systems - Analog and digital, Singh and Sapre, 2nd edition, 2007, TMH.

Reference Books:

1. Wayne Tomasi, "Electronic Communications Systems – Fundamentals Through advanced", 5th Edition Pearson Education, 2012

2. H. Taub and D. L. Schilling, Principles of Communication Systems, 3rd Reprint,McGraw Hill, 2006.

3. George Kennedy and Bernard Davis," Electronic Communication systems", 4thEdition, TMH, 2008

4. Modern digital and analog Communication systems, B. P. Lathi, 3rd edition, 2015, Oxford University Press.

5. Roddy and Coolen, "Electronic Communication Systems", Pearson Education.

6. Frank R. Dungan, "Electronic Communication Systems", Delmar Publishers.

ET3T004	Digital Circuits and Microprocessor	3 Credit

Course Objectives:

1. Develop a strong foundation of digital electronics.
2. Understand concepts of combinational and sequential circuits.
3. Develop and design synchronous circuits and sequential machines.
4. Understand the concepts of processors

Course Outcomes:

Students will be able to:

1. Define Logic Families and Programmable Devices and understand the architecture of logic families and combinational digital circuits and describe the basic concept and interrupts in microprocessors.
2. Classify SOP and POS forms, combinational and sequential circuits, synchronous and asynchronous circuits.
3. Apply the principles of Boolean algebra to manipulate, minimize design logic circuits using logic gates and K-map and Use HDL & appropriate EDA tool for digital logic design and simulation.
4. Analyze combinational logic circuits and sequential circuits.
5. Recommend various combinational logic circuits like code converters, multiplexers, adders in the design of complex hierarchical combinational blocks like multipliers, fast adders etc and Validate sequential logic circuits elements like latches, flip-flops for counters, registers, simple finite state machine and similar circuits.
6. Design modular combinational circuits, synchronous sequential logic circuits and interface various devices with microprocessor.

Course Contents:

Module-1: Logic Simplification **[6 Hrs]**

Boolean Algebra and De Morgan's Theorem, SOP & POS forms, Logic Gates, combinational Logic Optimization Techniques, Canonical forms of Boolean expression. Implementations of Boolean expressions using logic gate, Introduction to logic families & their characteristics such as Fan-In, Fan-out, Propagation delay, Power dissipation, Noise Margin

Module-2: Combinational logic Design **[5 Hrs]**

Comparators, Multiplexers, Demultiplexer, Encoder, Decoder, K-Map, half and full adders, Subtractors, serial parallel adders, Barrel Shifter, ALU. VHDL constructs and codes for combinational circuits.

Module-3: Sequential circuits **[5 Hrs]**

Latches and flip-flops: SR-FF, D-FF, JK-FF, Master-Slave JK-FF & T-FF's, Excitation &Truth Table, Flip-flop conversions, Shift registers. Introduction to Synchronous Counters: Ring counter, Johnson counter.

Module-4: Synchronous machines **[5 Hrs]**

Classification of synchronous machines, Design of synchronous sequential machines using Moore & Mealy circuits: Sequence detector, State diagram and implementation.

Module-5: Fundamentals of Microprocessor **[5 Hrs]**

Basic 8085 microprocessor architecture and its functional blocks, 8085 microprocessor IC pinouts and signals.

Module-6: Programming with 8085 **[6 Hrs]**

Assembly Language Programming Basics, Addressing Modes, Instruction set of microprocessor, Instruction timing diagram. Writing, Assembling & Executing Assembly Language Programs, Memory Interfacing.

Text Books:

1. An approach to digital Design: Morris Mano, Pearson Publications.
2. Microprocessor Architecture, Programming and Applications with the 8085:Ramesh Gaonkar, Penram International Publications.
3. Engineering Approach to Digital Design: W. Fletcher, PHI Publications.

Reference Books:

1. Fundamentals of digital circuits: A. Anand Kumar, Prentice-Hall of India, 4Edition.t
2. Modern digital Electronics: R.P. Jain, Tata McGraw Hill, 4Edition.r
3. Digital Electronic Principles: Malvino, PHI, 3Edition.

ET3T005	Integrated Circuit and Applications	4 Credit

Prerequisites:

1. Concepts of Basic Electrical Engineering.
2. Fundamentals of Engineering Mathematics

Course Objectives:

1. To understand characteristics of various Analog Circuits.
2. To study and interpret the datasheet
3. To study various op-amp parameters and their significance for Op-Amp.
4. To analyze and identify linear and nonlinear applications of Op-Amp.
5. To understand functionalities of PLL.

Course Outcomes:

Students will be able to:

1. Understand and explain the basic concepts of OPAMP.
2. Demonstrate the working principle of various analog circuits.
3. Conduct experiments using analog electronic components, electronic instruments and modern tool.
4. Analyze analog circuits to evaluate various performance parameters.
5. Compare multivibrator circuits, Data converters.
6. Design and realize filters, Oscillators, linear and non-linear applications of Op-Amp.

Course Contents:

Module-1: Introduction to Operational Amplifier **[6 Hrs]**

Op-Amp Fundamentals: Block diagram of operational amplifier, Op-Amp parameters, virtual ground concept, Differential amplifiers, Interpreting datasheet. Inverting & non invertingconfigurations **Circuits with resistive feedback**: Concept of feedback & their types.

Module-2: OP-Amp Linear Applications **[6 Hrs]**

Voltage follower, Summing amplifier, scaling and averaging amplifier, Instrumentation amplifier and applications, Integrator and differentiators (Practical considerations and design), current to voltage converters, voltage to current converters, Peak detector, using Op-Amp & Transistor and analog multipliers.

Module-3: OP-Amp Non Linear Applications **[6 Hrs]**

Comparators, Log and antilog amplifiers, Schmitt trigger, Clipper and Clamper, Precision Rectifier. Multivibrators: Bistable, Monostable, Astable multivibrator circuits using Op-Amp, Sample/Hold circuits.

Module-4: Signal Generator **[6 Hrs]**

Principle of Oscillators, Barkhausen's criterion, Oscillator types: RC, LC oscillators, Triangular wave generator, Saw tooth wave generators. Monolithic timer IC 555, applications of IC 555, V to F and F to V converters.

Module-5: Design of Converters and filters **[6 Hrs]**

D-A conversion techniques, A-D Conversion techniques, First and second order Low Pass filter, High Pass filter, Band Pass filter, Band Select and All pass active filters.

Module-6: Phase Locked Loops & multipliers **[6 Hrs]**

Block diagram of PLL free running frequency, lock range, capture range and Sample circuits for each block. Applications of PLL - Frequency synthesizer FM demodulator, AM demodulator, FSK demodulator, Analog multiplier, Multiplier IC.

Text Books:

1. David A. Bell, 'Op-amp & Linear ICs', Oxford, 2013.
2. D. Roy Choudhary, SheilB.Jani, 'Linear Integrated Circuits', II edition, New Age, 2003.
3. Ramakant A. Gayakward, 'Op-amps and Linear Integrated Circuits', IV edition, Pearson Education, 2003 / PHI. 2000.
4. N. C. Goyal and Khetan 'A Monograph on Electronics Design Principals', Khanna Publications
5. Sergio Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", McGraw Hill.

Reference Books:

1. Fiore, "Opamps& Linear Integrated Circuits Concepts & Applications", Cengage, 2010.
2. Floyd ,Buchla, "Fundamentals of Analog Circuits", Pearson, 2013.
3. Jacob Millman, Christos C. Halkias, "Integrated Electronics – Analog and Digital circuits system", Tata McGraw Hill, 2003.
4. Robert F. Coughlin, Fredrick F. Driscoll, 'Op-amp and Linear ICs', PHI Learning, 6th edition, 2012.
5. Tobey, Graham, Huelsman "Operational Amplifier Design and Applications" McGraw Hill.

ET3T006	Network Synthesis and Analog Filter	3 Credits

Prerequisites:

Basic knowledge of network analysis, Ohms law, Kirchoff's Current and Voltage law.

Course Objectives:

1. To review basic components of electric network.
2. To appreciate the consequences of linearity using various network theorems.
3. To analyze Analog circuits that include energy storage elements using Laplace transforms for circuit analysis.
4. To analyze and synthesize waveforms for different electrical parameters.
5. To analyze four terminal networks using two-port parameters
6. To learn about the basics of analog Filters

Course outcomes:

Students will be able to:

1. Define various terminologies and network theorems.
2. Understand the basics of Network synthesis and analog filters.
3. Apply knowledge of mathematics to solve numerical based on network simplification and it will be used to analyze the same.
4. Analyze steady state and transient response of electrical circuits
5. Characterize the transfer function for two – port networks.
6. Design various electrical circuits using network theorems.

Course Contents:

Module-1: Basics of electric circuits **[5 Hrs]**

Basics of electric circuits, circuit elements and their voltage – current relationship,classification of circuit elements, sources – their types and characteristics, concept of equivalent sources, source transformation, nodal analysis of circuits containing resistors, inductors, capacitors, transformers, and both independent and dependent sources to determine current, voltage, power, and energy. Series Circuit, Parallel Circuit, Source shifting, Principe of duality, concept of V-shift and I-shift.

Module-2: Basics of Network Analysis **[5 Hrs]**

Mutual inductance, coefficient of coupling, dot convention, dot marking in coupled coils, mesh analysis of circuits containing resistors, inductors, capacitors, transformers, and both independent and dependent sources to determine current, voltage, power, and energy.

Module-3: Network Theorems **[5 Hrs]**

Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem, Reciprocity Theorem.

Module-4: Laplace Transform **[5 Hrs]**

Review of Laplace Transform, concept of complex frequency, transform impedance and admittance, s – domain impedance and admittance models for resistor, inductor and capacitor, series and parallel combinations of elements. Transformed network on loop and mesh basis, mesh and node equations for transformed networks, time response of electrical network with and without initial conditions by Laplace transform, Transient analysis.

Module-5: Introduction to Active Filters **[6 Hrs]**

Aspects of filter design problem, approximation problem in network theory, maximally flat low pass filter approximation (Butterworth), Chebyshev approximations.

Module-6: Synthesis of Active filters **[5 Hrs]**

Synthesis of Active filters: Low Pass, Band Pass, RC-CR Transformation, Sensitivity, Biquad Circuits.

Text Books:

1. Franklin Kuo, "Network Analysis & Synthesis", Wiley International.
2. Govind Daryanani, "Analysis and Synthesis of Filters".

Reference Books:

1. Kendall Su, "Analog Filters", Kluwer Academic Publisher, 2nd Edition, 2002.
2. John O' Malley, "Basic Circuit Analysis", Schaum's series.
3. Van Valkenberg, "Network Analysis", Pearson Education.

ET3L002	Electronics Devices and Circuits-I Lab	1 Credit

Prerequisites: Basic knowledge of Semiconductor Physics and theoretical knowledge about the practical.

Course Objectives:

1. To identify Basic electronic components and devices
2. To observe the characteristics of diodes and Transistors
3. To analyze different amplifier configurations and their Frequency response
4. To design Electronic circuits using diodes and transistors

Course Outcomes:

At the end of the laboratory work, students will demonstrate the ability to:

1. Acquire the basic concepts of different semiconductor components and understand the use of semiconductor devices in different electronic circuits.
2. Identify basic devices such as diodes, BJT and JFET from their package information by referring to manufacturer's data sheets.
3. Plot and study the characteristics of semiconductor devices.
4. Simulate Electronic circuits using SPICE.
5. Calculate different performance parameters of transistor.
6. Design, build and test the performance of various circuits.

List of Experiments:

1. To Plot the V- I characteristics of PN junction diode (Silicon), Zener diode, LED under forward and reverse bias conditions.
2. To find the i) Voltage regulation ii) Load Regulation of a Zener shunt regulator
3. To design Half wave rectifier (with and without Filter) and find ripple factor and efficiency of Half wave Rectifier
4. To plot input and output wave forms of the Full Wave Rectifier (with and without Filter) and find ripple factor and efficiency of Full wave Rectifier
5. To observe the action of a Transistor as an Electronic switch
6. To plot input and Output Characteristics of Common Base Transistor configuration
7. To plot input and Output Characteristics of Common Emitter Transistor configuration
8. To obtain Frequency Response of single stage CE Amplifier and Find performance parameters
9. To plot Drain and Transfer characteristics of Field Effect Transistor (JFET) and Find gm,rd and μ from characteristics

10. Design and simulate LC Oscillators (Compare practical and theoretical oscillation frequency)
11. Build and test RC oscillator
12. Design and simulate Power Amplifiers - Class A, Class B, Class AB
13. Design and simulate Voltage Shunt Feedback Amplifiers
14. Design and simulate Current Series Feedback Amplifiers
15. Applications of Diodes: To verify the truth table for Logic Gates (AND & OR) using Diodes

ET3L003	Analog Communication System Lab	1 Credit

Course outcomes:

Students will be able to:

1. Observe SSB detection techniques.
2. Realize various modulation technique..
3. Generate signals using Scilab.
4. Identify and design different analog modulation techniques.
5. Analyze multiplexing systems such as FDM, TDM and QAM.
6. Compare different communication systems by analysing in time and frequency domain.

List of Experiments:

1. To generate amplitude modulated wave and determine the percentage modulation.
2. To generate frequency modulated signal and determine the modulation index and bandwidth for various values of amplitude and frequency of modulating signal.
3. To generate SSB using phase method and detection of SSB signal using Synchronous detector.
4. To generate DSB using phase method and detection of DSB signal using Synchronous detector
5. To generate the pulse amplitude modulated and demodulated signals
6. To implement the pulse width modulated and demodulated signals
7. To Design & generate the pulse position modulated and demodulated signals
8. To Study Differential PULSE Code Modulation & Demodulation
9. Implement and Study the AM Superhetrodyne radio receiver
10. To construct the frequency division multiplexing and demultiplexing circuit and to verify its operation
11. To perform the AM DSB-SC signal Generation and Detection using Scilab Simulink.
12. To perform the FM signal Generation and Detection using Scilab Simulink.
13. Quadrature Amplitude Modulation and Demodulation.
14. Time Division Multiplexing and Demultiplexing.
15. Study of phase modulator.

ET3L004	Digital Circuits and Microprocessor Lab	1 Credit

Course Objectives:

1. To acquire the basic knowledge of digital logic levels and application of knowledge to understand digital electronics circuits.

2. To prepare students to perform the analysis and design of various digital electronic circuits.

3. To study programming based on 8085 microprocessor

Course Outcomes:

Students will be able to:

1. Find and prevent various hazards and timing problems in a digital design.

2. Understand the fundamental of basic gates and their use in combinational and sequential circuits Outline the use of digital components as a switching elements.

3. Develop ability to handle arithmetic operations using assembly language programming.

4. Analyze basic arithmetic and logical circuits required in microcomputer systems.

5. Examine the structure of various number systems and its application in digital design.

6. Design various combinational and sequential circuits and develop skill to build, and troubleshoot cost effective digital circuits.

List of Experiments:

1. Verification and interpretation of truth table for AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR gates.

2. Construction of half / full adder using XOR and NAND gates and verification of its operation.

3. To Study & Verify Half and Full Subtractor.

4. Verify the truth table of RS, JK, T and D flip-flops using NAND & NOR gates.

5. Implementation and verification of decoder/de-multiplexer and encoder using logic gates.

6. Implementation of 4x1 multiplexer and 1x4 demultiplexer using logic gates.

7. Design and verify the 4- Bit Synchronous/ Asynchronous Counter using JK flip flop.

8. Verify Binary to Gray and Gray to Binary conversion using NAND gates only.

9. Verify the truth table of one bit and two bit comparator using logic gates.

10. Write a Program Using 8085 & Verify for:

a. Addition of Two 8-Bit Numbers.

b. Addition of Two 16-Bit Numbers. (With Carry)

11. Write a Program Using 8085 & Verify for:

a. Subtraction of Two 8-Bit Numbers. (Display of Borrow)

b. Subtraction of Two 16-Bit Numbers. (Display of Borrow)

12. Write a Program Using 8085 & Test for Typical Data:

a. Multiplication of Two 8-Bit Numbers by Bit Rotation Method

b. Division of Two 8-Bit Numbers by Repeated Subtraction Method

13. Write a Program to Move a Block of Data Using 8085 & Verify

14. Write a Program to Arrange Number in Ascending Order Using 8085 & Verify.

15. Write a Program to Check Number of 1's and 0's in Given Number Using 8085 &Verify.

ET3T008	Innovation and Entrepreneurship Development	Audit

Course Objectives

1. To understand the importance of Innovation and Idea Generation
2. To understand the concept of entrepreneurship.

Course Outcomes

At the end of the course students will be able to

1. Identify and validate of ideas.
2. Remember Patent registration of Innovation.
3. Understand roles and responsibilities of Entrepreneurship.

Module 1: Innovation **[06Hrs]**

Concept of creativity, innovation, invention, discovery. Methods for development of creativity, convergent & divergent thinking etc. Introduction to Intellectual Property Rights (IPR), Patent and laws related to patents.

Module2: Entrepreneurship **[06Hrs]**

Concept of entrepreneurship, its relations in economic developments, Eventuation of concept of entrepreneur, characteristics of an Entrepreneur, Types of entrepreneurs, Qualities of entrepreneur, Factors affecting growth of entrepreneurship

Module 3: Role of Entrepreneurial Bodies **[06Hrs]**

Theory of achievement, motivation, Medelland's. Experiment, Women entrepreneurship, Role of SSI, its advantages & limitations, policies governing small scale industries, Procedure to set up small scale industrial unit, Advantages and limitations of SSI.

Module4: Role of Entrepreneurial Support **[06 Hrs]**

Factors governing project selection, Market survey, Preparation of project report. Financial, technical & market analysis of project. Entrepreneurial support systems, Role of consultancy organization like, District Industrial Centre, State Industrial Development Corporation, Financial institution, Latest SSI schemes of DIC (to be confirmed from DIC from time to time.

Text Book

1) Entrepreneurship Development, S. S. Khanka, S. Chand Publishers.

Reference Book

1) Creativity Innovation & Entrepreneurship, Zechariah James Blanchard, Needle Rat Business Publishers.

JAIDEV EDUCATION SOCIETY'S
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An Autonomous Institute, with NAAC "A" Grade
Department of Electronics and Telecommunication Engineering
"Rectifying Ideas, Amplifying Knowledge"
Session: 2020-21

Education to Eternity

Course Structure and Syllabus (Autonomous)

For

Fourth Semester B. Tech. in Electronics and Telecommunication Engineering

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				Credit
				L	T	P	CA	MSE	ESE	Total	
1	BSC	ET4T001	Partial differential equation and Numerical Methods	2	1	0	20	20	60	100	3
2	ESC	ET4T002	Basics of Python Programming	3	0	0	20	20	60	100	3
3	ESC	ET4T003	Electrical Machines and Instruments	2	1	0	20	20	60	100	3
4	ESC	ET4T004	Electronic Devices and circuits-II	2	1	0	20	20	60	100	3
5	PCC	ET4T005	Signal and system	3	0	0	20	20	60	100	3
6	PCC	ET4T006	Electromagnetic Field	3	1	0	20	20	60	100	4
7	ESC	ET4L003	Electrical Machines and Instruments lab	0	0	2	60	0	40	100	1
8	ESC	ET4L004	Electronic Devices and circuits-II	0	0	2	60	0	40	100	1
9	PCC	ET4L005	Signal and system lab	0	0	2	60	0	40	100	1
10	Internship	ET4F006	Field Training-2	0	0	0	20	0	30	50	1
11	MC	ET4T007	Universal Human Values	2	0	0	10	15	25	50	Audit
			Total	**17**	**4**	**6**	**330**	**135**	**535**	**1000**	**23**

ET4T001	Partial Differential Equation and Numerical Methods	3 Credit

Course Objectives:

1. To prepare students for successful career in industries, for Post Graduate programme and to work in research institutes.
2. To understand different numerical techniques used for solving algebraic and transcendental equations.
3. To understand numerical methods to solve a system of linear equations.
4. To understand numerical integration and differentiation techniques.

Course Outcomes:

At the end of course students will be able to

1. Understand calculation and interpretation of various errors in numerical methods and partial differential equations.
2. Familiar with finite precision computation.
3. Solve nonlinear equations in a single variable and find numerical solutions.
4. Apply Numerical analysis which has enormous application in the field of science and some fields of Engineering.
5. Analyze the numerical integration and differentiation, numerical solution of ordinary differential equation.
6. Design mathematical model for various electronic applications.

Course Contents:

Module-1: Error Analysis **[6 Hrs]**

Significant figures, round-off, precision and accuracy, approximate and true error, truncation error and Taylor series, machine epsilon, data uncertainties, error propagation, importance of errors in computer programming.

Module-2: Solution of Transcendental / Polynomial Equations and System of Linear Equation **[6 Hrs]**

Solution of Transcendental / Polynomial Equations: Finding root of polynomial equations deploying computational methods such as Bisection, Regula-falsi, Newton-Raphson, Seccant, Successive approximation. System of linear equation: Solving linear equations deploying computational methods such as Gauss elimination, Gauss Jordan, Partial pivoting, Matrixtriangularisation (LU decomposition), Cholesky, Gauss Seidel and Jacobi methods.

Module-3: Interpolation and Polynomial Approximation **[6 Hrs]**

Least square approximation, Orthogonal polynomials Chebyshev polynomials, Finite difference operator and their relations, Forward, backward, central and divided difference, Newton's forward divided difference, Backward difference interpolation, Sterling interpolation, Lagrange"s interpolation polynomials, Spline interpolation, Least square approximation.

Module-4: Numerical Integration and Differentiation **[5 Hrs]**

Numerical Integration: Methods based on interpolation such as Trapezoidal rule, Simsons 1/3and 3/8 rules. Numerical differentiation: Euler's method, Modified Euler's method, Taylor'sseries, RungeKutta 2ndand 4th order, Stability analysis of above methods.

Module-5: Advance Partial Differential equations **[6 Hrs]**

Introduction Partial differential equation, method of separation of variables, Application of partial differential equations. (Heat equation, wave equation, Laplace Equation)

Module-6: Object Oriented Programming **[6 Hrs]**

Software Evaluation, Object oriented programming paradigm, Basic concepts of object oriented programming, Benefits of OOP, Object oriented languages, Applications of OOP Beginning with C++: Structure of C++ program, creating the source file, Compiling & linking, Basic data types, User defined data types, Symbolic constants, Declaration of variables, Dynamic initialization of variables, Reference variables, Operators in C++, Scope resolution operator, Type cast operator. Functions in C++: Function prototyping, Inline functions, Function overloading, Friend and virtual functions. Classes and Objects: Specifying a class, Defining member functions, C++ program with class, Arrays within a class, Memory allocation for objects, Constructors, Multiple constructor in class, Dynamic initialization of objects, Dynamic constructor, Destructors.

Texts Books:

1. Steven C Chapra, Reymond P. Canale, "Numerical Methods for Engineers", Tata McGraw Hill Publications, 2010.

2. E. Balaguruswamy, "Numerical Methods", TataMcGraw Hill Publications, 1999.

References Books:

1. V. Rajaraman, "Fundamental of Computers", Prentice Hall of India,NewDelhi, 2003.

2. S. S. Sastri, "Introductory Methods of Numerical Methods", Prentice Hall of India, NewDelhi 3rd edition, 2003.

3. K. E. Atkinson, "An Introduction to Numerical Analysis", Wiley,1978.

4. M.J. Maron, "Numerical Analysis: A Practical Approach", Macmillan, New York, 1982D.Ravichandran, "Programming with C++", TMH

5. E. Balagurusamy, "Object-Oriented Programming with C++", TMH, New Delhi,2001, 2nd Edition

6. YeshwantKanetkar, "Let us C++, BPB Pub.", Delhi, 2002, 4thEdition

ET4T002	Basics of Python Programming	3 Credits

Prerequisites: The prerequisite for learning Python is basic knowledge of concepts like Variables, Loops, and Control Statements etc.

Course Objectives:

To make students aware about

1. To understand the role computation can play in solving problems.
2. To understand why Python is a useful scripting language for developers.
3. To learn how to design and program Python applications.
4. To learn how to read and write files in Python
5. To learn how to design object□oriented programs with Python classes.
6. To learn how to use exception handling in Python applications for error handling.

Course Outcomes:

Students will be able to

1. Remember variables, types, operators, data structures, arguments, object oriented programming and libraries.
2. Understand assignment, keyword, expressions, lists, modules, exceptions and standard libraries.
3. Apply variables, types, operators, data structures, arguments, object oriented programming and Libraries.
4. Analyse modern updates in python for keyword, expressions, lists, modules, exceptions, standard libraries.
5. Evaluate storage space required to program python scripts, variables, types, operators and data structures.
6. Create python code to make functional Electronics hardware.

Course Contents:

Module-1: Introduction **[6 Hrs]**

History of Python, Need of Python Programming, Applications Basics of Python Programming Using the REPL(Shell), Running Python Scripts, Variables, Assignment, Keywords, Input-Output, Indentation.

Module-2: Types, Operators and Expressions **[6 Hrs]**

Types – Integers, Strings, Booleans; Operators - Arithmetic Operators, Comparison(Relational) Operators, Assignment Operators, Logical Operators, Bit-wise Operators, Membership Operators, Identity Operators, Expressions and order of evaluations Control Flow- if, if-elif-else, for, while break, continue, pass.

Module-3: Data Structures **[6 Hrs]**

Lists, Operations, Slicing, Methods; Tuples, Sets, Dictionaries, Sequences, Comprehensions.

Module-4: Default Arguments **[6 Hrs]**

Variable-length arguments, Anonymous Functions, Fruitful Functions (Function Returning Values), Scope of the Variables in a Function- Global and Local Variables. Modules: Creating modules, import statement, from. Import statement, name spacing, Python packages, Introduction to PIP, Installing Packages via PIP, Using Python Packages.

Module-5: Object-Oriented Programming OOP in Python **[6Hrs]**

Classes, self-variable Methods, Constructor Method, Inheritance, Overriding Methods, Data hiding, Error, and Exceptions: Difference between an error and Exception, Handling Exception, try except for block, Raising Exceptions, User Defined Exceptions.

Module-6: Brief Tour of the Standard Library **[6 Hrs]**

Operating System Interface – String Pattern Matching, Mathematics, Internet Access, Dates and Times, Data Compression, Multithreading, GUI Programming, Turtle Graphics Testing: Why testing is required ?, Basic concepts of testing, Unit testing in Python, Writing Test cases, Running Tests.

Text Books:

1 Python Programming: A Modern Approach, Vamsi Kurama, Pearson

2. Learning Python, Mark Lutz, Orielly

Reference Books:

1 Think Python, Allen Downey, Green Tea Press

2. Core Python Programming, W.Chun, Pearson

3. Introduction to Python, Kenneth A. Lambert, Cengage

E-Resources:

1.https://www.python.org/

2.https://swayam.gov.in/nd1_noc19_cs41/preview

3. https://www.codecademy.com/learn/learn-python

4. https://www.learnpython.org/

5. https://developers.google.com/edu/python/
6. https://www.datacamp.com/tracks/python-programming
7. https://www.udemy.com/courses/search/?q=python+programming
8. https://docs.python.org/3/tutorial/index.html
9. http://www.pythonchallenge.com/
10. https://www.tutorialspoint.com/python/index.htm

ET4T003	Electrical Machines and Instruments	3 Credit

Course Objectives:

1. Develop a basic foundation of Electrical Machines.
2. Understand the basic principle, construction &operation, of ac and dc machines and electrical Instruments.
3. Understand the performance characteristics of ac and dc machines and electrical Instruments
4. Understand the applications of ac and dc machines as well as electrical Instruments in day today life.

Course outcomes:

Students will be able to:

1. Remember basic principles & construction, of electrical instruments and ac & dc machines.
2. Understand the operation, performance and characteristics of electrical instruments and ac & dc machines.
3. To identify the different issues related to the electrical instruments, speed control and torque improvement in ac & dc machines.
4. Analyse the performance indices of electrical instruments and ac & dc machines. Dc machines during various conditions..
5. Evaluate the operation of ac and dc machines along with the testing of electrical instruments.
6. Solve the different problems related to operation, & performance indices of electrical instruments ac and dc machines.

Course Contents:

Module-1: DC Machines **[5 Hrs]**

Construction, working principle (motor & generator), EMF equation of DC Machine (motor and generator), Types and its characteristics of DC machines (motor and generator), back emf, starters of dc machine, Speed control of DC motor ,Breaking of DC motor, applications of DC machines (motor and generator).

Module-2: Synchronous Machines **[5 Hrs]**

Construction, types, armature reaction, circuit model of synchronous machine, determination of synchronous reactance, phasor diagram, power angle characteristics, parallel operation of synchronous generators, synchronous motor operation, synchronous condenser.

Module-3: Three phase Induction (Asynchronous) Motor **[5 Hrs]**

Types of induction motor, flux and mmf waves, development of circuit model, power across air gap, torque and power output, starting methods, cogging and crawling, speed control, deep bar/ double cage rotor, induction generator, efficiency .of induction motors

Module-4: Special Machines **[5 Hrs]**

Construction, working and application of steeper motor, variable reluctance motor, servo motor, FHP motor, hysteresis, repulsion, linear IM.

Module-5: Electrical Instruments **[6 Hrs]**

Classification selection of transducers strain gauges, LVDT, Temperature transducers, piezoelectric, photosensitive transducers, Hall Effect transducers, proximity devices Digital transducers need of signal conditioning and types, interfacing techniques of transducers with microprocessor and controller.

Module-6: Applications of Electrical Instruments **[5 Hrs]**

Measurement of electrical telemetry thickness vibration,, humidity, thermal conductivity and gas analysis emission computerized tomography, smoke and fire detection, burglar alarm, object counter level measurement, on /off timers, RTC, sound level meter, tachometer, VAW meter.

Text Books:

1. Electrical Machines by Ashfaqu Husain, Dhanpatrai and publication
2. Instrumentation Devices System edition C. S. Rajan, G. R. sharma.

Reference Books:

1. A course in Electrical and Electronic Measurement and Instrumentation" by A. K. Sawhney (Publisher name: Dhanpat Rai& Co.)
2. Electronics Instrumentation by H.S. Kalsi (Publisher McGraw Hill)
3. Abhijit Chakrabarti & Sudipta Debnath, "Electrical Machines", Tata McGraw-hill Publication.
4. William H Hayt, Jack E Kimmerly and Steven M. Durbin, "Engineering Circuit Analysis",Tata McGraw Hill.
5. A.E. Fitzgerald, Charles Kingsley & Jr. Stephen D. Umans, "Electrical Machinery", TataMcGraw-hill Publication 6th Edition.
6. I.J Nagarath& D.P Kothari, "Electrical Machines", Tata McGraw-hill Publication 4th Edition.
7. T. J. E. Miller, "Brushless permanent-magnet and reluctance motor drives", OxfordUniversity Press (1989).
8. B. L. Theraja, "Electrical technology" volume 2, S. Chand.

ET4T004	Electronics Devices and Circuits-II	3 Credit

Prerequisites: Basic knowledge of Semiconductor Physics

Course Objectives:

1. To introduce semiconductor devices MOSFET, it's characteristics, DC analysis, biasing and applications
2. To analyze and interpret MOSFET circuits for small signal
3. To study the different types of voltage regulators
4. To design different electronic circuits

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Explain the working principle, operation and characteristics of Semiconductor devices such as MOSFET
2. Apply Knowledge of semiconductor devices and concepts to implement various electronic circuits.
3. Analyze different amplifier configurations.
4. Evaluate the small signal model and performance parameters of the device.
5. Design different oscillator circuits for various frequencies
6. Build and test the performance of electronic circuits

Course Contents:

Module-1: MOSFET **[6 Hrs]**

Structure, Symbol, Construction of n-channel E-MOSFET, MOS Transistor operation, EMOSFET Characteristics& parameters, non-ideal voltage current characteristics viz. Finite output resistance, body effect, sub-threshold conduction, breakdown effects and temperature effects, N-MOS, P-MOS and CMOS devices

Module-2: MOSFET Biasing and its DC Analysis **[5 Hrs]**

Common source circuit, Load Line & Modes of operation, Common MOSFET configurations: DC Analysis, constant current source biasing, MOSFET as switch, diode/active resistor, Current sink and source, Current mirror

Module-3: CMOS Inverter **[5 Hrs]**

Principle of operation, dc characteristics, transient characteristics, noise margin, static loadMOS inverter, transmission gate

Module-4: Study of CMOS Logic

[6 Hrs]

Study of Combinational logic, gates, compound gates, multiplexers, and memory elements using CMOS technology

Module-5: Oscillators

[5 Hrs]

Barkhausen criterion, stability with feedback. Classification of oscillators, RC Oscillators: FET RC Phase Shift oscillator, Wein bridge oscillator, LC Oscillators: Hartley and Colpitts oscillators, Crystal oscillators, UJT Relaxation oscillator

Module-6: Voltage Regulators

[5 Hrs]

Block diagram of an adjustable three terminal positive and negative regulators (317,337) typical connection diagram, current boosting, Low drop out voltage regulators, Introduction to Switch Mode Power supply (SMPS), Block diagram of SMPS, Types of SMPS. Comparison of Linear Power supply and SMPS

Text Books:

1. Neil Weste and David Harris, Addison-Wesley "CMOS VLSI Design – A Circuits and Systems Perspective", Fourth edition, Pearson

2. R.L.Boylestad & Nashlesky, "Electronic devices and Circuits Theory" Nineth Edition, Prentice Hall of India

3. Donald Neaman, "Electronic Circuit Analysis and Design", Third Edition,TataMcGraw Hill

4. Millman, Halkias, "Integrated Electronics- Analog and Digital Circuits and Systems",Second Edition , Tata McGraw Hill

Reference Books:

1. BrijeshIyer, S. L. Nalbalwar, R. Dudhe, "Electronics Devices & Circuits", SynergyKnowledgeware Mumbai, 2017. ISBN:9789383352616

2. David A. Bell,"Electronic Devices and Circuits", Fourth Edition, PHI

3. Floyd," Electronic Devices", Seventh Edition, Pearson

4. Sedra and Smith, "Microelectronic Circuits", Oxford University Press, 2004

E-Resources:

1. https://nptel.ac.in/content/storage2/courses/117101058/downloads/

2. http://www.nesoacademy.org/electronics-engineering/analog-electronics/analog

3. https://onionesquereality.wordpress.com/.../more-video-lectures-iit-open

4. http://www.electronics-tutorials.ws/transistor/tran_1.html

5. http://www.allaboutcircuits.com/textbook/semiconductors/chpt-1/active-versus-passivedevices/

ET4T005	Signal and System	3 Credit

Prerequisites:

1. Basic Idea of Transform and its mathematical descriptions (Laplace, Fourier and ZTransform)
2. Differential equations and Integrals (advanced level)
3. Ordinary differential equations
4. Series and expansions
5. Fourier analysis and complex Fourier Series/transform
6. Applications of Fourier series, Fourier Transform to circuits.

Course Objectives:

1. To develop a strong foundation of continuous and discrete time signal and system.
2. Introduce ideas for analysis of various types of continuous & discrete time system.
3. Learn fundamental concepts and transforms as relevant to time and frequency domain Signals.
4. Understand the process of sampling and interpolation in real time signal transmission.

Course Outcomes:

1. Understand different types of signals & systems.
2. Familiar with the properties of LTI (Linear Time Invariant System) system and process involved in analysis of signals before transmission.
3. Solve various complex mathematical problems for signal analysis and conversion of signals from one domain to another.
4. Apply knowledge of sampling and interpolation to sample and reconstruct signals during real time signal transmission and reception.
5. Analyze continuous and discrete systems in time and frequency domain.
6. Design Various Mathematical models to Investigate stability of the system.

Course Contents:

Module-1: Basics of signals and system **[6 Hrs]**

Introduction and Classification of signals, Definition of signal, Continuous time and discrete time signal, Classification of signals as even, odd, periodic and non-periodic, Deterministic and non-deterministic, energy and power, elementary signals used for testing, Exponential, sine, impulse, step and its properties, ramp, rectangular, triangular, signum, sinc, Operations on signals, Amplitude scaling, addition, multiplication, differentiation, integration, time scaling, time shifting and time folding, Systems Definition, Classification, linear and non-linear, time variant and invariant, causal and non-causal, static and dynamic, stable and unstable, invertible.

Module-2: Time Response Analysis **[6 Hrs]**

Continuous-Time and Discrete-Time Signals, Transformations of the Independent Variable, Continuous-Time and Discrete-Time Systems, Basic System Properties, Discrete-Time LTI (Linear Time Invariant System) Systems, the Convolution Sum, Continuous-Time LTI Systems, the Convolution Integral, Properties of Linear Time-Invariant Systems, Causal LTI Systems Described by Differential and Difference Equations.

Module-3: Fourier Series Analysis **[6 Hrs]**

The Response of LTI Systems to Complex Exponentials, Fourier Series Representation of Continuous-Time Periodic Signals, Convergence of the Fourier Series, Properties of Continuous-Time Fourier Series, Fourier Series Representation of Discrete-Time Periodic Signals, Properties of Discrete-Time Fourier Series, Fourier Series and LTI Systems, Examples of Continuous-Time Filters Described by Differential Equations, Examples of Discrete-Time Filters Described by Difference Equations.

Module-4: Fourier Transform Analysis **6 Hrs**

The Continuous-Time Fourier Transform, Representation of Aperiodic Signals, The Fourier Transform for Periodic Signals, Properties of the Continuous-Time Fourier Transform, Systems Characterized by Linear Constant-Coefficient Differential Equation, The Discrete-Time Fourier Transform, Representation of Aperiodic Signals, The Fourier Transform for Periodic Signals, Properties of the Discrete-Time Fourier Transform, Systems Characterized by Linear Constant-Coefficient Difference Equations.

Module-5: Frequency Response Analysis **[6 Hrs]**

The Magnitude-Phase Representation of the Frequency Response of LTI Systems, Concept ofFrequency Response, Group Delay, Phase Delay, Time-Domain Properties of Ideal Frequency-Selective Filters, Time- Domain and Frequency-Domain Aspects of Non ideal Filters, First-Order and Second-Order Continuous-Time Systems, Discrete-Time System, Representation of a Continuous-Time Signal by its Samples, the Sampling theorem, Reconstruction of a Signal from Its Samples Using Interpolation, Aliasing effect, Discrete-Time Processing of Continuous-Time Signals.

Module-6: Laplace and Z-Domain Analysis **[6 Hrs]**

The Laplace Transform, Region of Convergence for Laplace Transforms, Inverse Laplace Transform, Properties of the Laplace Transform, Analysis and Characterization of LTI Systems Using Laplace Transform, System Function Algebra and Block Diagram Representations, The Unilateral Laplace Transform, The z-Transform, Region of Convergence for the z-Transform, Inverse z-Transform, Properties of z-Transform, Analysis and Characterization of LTI Systems Using z-Transforms, System Function Algebra and Block Diagram Representations, The Unilateral z-Transform.

Text Books:

1. Simon Haykin, Barry van Veen, "Signals and Systems", John Wiley and Sons (Asia), Private Limited,

2. B. P. Lathi, "Linear Systems and Signals", OXFORD University Press.

3. A.V. Oppenheim, A.S. Willsky and I.T. Young, "Signals and Systems", Prentice Hall,1983.

4. "Signals and Systems", A. NagoorKanni, 2nd Edition, McGraw Hill.

Reference Books:

1. J. Nagrath, S. N. Sharan, R. Ranjan, S. Kumar, "Signals and Systems", TMH New Delhi,2001.

2. M. J. Roberts, "Signals and Systems - Analysis using Transform methods and MATLAB",TMH, 2003.

3. Signals Systems and Transforms, 3rd Edition, 2004, C. L. Philips, J.M.Parr and EveA.Riskin ,Pearson education.

4. S.S. Soliman& M.D. Srinath, "Continuous and Discrete Signals and Systems", Prentice-Hall, 1990.

5. ShailaDinkarApte "Signals and Systems" Principles and Applications",CambridgeUniversityPress.

E-Resources:

1. NPTEL link principal of signals and system.
https://www.youtube.com/watch?v=xrVWB9VYZ64&list=PLq-Gm0yRYwTjwxaqapPsSAHzs4_nkQLVr

2. E-BOOK Signal and Systems Simon Haykin Wiley
https://www.academia.edu/38588821/Signal_and_Systems_Simon_Haykin_Wiley

3. E-BOOK B. P. Lathi, "Linear Systems and Signals",
https://india.oup.com/productPage/5591038/7421214/9780198062271

ET4T006	Electromagnetic Fields	4 Credits

Course Objectives:

Learners can be able to explore their knowledge in the area of EM Waves and its analysis.

1. To learn basic coordinate system, significance of divergence, gradient, curl and its applications to EM Waves.
2. To understand the boundary conditions for different materials /surfaces.
3. To get insight on finding solution for non-regular geometrical bodies using Finite
4. Element Method, Method of Moments, Finite Difference Time Domain.
5. To get the basics of microwave, transmission lines and antenna parameters.
6. Students get acquainted with different physical laws and theorems and provide basic platform for upcoming communication technologies.

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Understand characteristics and wave propagation on high frequency transmission lines
2. Carryout impedance transformation on TL
3. Use sections of transmission line sections for realizing circuit elements
4. Characterize uniform plane wave
5. Calculate reflection and transmission of waves at media interface
6. Analyze wave propagation on metallic waveguides in modal form
7. Understand principle of radiation and radiation characteristics of an antenna

Course Contents:

Module-1: Maxwell's Equations **[6 Hrs]**

Maxwell's Equations Basics of Vectors, Vector calculus, Basic laws of Electromagnetics, Maxwell's Equations, Boundary conditions at Media Interface

Module-2: Uniform Plane Wave **[6 Hrs]**

Uniform Plane Wave Uniform plane wave, Propagation of wave, Wave polarization, Poincare"s Sphere, Wave propagation in conducting medium, phase and group velocity, Power flow and Poynting vector, Surface current and power loss in a conductor.

Module-3: Transmission Lines **[6 Hrs]**

Equations of Voltage and Current on TX line, Propagation constant and characteristic impedance, and reflection coefficient and VSWR, Impedance Transformation on Loss-less and Low loss Transmission line, Power transfer on TX line, Smith Chart, Admittance Smith Chart, Applications of transmission lines: Impedance Matching, use transmission line sections as circuit elements.

Module-4: Plane Waves at a Media Interface **[6 Hrs]**

Plane wave in arbitrary direction, Reflection and refraction at dielectric interface, Total internal reflection, wave polarization at media interface, Reflection from a conducting boundary.

Module-5: Wave propagation **[6 Hrs]**

Wave propagation in parallel plane waveguide, Analysis of waveguide general approach, Rectangular waveguide, Modal propagation in rectangular waveguide, Surface currents on the waveguide walls, Field visualization, Attenuation in waveguide

Module-6: Radiation **[6 Hrs]**

Solution for potential function, Radiation from the Hertz dipole, Power radiated by hertz dipole, Radiation Parameters of antenna, receiving antenna, Monopole and Dipole antenna

Text/Reference Books

1. R.K. Shevgaonkar, Electromagnetic Waves, Tata McGraw Hill India, 2005
2. E.C. Jordan & K.G. Balmain, Electromagnetic waves & Radiating Systems, Prentice Hall, India
3. Narayana Rao, N: Engineering Electromagnetics, 3rd ed., Prentice Hall, 1997.
4. David Cheng, "Electromagnetics", Prentice Hall.
5. Sadiku, "Elements of Electromagnetics", Oxford.
6. Krauss, "Electromagnetics", McGraw Hill, New York, 4th edition.
7. W. H. Hayt, "Engineering Electromagnetics", McGraw Hill, New Delhi, 1999.
8. Edminister, Schaum series, "Electromagnetics", McGraw Hill, New York, 1993, 2nd edition.
9. Sarvate, "Electromagnetism", Wiley Eastern.

ET4L003 **Electrical Machines and Instruments Lab** **1 Credit**

Course Outcomes:

Students will be able to:

1. Remember basic principles & construction, of electrical instruments and ac & dc machines.
2. Understand the operation, performance and characteristics of electrical instruments and ac & dc machines.
3. To identify the different issues related to the electrical instruments, speed control and torque improvement in ac & dc machines.
4. Analyse the performance indices of electrical instruments and ac & dc machines.
5. Evaluate the operation of ac and dc machines along with the testing of electrical instruments.
6. Solve the different problems related to operation, & performance indices of electrical instruments ac and dc machines.

List of Experiments:

1. To study the construction of field and armature of DC Machine.
2. To determine external characteristics of DC Generator
3. To perform Load test on DC shunt motor.
4. To perform speed control of DC shunt motor using armature and field control method.
5. To perform Load test on DC shunt generator.
6. .To study and perform the voltage build up in the DC shunt Generator
7. To study the internal construction of three phase induction motor.
8. To perform no Load and block rotor tests on squirrel cage induction motor
9. To study various starting methods of three phase induction motor
10. To control speed of induction motor by V/F control
11. To control speed of slip ring induction motor by rotor resistance control
12. To study the internal construction of three phase synchronous machine.
13. Determination of sequence impedance of salient pole synchronous machine
14. To perform speed control of Stepper motor
15. To study various electrical instruments with their industrial applications.

ET4L004	Electronic Circuit and Devices-II Lab	1 Credit

Prerequisites: Basic knowledge of Semiconductor Physics and theoretical knowledge of respective practical.

Course Objectives:

1. To identify Basic electronic components and devices
2. To observe the characteristics of MOSFET, CMOS Inverter, UJT
3. To analyze different amplifier configurations and their Frequency response
4. To design and Simulate Electronic circuits

Course Outcomes:

At the end of the laboratory work, students will demonstrate the ability to:

1. Acquire the basic concepts of different semiconductor components and understand theuse of semiconductor devices in different electronic circuits.
2. Plot and study the characteristics of semiconductor devices like MOSFET, UJT
3. Simulate Electronic circuits using SPICE.
4. Calculate different performance parameters of transistor.
5. Design, build, and test the performance of various circuits.

List of Experiments:

1. To Plot Drain and Transfer characteristics of N- Channel E- MOSFET
2. To design NMOS Common source amplifier
3. To obtain the frequency response of MOSFET amplifier in common source configuration with given specifications
4. To Study MOSFET as a Switch
5. To assemble and characterize MOSFET current mirrors
6. To design and plot the static (VTC) and dynamic characteristics of a digital CMOS inverter using Virtual lab
7. To design and plot the dynamic characteristics of 2-input NAND and NOR logic gates using CMOS technology using Virtual lab
8. Implement 2:1 Multiplexer using transmission gate
9. Implementation of NAND and NOR gate
10. To Design and Simulate Wein Bridge oscillator using FET
11. To Design and Simulate RC Phase shift oscillator using FET
12. To Design and Simulate Hartley Oscillator using FET

13. To Design and Simulate Colpitts Oscillator using FET
14. To Study the operation of UJT as a Relaxation Oscillator
15. To Design adjustable Voltage Regulated Power Supply using LM317

ET4L005	Signal and System Lab	1 Credit

Course Objectives:

1. Develop a strong foundation of continuous and discrete time signal and system analysis using Scilab.
2. Understand the various continuous and discrete time signals generation methods.
3. Understand the basic operations on the signals.
4. Understand the Design and analysis of linear time-invariant (LTI) systems.
5. Understand the spectral characteristics of signals using Fourier analysis.
6. Develop a strong foundation of systems using Laplace transform and Z-transform

Course Outcomes:

Upon successful completion of this course the students will be able to:

1. Understand basics of Scilab syntax, functions and programming.
2. Familiar With characterization of various continuous and discrete time signals.
3. Solve the Problems on basic operations on the signals.
4. Apply Knowledge of linear time-invariant (LTI) systems for computing its response.
5. Analyze the spectral characteristics of signals using various transforms.
6. Design the Mathematical model of systems using various transforms.

List of Experiments:

1. Introduction to Scilab.
2. To create user defined functions for generating Continuous and Discontinues time sinusoidal signal.
3. To create user defined functions for generating Continuous and Discontinues time delta signal and unit step signal.
4. To create user defined functions for generating Continuous and Discontinues time Exponential and RAMP Signal.
5. To create user defined functions for signal operation: signal addition, subtraction, and multiplication.
6. To create user defined functions for signal operation: time shifting, time scaling and time inversion.
7. To compute convolution of two signals and verify its properties.
8. To compute auto-correlation of two signals and verify its properties.
9. To compute cross-correlation of two signals and verify its properties.
10. To obtain the response of LTI system defined by linear constant coefficient difference equations.
11. To synthesize the periodic signal using Fourier series.

12. To analyze the spectrum of the signal using Fourier transform and verify its properties.

13. To compute and plot the impulse response and pole-zero diagram of transfer function using Laplace transform

14. To compute and plot the impulse response and pole-zero diagram of transfer function using Z-transform.

15. Program for calculating Inverse z-transform of Given function.

16. Program for calculating Inverse Laplace-transform of Given function

17. To Analyze discrete-time signals with the (discrete) Fast Fourier transform

18. To find whether the system is linear or nonlinear for the given signal.

ET4T007	Universal Human Values	Audit

Course Objective:

The objective of the course is four fold:

1. Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
2. Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
3. Strengthening of self-reflection.
4. Development of commitment and courage to act.

Course Contents:

Module 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

1. Purpose and motivation for the course, recapitulation from Universal Human Values-I
2. Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration
3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
4. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority
5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
6. Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking

Module 2: Understanding Harmony in the Human Being - Harmony in Myself!

7. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
8. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility
9. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
10. Understanding the characteristics and activities of 'I' and harmony in 'I'
11. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail

12. Programs to ensure Sanyam and Health. Include practice sessions to discuss the role others have played in making material goods available to me.

Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease

Module 3: Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship

13. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship

14. Understanding the meaning of Trust; Difference between intention and competence

15. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship

16. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals

17. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives

Module 4: Understanding Harmony in the Nature and Existence - Whole existence as Coexistence

18. Understanding the harmony in the Nature

19. Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self regulation in nature

20. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space

21. Holistic perception of harmony at all levels of existence. Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

Module 5: Implications of the above Holistic Understanding of Harmony on Professional Ethics

22. Natural acceptance of human values

23. Definitiveness of Ethical Human Conduct

24. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order

25. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.

26. Case studies of typical holistic technologies, management models and production systems

27. Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations

28. Sum up. Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. to discuss the conduct as an engineer or scientist etc.

Text Books:

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010

Reference Books:

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj - PanditSunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

B. Tech (Electronics Engineering)

Proposed Curriculum for Semester VII [Final Year]

S.N.	Course Code	Type of Course	Course Title	Hours Per Week			Evaluation Scheme			Total Marks	Credits
				L	T	P	MSE	CA	ESE		
1	BTEXC701	Professional Core Course 1	Antennas and Wave Propagation	3	0	0	20	20	60	100	3
2	BTEXPE702	Program Elective 3	Group A	3	0	0	20	20	60	100	3
3	BTEXPE703	Program Elective 4	Group B	3	0	0	20	20	60	100	3
4	BTEXPE704	Program Elective 5	Group C	3	0	0	20	20	60	100	3
5	BTHM705	Humanities & Social Science including Management Courses	Financial management	2	0	0	--	50	--	50	2
6	BTEXL706	Program Elective 3 Lab		0	0	2	--	30	20	50	1
7	BTEXL707	Program Elective 4 Lab		0	0	2	--	30	20	50	1
8	BTEXL708	Program Elective 5 Lab		0	0	2	--	30	20	50	1
9	BTEXP709	Project Part-I		0	0	8	--	50	50	100	4
10	BTEXS710	Seminar		0	0	2	--	30	20	50	1
11	BTEXF612	Field Training/ Internship/Industrial Training Evaluation		--	--	--	--	--	50	50	1
			Total	**14**	**0**	**16**	**80**	**300**	**420**	**800**	**23**

Program Elective 3 (Group A)	Program Elective 4 (Group B)	Program Elective 5 (Group C)
(A) Digital Image Processing	(A) IOT 4.0	(A) Microwave Theory & Techniques
(B) Data Compression and Encryption /Cryptography	(B) Wireless Sensor Networks	(B) Satellite Communication
(C) NSQF (Level 7 Course)	(C) CMOS Design	(C) Fiber Optic Communication
(D) Parallel Processing	(D) Process Instrumentation	(D) Wireless Communication

B. Tech (Electronics Engineering)

Course Structure for Semester VIII [Fourth Year] w.e.f. 2020-2021

Course Code	Type of Course	Course Title	Weekly Teaching Scheme			Evaluation Scheme				Credits
			L	T	P	MSE	CA	ESE	Total	
• Introduction to Internet of Things • Computer Vision and Image Processing • Biomedical Signal Processing • Industrial Automation and Control • Cryptography and Network Security • Digital IC Design # Student to opt any two subjects from above list			3	-	--	20*	20*	60*	100	3
			3	-	--	20*	20*	60*	100	3
BTMEP803	Project Part-II or Internship*		--	--	30	--	--	100	150	15
		Total	--	--				220	350	21

** Six months of Internship in the industry*

**Students doing project at institute will have to appear for CA/MSE/ESE*

** Student doing project at Industry will give NPTEL examination / Examination conducted by university i.e. CA/MSE/ESE*

 # These subjects are to be studied on self –study mode using SWAYAM/NPTEL/Any other source

 # Teacher who work as a facilitator for the course should be allotted 3 hrs/week load.

 # Project Load: 2hrs/week/project.

Mapping of Courses with MOOCs Platform SWYAM / NPTEL

No	Course Name	Duration (Weeks)	Institute Offering Course	Name of Professor
1	Introduction to internet of things	12	IIT Kharagpur	Prof. Sudip Misra
2	Computer Vision and Image Processing	12	IIT Gandhinagar	Prof. M. K. Bhuyan
3	Biomedical Signal Processing	12	IIT Kharagpur	Prof. Sudipta Mukhopadhyay
4	Industrial Automation and Control	12	IIT Kharagpur	Prof. Siddhartha Mukhopadhyay
5	Cryptography & Network Security	12	IIT Kharagpur	Prof. Sourav Mukhopadhyay
6	Digital IC Design	12	IIT Madras	Prof. Janakiraman

BTEXC701	Antennas and Wave Propagation	3 Credits

Course Objectives:

- To understand the applications of electromagnetic engineering.
- To formulate and solve the Helmholtz wave equation and solve it for Uniform Plane Wave.
- To analyze and understand the Uniform plane wave propagation in various media.
- To solve the electric field and magnetic fields for a given wire antenna.

Course Outcomes:

After successfully completing the course students will be able to

1. Formulate the wave equation and solve it for uniform plane wave.
2. Analyze the given wire antenna and its radiation characteristics.
3. Identify the suitable antenna for a given communication system.

UNIT - 1

Uniform Plane Waves

Maxwell Equations in phasor form, Wave Equation, Uniform Plane wave in Homogeneous, free space, dielectric, conducting medium. Polarization: Linear, circular & Elliptical polarization, unpolarized wave. Reflection of plane waves, Normal incidence, oblique incidence, Electromagnetic Power and Poynting theorem and vector.

UNIT - 2

Wave Propagation

Fundamental equations for free space propagation, Friis Transmission equation, Attenuation over reflecting surface, Effect of earth's curvature. Ground, sky & space wave propagations. Structure of atmosphere. Characteristics of ionized regions. Effects of earth's magnetic field. Virtual height, MUF, Skip distance. Ionospheric abnormalities. Multi-hop propagation. Space link geometry. Characteristics of Wireless Channel: Fading, Multipath delay spread, Coherence Bandwidth, and Coherence Time.

UNIT - 3

Antenna Fundamentals

Introduction, Types of Antenna, Radiation Mechanism, Antenna Terminology: Radiation pattern, radiation power density, radiation intensity, directivity, gain, antenna efficiency, half power beam width, bandwidth, antenna polarization, input impedance, antenna radiation efficiency, effective length, effective area, reciprocity. Radiation Integrals: Vector potentials A, J, F, M, Electric and magnetic fields electric and magnetic current sources, solution of inhomogeneous vector potential wave equation, far field radiation.

UNIT - 4

Wire Antennas

Analysis of Linear and Loop antennas: Infinitesimal dipole, small dipole, and finite length dipole half wave length dipole, small circular loop antenna. Complete Analytical treatment of all these elements.

UNIT - 5

Antenna Arrays

Antenna Arrays: Two element array, pattern multiplication N-element linear array, uniform amplitude and spacing, broad side and end-fire array, N-element array: Uniform spacing, nonuniform amplitude, array factor, binomial and Dolph Tchebyshev array. Planar Array, Circular Array, Log Periodic Antenna, Yagi Uda Antenna Array.

UNIT - 6

Antennas and Applications

Structural details, dimensions, radiation pattern, specifications, features and applications of following Antennas: Hertz & Marconi antennas, V- Antenna, Rhombic antenna. TW antennas. Loop antenna, Whip antenna, Biconical, Helical, Horn, Slot, Microstrip, Turnstile, Super turnstile & Lens antennas. Antennas with parabolic reflectors.

TEXT/REFERENCE BOOKS

1. C. A. Balanis, “Antenna Theory - Analysis and Design", John Wiley.
2. Mathew N O Sadiku, “Elements of Electromagnetics” 3rd edition, Oxford University Press.
3. John D Kraus, Ronald J Marhefka, Ahmad S Khan, Antennas for All Applications, 3rd Edition, the McGraw Hill Companies.
4. K. D. Prasad, “Antenna & Wave Propagation”, Satya Prakashan, New Delhi.
5. John D Kraus, “Antenna& Wave Propagation”, 4th Edition, McGraw Hill, 2010.
6. Vijay K Garg, Wireless Communications and Networking, Morgan Kaufmann Publishers, An Imprint of Elsevier, 2008.

BTEXPE702A	Digital Image Processing	3 Credits

Course Objectives:

- To learn the fundamental concepts of Digital Image Processing.
- To study basic image processing operations.
- To understand image analysis algorithms.
- To expose students to current applications in the field of digital image processing.

Course Outcomes:

After successfully completing the course students will be able to

1. Develop and implement algorithms for digital image processing.
2. Apply image processing algorithms for practical object recognition applications.

UNIT - 1

Fundamentals of Image Processing

Steps in image processing, Human Visual System, Sampling & quantization, Representing digital images, Spatial & gray-level resolution, Image file formats, Basic relationships between pixels, Distance Measures, Basic operations on images-image addition, subtraction, logical operations, scaling, translation, rotation, Image Histogram, Color fundamentals & models – RGB, HSI YIQ.

UNIT - 2

Image Enhancement and Restoration

Spatial domain enhancement: Point operations-Log transformation, Power-law transformation, Piecewise linear transformations, Histogram equalization. Filtering operations- Image smoothing, Image sharpening. Frequency domain enhancement: 2D DFT, Smoothing and Sharpening in frequency domain. Homomorphic filtering. Restoration: Noise models, Restoration using Inverse filtering and Wiener filtering.

UNIT - 3

Image Compression

Types of redundancy, Fidelity criteria, Lossless compression – Runlength coding, Huffman coding, Bit-plane coding, Arithmetic coding, Introduction to DCT, Wavelet transform. Lossy compression – DCT based compression, Wavelet based compression. Image and Video Compression Standards – JPEG, MPEG

UNIT - 4

Image Segmentation and Morphological Operations

Image Segmentation: Point Detections, Line detection, Edge Detection-First order derivative –Prewitt and Sobe, Second order derivative – LoG, DoG, Canny, Edge linking, Hough Transform, Thresholding – Global, Adaptive. Otsu's Method, Region Growing, Region Splitting and Merging, Morphological Operations: Dilation, Erosion, Opening, Closing, Hit-or-Miss transform, Boundary Detection, Thinning, Thickening, Skeleton.

UNIT - 5

Representation and Description

Representation – Chain codes, Polygonal approximation, Signatures. Boundary Descriptors – Shape numbers, Fourier Descriptors, Statistical moments. Regional Descriptors – Topological, Texture, Principal Components for Description.

UNIT - 6

Object Recognition and Applications

Feature extraction, Patterns and Pattern Classes, Representation of Pattern classes, Types of classification algorithms, Minimum distance classifier, Correlation based classifier, Bayes classifier. Applications: Biometric Authentication, Character Recognition, Content based Image Retrieval, Remote Sensing, Medical application of Image processing.

TEXT/REFERENCE BOOKS

1. Rafael C. Gonzalez and Richard E. Woods, "Digital Image Processing", Third Edition, - Pearson Education.
2. S Sridhar, "Digital Image Processing", Oxford University Press.
3. Rafael C. Gonzalez, Richard E. Woods, and Steven L. Eddins, "Digital Image Processing Using MATLAB", Second Edition, - Tata McGraw Hill Publication.
4. S Jayaraman, S Esakkirajan, T Veerakumar, "Digital Image Processing", Tata Mc Graw Hill Publication

BTEXPE702B	Data Compression and Encryption/Cryptography	3 Credits

Course Objectives:

- To teach the students Lossless and Lossy compression techniques for different types of data.
- To understand data encryption techniques.
- Network security and ethical hacking.

Course Outcomes:

After successfully completion of the course, students will able to:

1. Implement text, audio and video compression techniques.
2. Understand symmetric and asymmetric key cryptography schemes.
3. Understand network security and ethical hacking.

UNIT - 1

Data Compression

Compression Techniques: Loss less compression, Lossy compression, measure of performance, modeling and coding, different types of models, and coding techniques Text Compression: Minimum variance Huffman coding, extended Huffman coding, Adaptive Huffman coding. Arithmetic coding, Dictionary coding techniques, LZ 77, LZ 78, LZW

UNIT - 2

Audio Compression

High quality digital audio, frequency and temporal masking, lossy sound compression, µ-law and A-law companding, and MP3 audio standard.

UNIT - 3

Image and Video Compression

PCM, DPCM JPEG, JPEG –LS, and JPEG 2000 standards, Intra frame coding, motion estimation and compensation, introduction to MPEG -2 H-264 encoder and decoder.

UNIT - 4

Data Security

Security goals, cryptography, stenography cryptographic attacks, services and mechanics, Integer arithmetic, modular arithmetic, and linear congruence, Substitution cipher, transposition cipher, stream and block cipher, and arithmetic modes for block ciphers, Data encryption standard, double DES, triple DES, attacks on DES, AES, key distribution center.

UNIT - 5

Number Theory and Asymmetric Key Cryptography

Primes, factorization, Fermat's little theorem, Euler's theorem, and extended Euclidean algorithm, RSA, attacks on RSA, Diffie Hellman key exchange , key management, and basics of elliptical curve cryptography, Message integrity, message authentication, MAC, hash function, H MAC, and digital signature algorithm.

UNIT - 6

System Security

Malware, Intruders, Intrusion detection system, firewall design, antivirus techniques, digital Immune systems, biometric authentication, and ethical hacking.

TEXT/REFERENCE BOOKS

1. Khalid Sayood, Introduction to Data Compression, Morgan Kaufmann, 2000.
2. David Saloman, Data Compression: The complete reference, Springer publication.
3. Behrous Forouzen, ―Cryptography and Network Security, Tata McGraw–Hill Education 2011.
4. Berard Menezes, Network Security and Cryptography, learning publication Cengage.
5. William Stallings, Cryptography and Network Security, Pearson Education Asia Publication, 5th edition.

BTEXPE702D	Parallel Processing	3 Credits

Course Objectives:

- Learn the concepts of parallel processing as it pertains to high-performance computing.
- Learn to design parallel programs on high performance computing.
- Discuss issues of parallel programming.
- Learn the concepts of message passing paradigm using open source APIs.
- Learn different open source tools.
- Learn the concepts of Multi-core processor

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Describe different parallel processing platforms involved in achieving High
2. Performance Computing.
3. Discuss different design issues in parallel programming
4. Develop efficient and high performance parallel programming
5. Learn parallel programming using message passing paradigm using open source MPIs.
6. Design algorithms suited for Multicore processor and GPU systems using Open MP and CUDA.

UNIT - 1

Parallel Programming Platforms

Implicit Parallelism: Trends in Microprocessor Architectures ,Limitations of Memory System Performance, Dichotomy of Parallel Computing Platforms, Physical Organization of Parallel Platforms, Communication Costs in Parallel Machines, Routing Mechanisms for Interconnection Networks, Impact of Process-Processor Mapping and Mapping Techniques.

UNIT - 2

Principles of Parallel Algorithm Design algorithms

Preliminaries, Decomposition Techniques, Characteristics of Tasks and Interactions, Mapping Techniques for Load Balancing, Methods for Containing Interaction Overheads, Parallel Algorithm Models.

UNIT - 3

Basic Communication Operations and algorithms

One-to-All Broadcast and All-to-One Reduction, All-to-All Broadcast and Reduction, All-Reduce and Prefix-Sum Operations, Scatter and Gather, All-to-All Personalized Communication, Circular Shift, Improving the Speed of Some Communication Operations.

UNIT - 4

Analytical Modeling of Parallel Programs

Sources of Overhead in Parallel Programs, Performance Metrics for Parallel Systems, Effect of Granularity and Data Mapping on Performance, Scalability of Parallel Systems, Minimum Execution Time and Minimum Cost-Optimal Execution Time, Asymptotic Analysis of Parallel Programs, Other Scalability Metrics.

UNIT - 5

Programming Using the Message Passing Paradigm

Principles of Message-Passing Programming, the Building Blocks: Send and Receive Operations, MPI: The Message Passing Interface, Topologies and Embedding, Overlapping Communication with Computation, Collective Communication and Computation Operations, Groups and Communicators

UNIT - 6

Programming Shared Address Space Platforms Thread Basics

Threads, the POSIX Thread Application Programmer Interface, Synchronization Primitives in POSIX, Controlling Thread and Synchronization Attributes, Thread Cancellation, Composite Synchronization Constructs.

TEXT/REFERENCE BOOKS

1. Introduction to parallel programming, Ananth Grama, Anshul Gupta, George Karypis, Vipin Kumar, Pearson Publication.
2. Introduction to Parallel Processing, M. SasiKumar, Dinesh Shikhare P.Raviprakash, PHI Publication.

BTEXPE703A	IoT 4.0	3 Credits

Course Objectives:

- Students will be explored to the interconnection and integration of the physical world and the cyber space.
- To provide ability to design and develop IOT devices.

Course Outcomes:

1. Learner will be able to understand the meaning of internet in general and IOT in terms of layers, protocols, packets peer to peer communication
2. Learner will be able to interpret IOT working at transport layer with the help of various protocols.
3. Learner will be able to understand IOT concept at data link layer.
4. Learner will be able to apply the concept of mobile networking to the internet connected devices.
5. Learner will be able to measure and schedule the performance of networked devices in IOT.
6. Learner will be able to analyze the challenges involve in developing IOT architecture.

UNIT - 1

Introduction

What is the Internet of Things: History of IoT, about objects/things in the IoT, Overview and motivations, Examples of applications, IoT definitions, IoT Frame work, General observations, ITU-T views, working definitions, and basic nodal capabilities.

UNIT - 2

Fundamental IoT Mechanisms & Key Technologies:

Identification of IoT objects and services, Structural aspects of the IoT, Environment characteristics, Traffic characteristics ,scalability, Interoperability, Security and Privacy, Open architecture, Key IoT Technologies ,Device Intelligence, Communication capabilities, Mobility support, Device Power, Sensor Technology, RFID technology, Satellite Technology.

UNIT - 3

Radio Frequency Identification Technology:

Introduction, Principles of RFID, Components of an RFID system, Reader, RFID tags, RFID middleware, Issue. Wireless Sensor Networks: History and context, node, connecting nodes, networking nodes, securing communication.

UNIT - 4

Wireless Technologies For IoT : Layer ½ Connectivity :

WPAN Technologies for IoT/M2M, Zigbee /IEEE 802.15.4, Radio Frequency for consumer Electronics (RF4CE), Bluetooth and its low-energy profile , IEEE 802.15.6 WBANS, IEEE 802.15 WPAN TG4j, MBANS, NFC, dedicated short range communication(DSRC) & related protocols. Comparison of WPAN technologies cellular & mobile network technologies for IoT/M2M.

UNIT - 5

Governance of The Internet of Things:

Introduction, Notion of governance, aspects of governance, Aspects of governance Bodies subject to governing principles, private organizations, International regulation and supervisor, substantive principles for IoT governance, Legitimacy and inclusion of stakeholders, transparency, accountability. IoT infrastructure governance, robustness, availability, reliability, interoperability, access. Future governance issues, practical implications, legal implications.

TEXT/REFERENCE BOOKS

1. Hakima Chaouchi, The Internet of Things, Connecting Objects to the Web, Wiley Publications
2. Daniel Minoli,Building the Internet of Things with IPv6 and MIPv6 The Evolving World of M2M Communications, Wiley Publications
3. Bernd Scholz-Reiter, Florian Michahelles, Architecting the Internet of Things, ISBN 978-3842-19156-5, Springer.

4. Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things Key Applications and Protocols, ISBN 978-1-119-99435-0, Wiley Publications.

BTEXPE703B	Wireless Sensor Networks	3 Credits

Course Objectives:

- To introduce the emerging research areas in the field of wireless sensor networks
- To understand different protocols and there uses in WSN.

Course Outcomes:

At the end of the course the students will be able to

1. Design wireless sensor networks for a given application
2. Understand emerging research areas in the field of sensor networks
3. Understand MAC protocols used for different communication standards used in WSN
4. Explore new protocols for WSN.

UNIT - 1

Introduction

Introduction to Sensor Networks, unique constraints and challenges, Advantage of Sensor Networks, Applications of Sensor Networks, Types of wireless sensor networks

UNIT - 2

Networks

Mobile Ad-hocNetworks (MANETs) and Wireless Sensor Networks, Enabling technologies for Wireless Sensor Networks. Issues and challenges in wireless sensor networks.

UNIT - 3

Protocols

Routing protocols, MAC protocols: Classification of MAC Protocols, S-MAC Protocol, B-MAC protocol, IEEE 802.15.4 standard and ZigBee

UNIT - 4

Dissemination protocol for large sensor network, Data dissemination, data gathering, and data fusion; Quality of a sensor network; Real-time traffic support and security protocols.

UNIT - 5

Design Principles for WSNs, Gateway Concepts Need for gateway, WSN to Internet Communication, and Internet to WSN Communication.

UNIT - 6

Single-node architecture, Hardware components & design constraints, Operating systems and execution environments.

TEXT/REFERENCE BOOKS

1. Waltenegus Dargie , Christian Poellabauer, " Fundamentals Of Wireless Sensor Networks Theory And Practice", By John Wiley & Sons Publications, 2011.
2. Sabrie Soloman, "Sensors Handbook" by McGraw Hill publication. 2009
3. Feng Zhao, Leonidas Guibas, " Wireless Sensor Networks" , Elsevier Publications,2004
4. Kazem Sohrby, Daniel Minoli, "Wireless Sensor Networks": Technology, Protocols and Applications, Wiley-Inter science
5. Philip Levis, And David Gay "TinyOS Programming" by Cambridge University Press 2009

BTEXPE703C	CMOS Design	3 Credits

Course Objectives:

- To develop an understanding of design different CMOS circuits using various logic families along with their circuit layout.
- To introduce the student how to use tools for VLSI IC design.

Course Outcomes:

At the end of the course the students will be able to

1. Design different CMOS circuits using various logic families along with their circuit layout.
2. Use tools for VLSI IC design.

UNIT - 1

Review of MOS transistor models, Non-ideal behavior of the MOS Transistor, Transistor as a switch, Inverter characteristics.

UNIT - 2

Integrated Circuit Layout: Design Rules, Parasitics

UNIT - 3

Delay: RC Delay model, linear delay model, logical path efforts

UNIT - 4

Power, interconnect and Robustness in CMOS circuit layout

UNIT - 5

Combinational Circuit Design: CMOS logic families including static, dynamic and dual rail logic

UNIT - 6

Sequential Circuit Design: Static circuits, Design of latches and Flip-flops.

TEXT/REFERENCE BOOKS

1. N.H.E. Weste and D.M. Harris, CMOS VLSI design: A Circuits and Systems Perspective, 4th Edition, Pearson Education India, 2011.
2. C. Mead and L. Conway, Introduction to VLSI Systems, Addison Wesley, 1979.
3. J. Rabaey, Digital Integrated Circuits: A Design Perspective, Prentice Hall India, 1997.
4. P. Douglas, VHDL: programming by example, McGraw Hill, 2013.
5. L. Glaser and D. Dobberpuhl, The Design and Analysis of VLSI Circuits, Addison Wesley, 1985

BTEXPE703D	Process Instrumentation	3 Credits

Course Objectives:

Course Outcomes:

At the end of the course the students will be able to

1. Understand various processes.
2. Develop Instrumentation for these processes.

3. Apply the control strategies for various process applications.
4. Mapping with PEOs.

UNIT - 1

Instrumentation for heat exchangers and dryers

Operation of heat exchanger, controlled and manipulated variables in heat exchanger control problem, instrumentation for feedback, feed-forward, cascade control strategies for heat exchanger, types and operation of dryers, controlled and manipulated variables in dryer control problem, instrumentation for feedback and feed-forward control of various types of dryers.

UNIT - 2

Instrumentation for evaporators & crystallizer

Types and operation of evaporators, Controlled and manipulated variables in evaporator control problem, instrumentation for feedback, feed-forward, cascade control strategies for evaporators, types and operation of crystallizers, controlled and manipulated variables in crystallizer control problem, instrumentation for control of various types of crystallizers.

UNIT - 3

Instrumentation for distillation columns

Operation of distillation column, manipulated and controlled variables in distillation column control, instrumentation for flow control of distillate, top and bottom composition control, reflux ratio control, pressure control schemes.

UNIT - 4

Boiler Instrumentation

Operation of boiler, manipulated and controlled variables in boiler control, safety interlocks and burner management system, instrumentation for boiler pressure controls, air to fuel ratio controls, boiler drum level controls, steam temperature control, optimization of boiler efficiency, operation and types of reactors, instrumentation for temperature, pressure control in CSTRs.

UNIT - 5

Instrumentation for pumps

Types and operation of pumps, manipulated and controlled variables in pump control problem, pump control methods and instrumentation for pump control.

UNIT - 6

Instrumentation for compressors

Types and operation of compressors, capacity control methods of compressors, instrumentation for control of different variables in centrifugal, rotary and reciprocating compressors including surge and anti-surge control.

TEXT/REFERENCE BOOKS

1. "Process Control, Instrument Engineering Hand book", B.G. Liptak, Chilton Book Company.
2. "Hand book of Process Instrumentation", Considine, McGraw Hill Publishing company.

BTEXPE704A	Microwave Theory and Techniques	3 Credits

Course Objectives:

- To lay the foundation for microwave engineering
- To understand the applications of microwave engineering
- Carryout the microwave network analysis.

Course Outcomes:

After successfully completing the course students will be able to

1. Formulate the wave equation in wave guide for analysis.
2. Identify the use of microwave components and devices in microwave applications.
3. Understand the working principles of all the microwave tubes
4. Understand the working principles of all the solid state devices
5. Choose a suitable microwave tube and solid state device for a particular application
6. Carry out the microwave network analysis
7. Choose a suitable microwave measurement instruments and carry out the required measurements.

UNIT - 1

Transmission Lines and Waveguides

Introduction to Microwaves engineering: History of Microwaves, Microwave Frequency bands, Applications of Microwave, General solution for TEM, TE and TM waves, Parallel plate waveguide, and rectangular waveguide, Wave guide parameters, Introduction to coaxial line, Rectangular waveguide cavity resonators, Circular waveguide cavity resonators.

UNIT - 2

Microwave Components

Multi-port junctions: Construction and operation of E-plane, H-plane, Magic Tee and Directional couplers.

Ferrites components: - Ferrite Composition and characteristics, Faraday rotation, Construction and operation of Gyrator, Isolator and Circulator.

Striplines: Structural details and applications of Striplines, Microstrip line, Parallel Strip line, Coplanar Strip line, Shielded Strip Line.

UNIT - 3

Microwave Network Analysis

Introduction and applications of Impedance and Equivalent voltages and currents, Impedance and Admittance matrices, The Transmission (ABCD) matrix

Scattering Matrix:-Significance, formulation and properties. S-Matrix calculations for-2 port network junction, E plane, H-plane and E-H (Magic Tee) Tees, Directional coupler, Isolator and Circulator, Related problems

UNIT - 4

Microwave Tubes

Limitations of conventional tubes, O and M type classification of microwave tubes, reentrant cavity, velocity modulation

O type tubes.

Two cavity Klystron: Construction and principle of operation, velocity modulation and bunching process Applegate diagram.

Reflex Klystron: Construction and principle of operation, velocity modulation and bunching process, Applegate diagram, Oscillating modes, o/p characteristics, efficiency, electronic & mechanical tuning.

M-type tubes

Magnetron: Construction and Principle of operation of 8 cavity cylindrical travelling wave magnetron, hull cutoff condition, modes of resonance, PI mode operation, o/p characteristics, Applications.

Slow wave devices

Advantages of slow wave devices, Helix TWT: Construction and principle of operation, Applications.

UNIT - 5

Microwave Solid State Devices

Microwave bipolar transistor, FET, MESFET, Varactor Diode, PIN Diode, Shottky Barrier Diode, Tunnel Diode, TEDs, Gunn Diodes, IMPATT diode and TRAPATT diode. Structural details, Principle of operation, various modes, specifications, and applications of all these devices.

UNIT - 6

Microwave Measurements

Measurement devices: Slotted line, Tunable detector, VSWR meter, Power Meter, S-parameter measurement, frequency measurements, Power measurement, Attenuation measurement, Phase shift measurement, VSWR measurement, Impedance measurement, Q of cavity resonator measurement.

TEXT/REFERENCE BOOKS

1. Samuel Y. Liao, “Microwave Devices and Circuits”, 3rd edition, Pearson
2. David M. Pozar, “Microwave Engineering", Fourth edition, Wiley.
3. M. Kulkarni, “Microwave and Radar engineering”, 3rd edition, Umesh Publications
4. M L Sisodia & G S Raghuvamshi, “Microwave Circuits and Passive Devices” Wiley, 1987
5. M L Sisodia & G S Raghuvanshi, “Basic Microwave Techniques and Laboratory
6. Manual”, New Age International (P) Limited, Publishers.

BTEXPE704B	Satellite Communication	3 Credits

Course Objectives:

- To provide students with good depth of knowledge in radar and Satellite communication.
- Knowledge of theory and practice of advanced communication techniques e.g. TDMA, CDMA, FDMA.
- This will equip the students for further studies and research knowledge of modern applications in radar and Satellite communication.

Course Outcomes:

At the end of the course, the students will have:

1. Knowledge of theory and practice related to radar and Satellite communication.
2. Ability to identify, formulate and solve engineering problems related to radar and Satellite communication.
3. The student would be able to analyze the various aspects of establishing a geo-stationary satellite communication link.
4. Acquired knowledge about Satellite Navigation System.
5. Acquired knowledge about Radar and Radar Equations.

UNIT - 1

Radar Communication

Basic principles and fundamentals, block diagram of basic radar, classification, radar performance factors, radar range equation, f actors influencing maxi mum range, effects of noise, Pulsed radar systems, block diagram and description, antennas and scanning, display methods, moving target indication, radar beacons, other radar systems such as CW Doppler radar, FM CW Doppler radar, phased array radars, planar array radars, various applications of radar such as navigational aids, military, surveillance.

UNIT - 2

Basic Principles satellite communication systems

General features, frequency allocation for satellite services, properties of satellite communication systems, Earth Station: Introduction, earth station subsystem, different types of earth stations

Satellite Orbits

Introduction, Kepler's laws, orbital dynamics, orbital characteristics, satellite spacing and orbital capacity, angle of elevation, eclipses, launching and positioning, satellite drift and station keeping.

UNIT - 3

Satellite Construction (Space Segment)

Introduction; attitude and orbit control system; telemetry, tracking and command; power systems, communication subsystems, antenna subsystem, equipment reliability and space qualification.

UNIT - 4

Satellite Links

Introduction, general link design equation, system noise temperature, uplink design, downlink design, complete link design, effects of rain.

UNIT - 5

The Space Segment Access and Utilization

Introduction, space segment access methods: TDMA, FDMA, CDMA, SDMA, assignment methods.

UNIT - 6

The Role and Application of Satellite Communication

Introduction to Digital Satellite and Mobile Satellite Communication.

TEXT/REFERENCE BOOKS

1. Skolnik, “Principles of Radar Engineering” MCH.
2. Timothy Pratt, Charles W. Bostian, Satellite Communications, John Wiley & Sons
3. Dennis Roddy, Satellite Communications, 3rd Ed., McGraw-Hill International Ed. 2001
4. W. L. Pritchard, J. A. Sciulli, Satellite Communication Systems Engineering, Prentice- Hall, Inc., NJ
5. M. O. Kolawole, Satellite Communication Engineering, Marcel Dekker, Inc. NY
6. Robert Gagliardi , "Satellite Communication" , CBS Publication
7. Ha, "Digital Satellite Communication", McGraw- Hill.

BTEXPE704C	Fiber Optic Communication	3 Credits

Course Objectives:

- To learn the basic elements of optical fiber transmission link, fiber modes configurations and structures.
- To understand the different kind of losses, signal distortion in optical wave guides and other signal degradation factors.
- To learn the various optical source materials, LED structures, quantum efficiency, Laser diodes
- Understand the functionality of each of the components that comprise a fiber-optic communication system: transmitter, fiber, amplifier, and receiver.
- Understand the properties of optical fiber that affect the performance of a communication link.
- Understand basic optical amplifier operation and its effect on signal power and noise in the system.
- Apply concepts listed above to the design of a basic communication link.

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Understand the principles fiber-optic communication, the components and the bandwidth advantages.
2. Understand the properties of the optical fibers and optical components.
3. Understand operation of lasers, LEDs, and detectors
4. Analyze system performance of optical communication systems
5. Design optical networks and understand non-linear effects in optical fibers

UNIT - 1

Introduction

Introduction to vector nature of light, propagation of light, propagation of light in a cylindrical dielectric rod, Ray model, wave model.

UNIT - 2

Types of optical fibers

Different types of optical fibers, Modal analysis of a step index fiber, Signal degradation on optical fiber due to dispersion and attenuation. Fabrication of fibers and measurement techniques like OTDR.

UNIT - 3

Optical sources

LEDs and Lasers, Photo-detectors - pin-diodes, APDs, detector responsivity, noise, optical receivers. Optical link design - BER calculation, quantum limit, power penalties.

UNIT - 4

Optical switches

Coupled mode analysis of directional couplers, electro-optic switches.

UNIT - 5

Optical amplifiers

EDFA, Raman amplifier, WDM and DWDM systems, Principles of WDM networks.

UNIT - 6

Nonlinear effects in fiber optic links

Nonlinear effects in fiber optic links, Concept of self-phase modulation, group velocity dispersion and solition based communication.

TEXT/REFERENCE BOOKS

1. J. Keiser, Fibre Optic communication, McGraw-Hill, 5th Ed. 2013 (Indian Edition).
2. T. Tamir, Integrated optics, (Topics in Applied Physics Vol.7), Springer-Verlag, 1975.
3. J. Gowar, Optical communication systems, Prentice Hall India, 1987.
4. S.E. Miller and A.G. Chynoweth, eds., Optical fibres telecommunications, Academic Press, 1979.
5. G. Agrawal, Nonlinear fibre optics, Academic Press, 2nd Ed. 1994.
6. G. Agrawal, Fiber optic Communication Systems, John Wiley and sons, New York, 1997

7. F.C. Allard, Fiber Optics Handbook for engineers and scientists, McGraw Hill, New York, 1990.

BTEXPE704D	Wireless Communication	3 Credits

Course Objectives:

- The objective of the course is to introduce the Concepts of basic wireless mobile communication systems.
- To learn and understand the basic principles of Telecommunication switching, traffic and networks.
- To learn and understand basic concepts of cellular system, wireless propagation and the techniques used to maximize the capacity of cellular network.
- To learn and understand architecture of GSM and CDMA system.
- To understand mobile management, voice signal processing and coding in GSM and CDMA system.

Course Outcomes:

After successfully completing the course students will be able to

1. Explain and apply the concepts telecommunication switching, traffic and networks.
2. Analyze the telecommunication traffic.
3. Analyze radio channel and cellular capacity.
4. Explain and apply concepts of GSM and CDMA system.

UNIT - 1

Introduction and Cellular Concept

Existing technology, Evolution in wireless systems, Trends in cellular system Frequency Reuse channel Assignment Strategies, Handoff Strategies, Interference and System Capacity, Cellular System, Design in worst case with an omni Directional Antenna, Co-Channel Interference Reduction with use of Directional Antenna, Improving Coverage and Capacity in Cellular systems, Trunking and Grade of service

UNIT - 2

Wireless Communication Systems GSM

GS Services and features, GSM Architecture and interfaces, GSM Radio Sub System, GSM Channel Types , Traffic Channels, Control Channels, Example of a GSM call, Frame structure for GSM , Signal Processing in GSM, GPRS.

UNIT - 3

Wideband Modulation Techniques and OFDM

Basic Principles, OFDM Signal Mathematical representation, Block Diagram, Selection Parameters for modulation, Pulse shaping, Windowing, Spectral Efficiency, Synchronization

UNIT - 4

Wireless Communication Systems CDMA IS95

Direct sequence Spread Spectrum, Spreading codes, Multipath Signal Propagation and RAKE receiver, Frame Quality and BER Requirements, Critical challenges of CDMA,TIA IS95 System, Physical and Logical Channels of IS95, CDMA IS95 call processing, soft hand off and power control in CDMA, Access and Paging Channel Capacity, Reverse and Forward Link Capacity of a CDMA System.

UNIT - 5

Wireless Communication Systems

CDMA 2000: CDMA layering structure, CDMA 2000 channels, logical channels, forward link physical, forward link features, reverse physical channels, CDMA 2000 Media Access control and LAC sub layer, Data services, Data services in CDMA 2000, mapping of logical channels to physicals, evolution of CDMA IS95 to CDMA 2000.

UNIT - 6

More Wireless Communication Systems

Bluetooth, Wi-Fi Standards, WIMAX, Wireless Sensor Networks, Zigbee, UWB, IEEE 802.20 and Beyond.

TEXT/REFERENCE BOOKS

1. Wireless Communication: Principles and Practice Theodare. S. Rappaport- Pearson Education.
2. Wireless Communication: Upena Dalal, Oxford Higher Education.
3. Wireless Network Evolution: 2G to 3G, Vijay. K. Garg, Pearson Education.

4. Principles and Application of GSM, Vijay Garg, Joseph. E. Wilkes Pearson Education.
5. Mobile Cellular Telecommunications: Analog and Digital Systems, William C. Y. Lee, Tata McGraw Hill Edition.
6. Introduction to Wireless Telecommunication Systems and Networks- Gary. J. Mullet, DELMAR CENGAGE Learning.
7. Wireless Communications and Networks: 3G and Beyond, ITI Saha Misra, Tata McGraw Hill Edition.
8. Fundamentals of Wireless Communication: David Tse, Pramod Viswanath, CAMBRIDGE University Press.
9. Mobile Wireless communications, Mischa Schwartz, CAMBRIDGE University Press.

BTETPE801A **Introduction to Internet of Things** **4 Credits**

PROF. SUDIP MISRA Dept. of Computer Science and Engineering IIT Kharagpur
Course Duration: 12 week

Course Outline:
Internet of Things (IoT) is presently a hot technology worldwide. Government, academia, and industry are involved in di-erent aspects of research, implementation, and business with IoT. IoT cuts across di-erent application domain verticals ranging from civilian to defence sectors. These domains include agriculture, space, healthcare, manufacturing, construction, water, and mining, which are presently transitioning their legacy infrastructure to support IoT. Today it is possible to envision pervasive connectivity, storage, and computation, which, in turn, gives rise to building di-erent IoT solutions. IoT-based applications such as innovative shopping system, infrastructure management in both urban and rural areas, remote health monitoring and emergency notication systems, and transportation systems, are gradually relying on IoT based systems. Therefore, it is very important to learn the fundamentals of this emerging technology.

Course Plan:
Week 01 : Introduction to IoT, Sensing, Actuation, Basics of Networking.

Week 02 : Basics of Networking, Communication Protocols.

Week 03 : Communication Protocols, Sensor Networks

Week 04 : Sensor Networks, Machine-to-Machine Communications.

Week 05 : Interoperability in IoT, Introduction to Arduino Programming, Integration of Sensors and Actuators with Arduino.

Week 06 : Introduction to Python programming, Introduction to Raspberry.

Week 07 : Implementation of IoT with Raspberry Pi, Introduction to SDN.

Week 08 : SDN for IoT, Data Handling and Analytics, Cloud Computing

Week 09 : Cloud Computing, Sensor-Cloud.

Week 10 : Fog Computing, Smart Cities and Smart Homes

Week 11 : Connected Vehicles, Smart Grid, Industrial IoT

Week 12 : Industrial IoT, Case Study: Agriculture, Healthcare, Activity Monitoring

BTETPE801B **Computer Vision and Image Processing** **4 Credits**

Dr. M. K. Bhuyan
Professor, Indian Institute of Technology Guwahati,
Course Duration: 12 week

Course Outline:

The course familiarizes students with fundamental concepts and issues related to computer vision and major approaches that address them. The focus of the course is on image acquisition and image formation models, radiometric models of image formation, image formation in the camera, image processing concepts, concept of feature extraction and feature selection for pattern classification/recognition, and advanced concepts like object classification, object tracking, image-based rendering, and image registration. Intended to be a companion to a typical teaching course on computer vision, the course takes a problem-solving approach

Course Plan:

I Image Formation and Image Processing

Introduction to Computer Vision and Basic Concepts of Image Formation

Introduction and Goals of Computer Vision, Image Formation and Radiometry, Geometric Transformation, Geometric Camera Models, Image Reconstruction from a Series of Projections

Image Processing Concepts

Fundamentals of Image Processing, Image Transforms, Image Filtering, Colour Image Processing, Mathematical Morphology, Image Segmentation

II Image Features

Image Descriptors and Features

Texture Descriptors, Colour Features, Edge Detection, Object Boundary and Shape Representations, Interest or Corner Point Detectors, Histogram of Oriented Gradients (HOG), Scale Invariant Feature Transform (SIFT), Speeded up Robust Features (SURF), Saliency

III Recognition

Fundamental Pattern Recognition Concepts

Introduction to Pattern Recognition, Linear Regression, Basic Concepts of Decision Functions, Elementary Statistical Decision Theory, Gaussian Classifier, Parameter Estimation, Clustering for Knowledge Representation, Dimension Reduction, Template Matching, Artificial Neural Network (ANN) for Pattern Classification, Convolutional Neural Networks (CNNs), Autoencoder

IV Applications

Applications of Computer Vision

Machine Learning Algorithms and their Applications in Medical Image Segmentation, Motion Estimation and Object Tracking, Face and Facial Expression Recognition, Gesture Recognition, Image Fusion, Programming Examples

BTETPE801C **Biomedical Signal Processing** **4 Credits**

Prof. Sudipta Mukhopadhyay ,IIT Kharagpur
Course Duration: 12 week

Course outline:
This course is prepared for the engineering students in their final year of undergraduate studies or in their graduate studies. Electrical Engineering students with a good background in Signals and Systems are prepared to take this course. Students in other engineering disciplines, or in computer science, mathematics, geo physics or physics should also be able to follow this course. While a course in Digital Signal Processing would be useful, it is not necessary for a capable student. The course has followed problem solving approach as engineers are known as problem solvers. The entire course is presented in the form of series of problems and solutions.

Course Plan:

Week 1: Preliminaries; Biomedical signal origin & dynamics (ECG)

Week 2: Biomedical signal origin & dynamics (EEG, EMG etc.)

Week 3: Filtering for Removal of artifacts Statistical Preliminaries; Time domain filtering (Synchronized Averaging, Moving Average)

Week 4: Filtering for Removal of artifacts contd. Time domain filtering (Moving Average Filter to Integration, Derivative-based operator), Frequency Domain Filtering (Notch Filter)

Week 5: Filtering for Removal of artifacts contd. Optimal Filtering: The Weiner Filter

Week 6: Filtering for Removal of artifacts contd. Adaptive Filtering Selecting Appropriate Filter

Week 7: Event Detection Example events (viz. P, QRS and T wave in ECG) Derivative based Approaches for QRS Detection Pan Tompkins Algorithm for QRS Detection

Week 8: Event Detection contd. Dicrotic Notch Detection Correlation Analysis of EEG Signal

Week 9: Waveform Analysis Illustrations of problem with case studies Morphological Analysis of ECG Correlation coefficient The Minimum phase correspondent and Signal Length

Week 10: Waveform Analysis contd. Envelop Extraction Amplitude demodulation The Envelogram Analysis of activity Root Mean Square value Zero-crossing rate Turns Count, Form factor

Week 11: Frequency-domain Analysis Periodogram

Week 12: Frequency-domain Analysis Averaged Periodogram Blackman-Tukey Spectral Estimator Daniellâ€™s Spectral Estimator Measures derived from PSD

BTETPE 802A **Industrial Automation and Control** **4 Credits**

Prof. S. Mukhopadhyay Department of Electrical Engineering IIT Kharagpur
Course Duration: 12 week

Course Plan:

Week 1: Introduction to Industrial Automation and Control , Architecture of Industrial Automation Systems, Introduction to sensors and measurement systems

Week 2: Temperature measurement, Pressure and Force measurements, Displacement and speed measurement, Flow measurement techniques , Measurement of level, humidity, pH etc

Week 3: Signal Conditioning and Processing, Estimation of errors and Calibration

Week 4: Introduction to Process Control, P-- I -- D Control, Controller Tuning.

Week 5: Implementation of PID Controllers, Special Control Structures : Feedforward and Ratio Control. Predictive Control, Control of Systems with Inverse Response, Cascade Control, Overriding Control, Selective Control, Split Range Control

Week 6: Introduction to Sequence Control, PLCs and Relay Ladder Logic Sequence Control : Scan Cycle, RLL Syntax , Structured Design Approach

Week 7: Sequence Control : Advanced RLL Programming ,The Hardware environment

Week 8 : Control of Machine tools : Introduction to CNC Machines , Analysis of a control loop

Week 9 : Introduction to Actuators : Flow Control Valves , Hydraulic Actuator Systems : Principles, Components and Symbols , Pumps and Motors, Proportional and Servo Valves

Week 10 : Pneumatic Control Systems : System Components , Controllers and Integrated Control Systems, Electric Drives : Introduction, Energy Saving with Adjustible Speed Drives , Step motors : Principles, Construction and Drives

Week 11: DC Motor Drives: Introduction, DC--DC Converters, Adjustible Speed Drives , Induction Motor Drives: Introduction, Characteristics, Adjustible Speed Drives ,Synchronous Motor Drives : Motor Principles, Adjustible Speed and Servo Drives

Week 12: Networking of Sensors, Actuators and Controllers : The Fieldbus ,The Fieldbus Communication Protocol , Introduction to Production Control Systems

BTETPE 802B **Cryptography and Network Security** **4 Credits**

Dr. Debdeep Mukhopadhyay IIT Kharagpur
Course Duration: 12 week

Course Outline

The course deals with the underlying principles of cryptography and network security. It develops the mathematical tools required to understand the topic of cryptography. Starting from the classical ciphers to modern day ciphers, the course provides an extensive coverage of the techniques and methods needed for the proper functioning of the ciphers. The course deals with the construction and cryptanalysis of block ciphers, stream ciphers and hash functions. The course defines one way functions and trap-door functions and presents the construction and cryptanalysis of public key ciphers, namely RSA. The key exchange problem and solutions using the DiffieHellman algorithm are discussed. Message Authentication Codes (MAC) and signature schemes are also detailed. The course deals with modern trends in asymmetric key cryptography, namely using Elliptic Curves. The course concludes with the design rationale of network protocols for key exchange and attacks on such protocols

Course Plan:

Introduction and Mathematical Foundations

Introduction, Overview on Modern Cryptography, Number Theory, Probability and Information Theory

Classical Cryptosystems

Classical Cryptosystems, Cryptanalysis of Classical Cryptosystems, Shannon's Theory

Symmetric Key Ciphers

Symmetric Key, Ciphers Modern Block Ciphers (DES), Modern Block Cipher (AES)

Cryptanalysis of Symmetric Key Ciphers

Linear Cryptanalysis, Differential Cryptanalysis, Other Cryptanalytic Techniques, Overview on S-Box Design Principles, Modes of operation of Block Ciphers

Stream Ciphers and Pseudo-randomness

Stream Ciphers, Pseudorandom functions

Hash Functions and MACs

Hash functions: The Merkle Damgard Construction, Message Authentication Codes (MACs)

Asymmetric Key Ciphers: Construction and Cryptanalysis

More Number Theoretic Results ,The RSA Cryptosystem, Primality Testing, Factoring Algorithms , Other attacks on RSA and Semantic Security of RSA ,The Discrete Logarithm Problem (DLP) and the Diffie Hellman Key Exchange algorithm, The ElGamal Encryption Algorithm Cryptanalysis of DLP

Digital Signatures

Signature schemes

Modern Trends in Asymmetric Key Cryptography

Elliptic curve based cryptography

Network Security

Secret Sharing Schemes, A Tutorial on Network Protocols, Kerberos, Pretty Good Privacy (PGP) Secure Socket Layer (SSL), Intruders and Viruses, Firewalls

BTETPE 802C **Digital IC Design** **4 credits**

PROF. JANAKIRAMAN Electrical and Electronics Engineering IIT Madras
Course Duration : 12 weeks

Course Outline: This is a most fundamental Digital Circuit Design course for pursing a major in VLSI. We do not deal with any Verilog coding during this course and instead discuss transistor level circuit design concepts in great detail.

Learning objectives of this course are:

- Characterize the key delay quantities of a standard cell
- Evaluate power dissipated in a circuit (dynamic and leakage)
- Design a circuit to perform a certain functionality with specified speed
- Identify the critical path of a combinational circuit
- Convert the combinational block to pipelined circuit
- Calculate the maximum (worst case) operating frequency of the designed circuit

Course Plan:

Week 1: The CMOS Inverter construction and Voltage Transfer Characteristics

Week 2: Resistance and Capacitance and transient response.

Week 3: Dynamic, Short Circuit and Leakage power – Stacking Effect

Week 4: Combinational Circuit Design and capacitance

Week 5: Parasitic Delay, Logical Effort and Electrical Effort

Week 6: Gate sizing and Buffering

Week 7: Asymmetric gate, Skewed gates, Ratio'ed logic

Week 8: Dynamic Gates and Domino logic and Static Timing Analysis

Week 9: Sequential circuits and feedback. Various D flip flop circuits – Static and Dynamic

Week 10: Setup and Hold Time measurement. Timing analysis of latch/ flop based systems

Week 11: Adders – Mirror adder, Carry Skip adder, Carry Select adder, Square Root adder

Week 12: Multipliers – Signed and Unsigned arithmetic, Carry Save Multiplier implementation

B. Tech (Electronics & Telecommunication Engineering)

Proposed Curriculum for Semester VII [Final Year]

Sr. No.	Course Code	Type of Course	Course Title	Hours Per Week			Evaluation Scheme			Total Marks	Credits
				L	T	P	MSE	CA	ESE		
1	BTETC701	Professional Core Course 1	Digital Communication	3	0	0	20	20	60	100	3
2	BTETPE702	Program Elective 3	Group A	3	0	0	20	20	60	100	3
3	BTETPE703	Program Elective 4	Group B	3	0	0	20	20	60	100	3
4	BTETPE704	Program Elective 5	Group C	3	0	0	20	20	60	100	3
5	BTHM705	Humanities & Social Science including Management Courses	Financial Management	2	0	0	20	20	60	100	2
6	BTETL706	Program Elective 3 Lab		0	0	2	--	30	20	50	1
7	BTETL707	Program Elective 4 Lab		0	0	2	--	30	20	50	1
8	BTETL708	Program Elective 5 Lab		0	0	2	--	30	20	50	1
9	BTETP709	Project Part I		0	0	8	--	50	50	100	4
10	BTETF611	Field Training/ Internship/Industrial Training Evaluation		--	--	--	--	--	50	50	1
			Total	**14**	**0**	**14**	**100**	**240**	**460**	**800**	**22**

Program Elective - 3 **(Group A)**	**Program Elective -4** **(Group B)**	**Program Elective- 5** **(Group C)**
(A) Microwave Theory & Techniques	(A) Embedded System Design	(A) Consumer Electronics
(B) RF Circuit Design	(B) Artificial Intelligence Deep learning	(B) Analog Integrated Circuit Design
(C) Satellite Communication	(C) VLSI Design & Technology	(C) Soft Computing
(D) Fiber Optic Communication	(D) Data Compression & Encryption	(D) Advance Industrial Automation-1
(E) Wireless Sensor Networks	(E) Big Data Analytics	(E) Mechatronics
(F) Mobile Computing	(F) Cyber Security	(F) Electronics in Smart City

B. Tech (Electronics & Telecommunication Engineering)

Course Structure for Semester VIII [Fourth Year] w.e.f. 2020-2021

Course Code	Type of Course	Course Title	Weekly Teaching Scheme			Evaluation Scheme				Credits
			L	T	P	MSE	CA	ESE	Total	
		• Introduction to Internet of Things • Computer Vision and Image Processing • Biomedical Signal Processing • Industrial Automation and Control • Cryptography and Network Security • Digital IC Design # Student to opt any two subjects from above list	3	-	--	20*	20*	60*	100	3
			3	-	--	20*	20*	60*	100	3
BTMEP803	Project Part-II or Internship*		--	--	30	--	--	100	150	15
		Total	--	--				220	350	21

** Six months of Internship in the industry*

**Students doing project at institute will have to appear for CA/MSE/ESE*

** Student doing project at Industry will give NPTEL examination / Examination conducted by university i.e. CA/MSE/ESE*

 # These subjects are to be studied on self –study mode using SWAYAM/NPTEL/Any other source

 # Teacher who work as a facilitator for the course should be allotted 3 hrs/week load.

 # Project Load: 2hrs/week/project.

Mapping of Courses with MOOCs Platform SWYAM / NPTEL

No	Course Name	Duration (Weeks)	Institute Offering Course	Name of Professor
1	Introduction to internet of things	12	IIT Kharagpur	Prof. Sudip Misra
2	Computer Vision and Image Processing	12	IIT Gandhinagar	Prof. M. K. Bhuyan
3	Biomedical Signal Processing	12	IIT Kharagpur	Prof. Sudipta Mukhopadhyay
4	Industrial Automation and Control	12	IIT Kharagpur	Prof. Siddhartha Mukhopadhyay
5	Cryptography & Network Security	12	IIT Kharagpur	Prof. Sourav Mukhopadhyay
6	Digital IC Design	12	IIT Madras	Prof. Janakiraman

2. R. S. Aggarwal, "A modern approach to verbal reasoning", S. Chand publications.
3. Philip Carter, "The Complete Book of Intelligence Test", John Willey & Sons Ltd.
4. Philip Carter, Ken Russell, "Succeed at IQ test", Kogan Page.
5. Eugene Ehrlich, Daniel Murphy, "Schaum's Outline of English Grammar", McGraw Hills.
6. David F. Beer, David A. Mc Murrey, "A Guide to Writing as an Engineer", ISBN: 978-1-118-30027-5 4th Edition, 2014, Wiley.

BTETC701	Digital Communication	3 Credits

Course Objectives:

- To understand the building blocks of digital communication system.
- To prepare mathematical background for communication signal analysis.
- To understand and analyze the signal flow in a digital communication system.
- To analyze error performance of a digital communication system in presence of noise and other interferences.
- To understand concept of spread spectrum communication system.

Course Outcomes:

1. Analyze the performance of a baseband and pass band digital communication system in terms of error rate and spectral efficiency.
2. Perform the time and frequency domain analysis of the signals in a digital communication system.
3. Select the blocks in a design of digital communication system.
4. Analyze Performance of spread spectrum communication system.

UNIT - 1

Digital Transmission of Analog Signal

Introduction to Digital Communication System: Why Digital?, Block Diagram and transformations, Basic Digital Communication Nomenclature. Digital Versus Analog Performance Criteria, Sampling Process, PCM Generation and Reconstruction, Quantization Noise, Non-uniform Quantization and Companding, PCM with noise: Decoding noise, Error threshold, Delta Modulation, Adaptive Delta Modulation, Delta Sigma Modulation, Differential Pulse Code Modulation, LPC speech synthesis.

UNIT - 2

Baseband Digital Transmission

Digital Multiplexing: Multiplexers and hierarchies, Data Multiplexers. Data formats and their spectra, synchronization: Bit Synchronization, Scramblers, Frame Synchronization. Inter-symbol interference, Equalization.

UNIT - 3

Random Processes

Introduction, Mathematical definition of a random process, Stationary processes, Mean, Correlation & Covariance function, Ergodic processes, Transmission of a random process through a LTI filter, Power spectral density, Gaussian process, noise, Narrow band noise, Representation of narrowband noise in terms of in phase & quadrature components.

UNIT - 4

Baseband Receivers

Detection Theory: MAP, LRT, Minimum Error Test, Error Probability, Signal space representation: Geometric representation of signal, Conversion of continuous AWGN channel to vector channel, Likelihood functions, Coherent Detection of binary signals in presence of noise, Optimum Filter, Matched Filter, Probability of Error of Matched Filter, Correlation receiver.

UNIT - 5

Passband Digital Transmission

Pass band transmission model, Signal space diagram, Generation and detection, Error Probability derivation and Power spectra of coherent BPSK, BFSK and QPSK. Geometric representation, Generation and detection of - M-ary PSK, M-ary QAM and their error probability, Generation and detection of -Minimum Shift Keying, Gaussian MSK, Non-coherent BFSK, DPSK and DE PSK ,Introduction to OFDM.

UNIT - 6

Spread Spectrum Techniques

Introduction, Pseudo noise sequences, A notion of spread spectrum, Direct sequence spread spectrum with coherent BPSK, Signal space dimensionality & processing gain, Probability of error, Concept of jamming, Frequency hop spread spectrum, Wireless Telephone Systems, Personal Communication System.

TEXT/REFERENCE BOOKS

1. Simon Haykin, "Digital Communication Systems", John Wiley & Sons, Fourth Edition.
2. A.B Carlson, P B Crully, J C Rutledge, "Communication Systems", Fourth Edition, McGraw Hill Publication.
3. Ha Nguyen, Ed Shwedyk, "A First Course in Digital Communication", Cambridge University Press.
4. B P Lathi, Zhi Ding "Modern Analog and Digital Communication System", Oxford University Press, Fourth Edition.
5. Bernard Sklar, Prabitra Kumar Ray, "Digital Communications Fundamentals and Applications" Second Edition, Pearson Education.
6. Taub, Schilling, "Principles of Communication System", Fourth Edition, McGraw Hill.
7. P Ramkrishna Rao, Digital Communication, Mc Graw Hill Publication.

BTETPE702A	Microwave Theory and Techniques	3 Credits

Course Objectives:

- To lay the foundation for microwave engineering.
- To understand the applications of microwave engineering.
- Carryout the microwave network analysis.

Course Outcomes:

After successfully completing the course students will be able to

1. Formulate the wave equation in wave guide for analysis.
2. Identify the use of microwave components and devices in microwave applications.
3. Understand the working principles of all the microwave tubes.

4. Understand the working principles of all the solid state devices.
5. Choose a suitable microwave tube and solid state device for a particular application.
6. Carry out the microwave network analysis.
7. Choose a suitable microwave measurement instruments and carry out the required measurements.

UNIT - 1

Transmission Lines and Waveguides:

Introduction to Microwaves engineering: History of Microwaves, Microwave Frequency bands. Applications of Microwave, General solution for TEM, TE and TM waves, Parallel plate waveguide, and rectangular waveguide, Wave guide parameters, Introduction to coaxial line, Rectangular waveguide cavity resonators, Circular waveguide cavity resonators.

UNIT - 2

Microwave Components:

Multi-port junctions: Construction and operation of E-plane, H-plane, Magic Tee and Directional couplers. Ferrites components: - Ferrite Composition and characteristics, Faraday rotation, Construction and operation of Gyrator, Isolator and Circulator.

Striplines: Structural details and applications of Striplines, Microstrip line, Parallel Strip line, Coplanar Strip line, Shielded Strip Line.

UNIT - 3

Microwave Network Analysis

Introduction and applications of Impedance and Equivalent voltages and currents, Impedance and Admittance matrices, The Transmission (ABCD) matrix Scattering Matrix:- Significance, formulation and properties. S-Matrix calculations for-2 port network junction, E plane, H-plane and E-H (Magic Tee) Tees, Directional coupler, Isolator and Circulator. Related problems.

UNIT - 4

Microwave Tubes

Limitations of conventional tubes, O and M type classification of microwave tubes, reentrant cavity, velocity modulation. O type tubes Two cavity Klystron: Construction and principle of operation, velocity modulation and bunching process Applegate diagram. Reflex Klystron: Construction and principle of operation, velocity modulation and bunching process, Applegate diagram, Oscillating modes, o/p characteristics, efficiency, electronic & mechanical tuning. M-type tubes Magnetron: Construction and Principle of operation of 8 cavity cylindrical travelling wave magnetron, hull cutoff condition, modes of resonance, PI mode operation, o/p characteristics, Applications. Slow wave devices Advantages of slow wave devices, Helix TWT: Construction and principle of operation, Applications.

UNIT - 5

Microwave bipolar transistor, FET, MESFET, Varactor Diode, PIN Diode, Shottky Barrier Diode, Tunnel Diode, TEDs, Gunn Diodes, IMPATT diode and TRAPATT diode. Structural details, Principle of operation, various modes, specifications, and applications of all these devices.

UNIT - 6

Microwave Measurements

Measurement devices: Slotted line, Tunable detector, VSWR meter, Power Meter, S-parameter measurement, frequency measurements, Power measurement, Attenuation measurement, Phase shift measurement, VSWR measurement, Impedance measurement, Q of cavity resonator measurement.

TEXT/REFERENCE BOOKS

1. Microwave Engineering – Annapurna Das, Sisir K Das TMH Publication, 2nd, 2010
2. Microwave Devices and circuits- Liao / Pearson Education
3. Antennas and Wave Propagation, John D. Krauss, Ronald J Marhefka and Ahmad S Khan, 4thSpecial Indian Edition , McGraw- Hill Education Pvt. Ltd., 2010.
4. Microwave Engineering – David M Pozar, John Wiley India Pvt. Ltd., 3rdEdn, 2008
5. Microwave Engineering – Sushrut Das, Oxford Higher Education, 2ndEdn, 2015
6. Antennas and Wave Propagation – Harish and Sachidananda: Oxford University Press, 2007.

BTETPE702B	RF Circuit Design	3 Credits

Course Objectives:

- To study RF issues related to active and passive components.
- To study circuit design aspects at RF
- To learn design and modeling of circuits at RF.

Course Outcomes:

After successfully completion of the course students will be able to

1. Understand behavior of passive components at high frequency and modeling of HF circuit.
2. Design HF amplifiers with gain bandwidth parameters.
3. Understand Mixer types and characteristics.
4. Gain the knowledge about PLLs and Oscillators with respect to their circuit topologies.

UNIT - 1

RF Behavior of Passive Components

HF Resistors, HF Capacitors, HF Inductors, Chip Components. Circuit Board Considerations: Chip Resistors, Chip Capacitors, Surface Mounted Inductors.

UNIT - 2

Bandwidth Estimation

Open Circuit Time Constant Method: Observations & Interpretations, Accuracy of OC τs, Considerations, and Design examples. Short Circuit Time Constant Method: Background, Observations & Interpretations, Considerations. Delay of a system in cascade, Rise time of systems in cascade, Relation between Rise Time and Bandwidth.

UNIT - 3

High Frequency Amplifier Design

Shunt Peaked Amplifier, Shunt Series peak Amplifier, Two port bandwidth enhancement, Design example. Bandwidth enhancement techniques. Tuned Amplifier: Common Source Amplifier with Single Tuned Load, Analysis of Tuned Amplifier. Neutralization and uni lateralization. Characteristics of RF amplifier. Amplifier power relations. Stability considerations, Stabilization methods.

UNIT - 4

Low Noise Amplifier Design

MOSFET two port noise parameters, LNA topologies, Power-constrained noise optimization. Design examples: Single ended LNA, Differential LNA. Linearity and large signal performance. Spurious free dynamic range.

UNIT - 5

Oscillators

Problem with Purely Linear Oscillators, Describing Functions, Describing Function for MOS. Colpitts Oscillator: Describing Function Model and Start-up Model of Colpitts Oscillator. Resonators: Quarter-Wave Resonators, Quartz Crystals. Tuned Oscillators: Basic LC Feedback Oscillators, Crystal Oscillator. Negative Resistance Oscillator.

UNIT - 6

Mixers

Mixer Fundamentals. Significant Characteristics of Mixer: Conversion Gain, Noise Figure, Linearity and Isolation, Spurs. Non Linear Systems as Linear Mixers. Multiplier Based Mixers: Single Balanced Mixer, Linearization techniques of Mixer, Active Double Balanced Mixer. Passive Double Balanced Mixer, Diode Ring Mixers.

TEXT/REFERENCE BOOKS

1. Reinhold Ludwig, Pavel Bretchko, “RF Circuit Design Theory and Applications”, Pearson Education.
2. Thomas H. Lee, “The Design of CMOS Radio-Frequency Integrated Circuits”, Second Edition, Cambridge Publications.
3. T. Yettrdal, Yunhg Cheng, “Devices modeling for analog and RF COMS circuits design”, John Wiley publication.
4. Calvin Plett, “Radio frequency Integrated Circuits Design”, Artech house.

BTETPE702C	Satellite Communication	3 Credits

Course Objectives:

- To provide students with good depth of knowledge in radar and Satellite communication.
- Knowledge of theory and practice of advanced communication techniques e.g. TDMA, CDMA, FDMA.
- This will equip the students for further studies and research knowledge of modern applications in radar and Satellite communication.

Course Outcomes:

At the end of the course, the students will have:

1. Knowledge of theory and practice related to radar and Satellite communication.
2. Ability to identify, formulate and solve engineering problems related to radar and Satellite communication.
3. The student would be able to analyze the various aspects of establishing a geo-stationary satellite communication link.
4. Acquired knowledge about Satellite Navigation System.
5. Acquired knowledge about Radar and Radar Equations.

UNIT - 1

Basic Principles

General features, frequency allocation for satellite services, properties of satellite communication systems.

Earth Station: Introduction, earth station subsystem, different types of earth stations.

UNIT - 2

Satellite Orbits

Introduction, Kepler's laws, orbital dynamics, orbital characteristics, satellite spacing and orbitalcapacity, angle of elevation, eclipses, launching and positioning, satellite drift and station keeping.

UNIT - 3

Satellite Construction (Space Segment)

Introduction; attitude and orbit control system; telemetry, tracking and command; power systems, communication subsystems, antenna subsystem, equipment reliability and space qualification.

UNIT - 4

Satellite Links

Introduction, general link design equation, system noise temperature, uplink design, downlink design, complete link design, effects of rain.

UNIT - 5

The Space Segment Access and Utilization

Introduction, space segment access methods: TDMA, FDMA, CDMA, SDMA, assignment methods.

UNIT - 6

The Role and Application of Satellite Communication

Introduction to Digital Satellite and Mobile Satellite Communication.

TEXT/REFERENCE BOOKS

1. Timothy Pratt, Charles W. Bostian, Satellite Communications, John Wiley & Sons.
2. Dennis Roddy, Satellite Communications, 3rd Ed., McGraw-Hill International Ed. 2001.
3. W. L. Pritchard, J. A. Sciulli, Satellite Communication Systems Engineering, Prentice-Hall, Inc., NJ.
4. M. O. Kolawole, Satellite Communication Engineering, Marcel Dekker, Inc. NY.
5. Robert Gagliardi , "Satellite Communication" , CBS Publication.
6. Ha, "Digital Satellite Communication", McGraw- Hill.
7. Timothy Pratt and Charles Bostian, "Satellite Communications", John Wiley and Sons.

BTETPE702D	Fiber Optic Communication	3 Credits

Course Objectives:

- To learn the basic elements of optical fiber transmission link, fiber modes configurations and structures.
- To understand the different kind of losses, signal distortion in optical wave guides and other signal degradation factors.
- To learn the various optical source materials, LED structures, quantum efficiency, Laser diodes
- Understand the functionality of each of the components that comprise a fiber-optic communication system: transmitter, fiber, amplifier, and receiver.
- Understand the properties of optical fiber that affect the performance of a communication link.
- Understand basic optical amplifier operation and its effect on signal power and noise in the system.
- Apply concepts listed above to the design of a basic communication link.

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Understand the principles fiber-optic communication, the components and the bandwidth advantages.
2. Understand the properties of the optical fibers and optical components.
3. Understand operation of lasers, LEDs, and detectors.
4. Analyze system performance of optical communication systems.
5. Design optical networks and understand non-linear effects in optical fibers

UNIT - 1

Introduction

Introduction to vector nature of light, propagation of light, propagation of light in a cylindrical dielectric rod, Ray model, wave model.

UNIT - 2

Types of optical fibers

Different types of optical fibers, Modal analysis of a step index fiber, Signal degradation on optical fiber due to dispersion and attenuation. Fabrication of fibers and measurement techniques like OTDR.

UNIT - 3

Optical sources

LEDs and Lasers, Photo-detectors - pin-diodes, APDs, detector responsivity, noise, optical receivers. Optical link design - BER calculation, quantum limit, power penalties

UNIT - 4

Optical switches

Coupled mode analysis of directional couplers, electro-optic switches.

UNIT - 5

Optical amplifiers

EDFA, Raman amplifier, WDM and DWDM systems, Principles of WDM networks.

UNIT - 6

Nonlinear effects in fiber optic links

Nonlinear effects in fiber optic links, Concept of self-phase modulation, group velocity dispersion and solition based communication.

TEXT/REFERENCE BOOKS

1. J. Keiser, Fibre Optic communication, McGraw-Hill, 5th Ed. 2013 (Indian Edition).
2. T. Tamir, Integrated optics, (Topics in Applied Physics Vol.7), Springer-Verlag, 1975.
3. J. Gowar, Optical communication systems, Prentice Hall India, 1987.
4. S.E. Miller and A.G. Chynoweth, eds., Optical fibres telecommunications, Academic Press, 1979.
5. G. Agrawal, Nonlinear fibre optics, Academic Press, 2nd Ed. 1994.
6. G. Agrawal, Fiber optic Communication Systems, John Wiley and sons, New York, 1997

7. F.C. Allard, Fiber Optics Handbook for engineers and scientists, McGraw Hill, New York (1990).

BTETPE702E	Wireless Sensor Networks	3 Credits

Course Objectives:

- To introduce the emerging research areas in the field of wireless sensor networks
- To understand different protocols and there uses in WSN.

Course Outcomes:

At the end of the course the students will be able to

1. Design wireless sensor networks for a given application
2. Understand emerging research areas in the field of sensor networks
3. Understand MAC protocols used for different communication standards used in WSN
4. Explore new protocols for WSN.

UNIT - 1

Introduction

Introduction to Sensor Networks, unique constraints and challenges, Advantage of Sensor Networks, Applications of Sensor Networks, Types of wireless sensor networks

UNIT - 2

Networks

Mobile Ad-hocNetworks (MANETs) and Wireless Sensor Networks, Enabling technologies for Wireless Sensor Networks. Issues and challenges in wireless sensor networks.

UNIT - 3

Protocols

Routing protocols, MAC protocols: Classification of MAC Protocols, S-MAC Protocol, B-MAC protocol, IEEE 802.15.4 standard and ZigBee.

UNIT - 4

Dissemination protocol

Dissemination protocol for large sensor network, Data dissemination, data gathering, and data fusion; Quality of a sensor network; Real-time traffic support and security protocols.

UNIT - 5

Design Principles for WSNs, Gateway Concepts Need for gateway, WSN to Internet Communication, and Internet to WSN Communication.

UNIT - 6

Single-node architecture, Hardware components & design constraints, Operating systems and execution environments.

TEXT/REFERENCE BOOKS

1. Waltenegus Dargie , Christian Poellabauer, " Fundamentals Of Wireless Sensor Networks Theory And Practice" , By John Wiley & Sons Publications ,2011
2. Sabrie Soloman, "Sensors Handbook" by McGraw Hill publication. 2009
3. Feng Zhao, Leonidas Guibas, " Wireless Sensor Networks" , Elsevier Publications,2004
4. Kazem Sohrby, Daniel Minoli, "Wireless Sensor Networks": Technology, Protocols and Applications, Wiley-Inter science
5. Philip Levis, And David Gay "Tiny OS Programming" by Cambridge University Press 2009.

BTETPE702F	**Mobile Computing**	**3 Credits**

Course Objectives:

- To provide guidelines, design principles and experience in developing applications for small, mobile devices, including an appreciation of context and location aware services.
- To introduce wireless communication and networking principles, that support connectivity to cellular networks, wireless internet and sensor devices.
- To appreciate the social and ethical issues of mobile computing, including privacy.

Course Outcomes:

1. At the end of the course, the student will be able to demonstrate:
2. A working understanding of the characteristics and limitations of mobile hardware devices including their user-interface modalities
3. The ability to develop applications that are mobile-device specific and demonstrate current practice in mobile computing contexts.

4. A comprehension and appreciation of the design and development of context-aware solutions for mobile devices.
5. An awareness of professional and ethical issues, in particular those relating to security and privacy of user data and user behavior.

UNIT - 1

Mobile Computing, Mobile Computing vs. wireless Networking, Mobile Computing Applications, Characteristics of Mobile computing, Structure of Mobile Computing Application.

UNIT - 2

MAC Protocols, Wireless MAC Issues, Fixed Assignment Schemes, Random Assignment Schemes, Reservation Based Schemes.

UNIT - 3

Overview of Mobile IP, Features of Mobile IP, Key Mechanism in Mobile IP, route Optimization. Overview of TCP/IP, Architecture of TCP/IP- Adaptation of TCP Window, Improvement in TCP Performance.

UNIT - 4

Global System for Mobile Communication (GSM), General Packet Radio Service (GPRS), Universal Mobile Telecommunication System (UMTS).

UNIT - 5

Ad-Hoc Basic Concepts , Characteristics , Applications , Design Issues , Routing , Essential of Traditional Routing Protocols ,Popular Routing Protocols , Vehicular Ad Hoc networks (VANET) , MANET vs. VANET , Security.

UNIT - 6

Mobile Device Operating Systems , Special Constrains & Requirements , Commercial Mobile Operating Systems , Software Development Kit: iOS, Android, BlackBerry, Windows Phone , M Commerce , Structure , Pros & Cons , Mobile Payment System , Security Issues.

TEXT/REFERENCE BOOKS

1. Principles of Mobile Computing, 2nd Edition, Uwe Hansmann, Lothar Merk, Martin Nicklous, Thomas Stober, Springer

2. Mobile Computing, Tomasz Imielinski, Springer.

BTETPE703A	Embedded System Design	3 Credits

Course Objectives:

- To understand the embedded system design issues.
- To learn real time operating system concepts.
- To understand the Embedded Linux environment.
- To learn embedded software development and testing process.

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Suggest design approach using advanced controllers to real-life situations.
2. Design interfacing of the systems with other data handling / processing systems.
3. Appreciate engineering constraints like energy dissipation, data exchange speeds etc.
4. Get to know the hardware – software co design issues and testing methodology for embedded system.

UNIT - 1

Introduction to Embedded Computing

The concept of embedded systems design, Characteristics of Embedding Computing Applications, Concept of Real time Systems

UNIT - 2

Design Process

Requirements, Specifications, Architecture Design, Designing of Components, Embedded microcontroller cores, embedded memories. Examples of embedded systems

UNIT - 3

Technological aspects of embedded systems

Interfacing between analog and digital blocks, signal conditioning, digital signal processing, subsystem interfacing, interfacing with external systems, user interfacing.

UNIT - 4

Design tradeoffs

Design tradeoffs due to process compatibility, thermal considerations, etc., Software aspects of embedded systems: real time programming languages and operating systems for embedded systems

UNIT - 5

Operating System

Basic Features of an Operating System, Kernel Features: Real-time Kernels, Polled Loops System, Co-routines, Interrupt-driven System, Multi-rate System Processes and Threads, Context Switching: Cooperative Multi-tasking, Pre-emptive Multi- tasking.

UNIT - 6

Scheduling and Inter-process Communication

Rate-Monotonic Scheduling, Earliest-Deadline First Scheduling, Task Assignment, Fault-Tolerant Scheduling Signals, Shared Memory Communication, Message-Based Communication

TEXT/REFERENCE BOOKS

1. J.W. Valvano, "Embedded Microcomputer System: Real Time Interfacing", Brooks/Cole, 2000.
2. Jack Ganssle, "The Art of Designing Embedded Systems", Newness, 1999.
3. V.K. Madisetti, "VLSI Digital Signal Processing", IEEE Press (NY, USA), 1995.
4. David Simon, "An Embedded Software Primer", Addison Wesley, 2000.
5. K.J. Ayala, "The 8051 Microcontroller: Architecture, Programming, and Applications", Penram Intl, 1996.

BTETPE703B	Artificial Intelligence Deep Learning	3 Credits

Course Objectives:

- Apply AI techniques to solve the given problems.
- Implement trivial AI techniques on relatively large system
- Explain uncertainty and Problem solving techniques.
- Compare various learning techniques.

Course Outcomes:

This course will enable students to

1. Identify the AI based problems.
2. Apply techniques to solve the AI problems.
3. Define learning and explain various logic inferences.
4. Discuss different learning techniques.

UNIT - 1

Introduction:

What Is AI? Thinking humanly: The cognitive modeling approach. Thinking rationally: The "laws of thought" approach, Acting rationally: The rational agent approach. The Foundations of Artificial Intelligence, Mathematics, Economics, Neuroscience, Computer engineering, The History of Artificial Intelligence. AI becomes an industry (1980-- present). Agents and Environments, Good Behaviour: The Concept of Rationality. The Nature of Environments. The Structure of Agents.

UNIT - 2

Search Techniques:

Problem-Solving Agents, Well-defined problems and solutions, Formulating problems, Real-world problems. Uninformed Search Strategies, Breadth-first search, Uniform-cost search, Depth-first search, Depth-limited search, Iterative deepening depth-first search, Bidirectional search, Informed (Heuristic) Search Strategies, Greedy best-first search, A* search: Minimizing the total estimated solution cost, Heuristic Functions. The effect of heuristic accuracy on performance. Beyon Classical Search, Local Search Algorithms and Optimization Problems, Local Search in Continuous Spaces.

UNIT - 3

Game Playing:

Games, Optimal Decisions in Games, The minimax algorithm, Optimal decisions in multiplayer games, Alpha Beta Pruning, Move ordering, Imperfect Real-Time Decisions, Cutting off search, Forward pruning, Stochastic Games, Evaluation functions for games of chance, Partially Observable Games, Krieg spiel: Partially observable chess, Card games, State-of-the-Art Game Programs, Alternative Approaches.

UNIT - 4

Logic and inference:

Defining Constraint Satisfaction Problems, Constraint Propagation: Inference in CSPs, Backtracking Search for CSPs, Local Search for CSPs, The Structure of Problems, Knowledge-Based Agents, The Wumpus World, Logic , Propositional Logic: A Very Simple Logic, Propositional Theorem Proving, Effective Propositional Model Checking, Agents Based on Propositional Logic. Forward Chaining, Backward Chaining, Definition of Classical Planning. Algorithms for Planning as State-Space Search, Planning Graphs.

UNIT - 5

Learning:

Forms of Learning, Supervised Learning, Learning Decision Trees, Evaluating and Choosing the Best Hypothesis, Model selection: Complexity versus goodness of fit, From error rates to loss, Regularization, The Theory of Learning, Regression and Classification with Linear Models, Artificial Neural Networks, Nonparametric Models, Ensemble Learning, Online Learning, Practical Machine Learning, A Logical Formulation of Learning. Knowledge in Learning. Explanation-Based Learning, Learning Using Relevance Information. Inductive Logic Programming. Statistical Learning. Learning with Complete Data. Learning with Hidden Variables: The EM Algorithm.

TEXT/REFERENCE BOOKS

1. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach. III Edition
2. E. Rich, K. Knight & S. B. Nair - Artificial Intelligence, 3/e, McGraw Hill.
3. Dan W. Patterson, Introduction to Artificial Intelligence and Expert Systems, Prentice Hal of India.
4. G. Luger, "Artificial Intelligence: Structures and Strategies for complex problem Solving", Fourth Edition, Pearson Education, 2002.
5. N.P. Padhy "Artificial Intelligence and Intelligent Systems" , Oxford UniversityPress-2015.

BTETPE703C	VLSI Design & Technology	3 Credits

Course Objectives:

- To study HDL based design approach.
- To learn digital CMOS logic design.
- To nurture students with CMOS analog circuit designs.
- To realize importance of testability in logic circuit design.
- To overview SoC issues and understand PLD architectures with advanced features.

Course Outcomes:

After successfully completing the course, students will be able to

1. Model digital circuit with HDL, simulate, synthesis and prototype in PLDs.
2. Understand chip level issues and need of testability.
3. Design analog & digital CMOS circuits for specified applications

UNIT - 1

VHDL Modeling

Data objects, Data types, Entity, Architecture & types of modeling, Sequential statements, Concurrent statements, Packages, Sub programs, Attributes, VHDL Test bench, Test benches using text files. VHDL modeling of Combinational, Sequential logics & FSM, Meta-stability.

UNIT - 2

PLD Architectures

PROM, PLA, PAL: Architectures and applications. Software Design Flow, CPLD Architecture, Features, Specifications, Applications, FPGA Architecture, Features, Specifications, Applications.

UNIT - 3

SoC & Interconnect

Clock skew, Clock distribution techniques, clock jitter, Supply and ground bounce, power distribution techniques. Power optimization, Interconnect routing techniques; wire parasitic, Signal integrity issues, I/O architecture, pad design, Architectures for low power.

UNIT - 4

Digital CMOS Circuits

MOS Capacitor, MOS Transistor theory, C-V characteristics, Non ideal I-V effects, Technology Scaling. CMOS inverters, DC transfer characteristics, Power components, Power delay product, Transmission gate. CMOS combo logic design, Delays: RC delay model, Effective resistance, Gate and diffusion capacitance, Equivalent RC circuits; Linear delay model, Logical effort, Parasitic delay, Delay in a logic gate, Path logical efforts.

UNIT -5

Analog CMOS Design

Current sink and source, Current mirror, Active load, Current source and Push-pull inverters, Common source, Common drain, Common gate amplifiers. Cascade amplifier, Differential amplifier, Operational amplifier

UNIT - 6

Testability

Types of fault, Need of Design for Testability (DFT), Testability, Fault models, Path sensitizing, Sequential circuit test, BIST, Test pattern generation, JTAG & Boundary scan, TAP Controller.

TEXT/REFERENCE BOOKS

1. Charles H. Roth, “Digital systems design using VHDL”, PWS.
2. Wyane Wolf, “Modern VLSI Design (System on Chip)”, PHI Publication.
3. Allen Holberg, “Analog CMOS Design”, Oxford University Press.
4. Neil H. E. Weste, David Money Harris, “CMOS VLSI Design: A Circuit & System Perspective”, Pearson Publication.

BTETPE703D	Data Compression & Encryption	3 Credits

Course Objectives:

- The concept of security, types of attack experienced.
- Encryption and authentication for deal with attacks, what is data compression, need and techniques of data compression.

Course Outcomes:

At the end of this course

1. The student will have the knowledge of Plaintext, cipher text, RSA and other cryptographic algorithm.
2. The student will have the knowledge of Key Distribution, Communication Model, Various models for data compression.

UNIT - 1

Data Compression and Encryption:

Need for data compression, Lossy/lossless compression, symmetrical compression and compression ratio, run length encoding for text and image compression, relative encoding and its applications in facsimile data compression and telemetry, scalar and quantization.

UNIT - 2

Statistical Methods:

Statistical modeling of information source, coding redundancy, variable size codes, prefix codes, Shannon- Fano coding, Huffman coding, adaptive Huffman coding, arithmetic coding and adaptive arithmetic coding, text compression using PPM method.

UNIT - 3

Dictionary Methods:

String compression, sliding window compression, LZ77, LZ78 and LZW algorithms and applications in text compression, zip and Gzip, ARC and Redundancy code.

UNIT - 4

Image Compression:

Lossless techniques of image compression, gray codes, two dimensional image transform ,Discrete cosine transform and its application in lossy image compression, quantization, Zig-Zag coding sequences, JPEG and JPEG-LS compression standards, pulse code modulation and differential pulse code modulation methods of image compression, video compression and MPEG industry standard.

UNIT - 5

Audio Compression:

Digital audio, lossy sound compression, M-law and A-law companding, DPCM and ADPCM audio compression, MPEG audio standard, frequency domain coding, format of compressed data.

UNIT - 6

Conventional Encryption:

Security of information, security attacks, classical techniques, caeser Cipher, block cipher principles, data encryption standard, key generation for DES, block cipher principle, design and modes of operation, S-box design, triple DES with two three keys, introduction to international data encryption algorithm, key distribution.

TEXT/REFERENCE BOOKS

1. Data compression- David Solomon Springer Verlag publication.
2. Cryptography and network security- William Stallings Pearson Education Asia Publication.
3. Introduction to data compression-Khalid Sayood Morgan kaufmann publication.
4. The data compression book- Mark Nelson BPB publication.
5. Applied cryptography-Bruce schnecer, John Wiley and sons Inc., publications.

BTETPE703E	Big Data Analytics	3 Credits

Course Objectives:

- To provide an overview of an exciting growing field of Big Data analytics.
- To discuss the challenges traditional data mining algorithms face when analyzing Big Data.
- To introduce the tools required to manage and analyze big data like Hadoop, NoSql Map Reduce.

- To teach the fundamental techniques and principles in achieving big data analytics with scalability and streaming capability
- To introduce to the students several types of big data like social media, web graphs and data streams
- To enable students to have skills that will help them to solve complex real-world problems in for decision support.

Course Outcomes:

At the end of this course, Students will able to:

1. Explain the motivation for big data systems and identify the main sources of Big Data in the real world.
2. Demonstrate an ability to use frameworks like Hadoop, NOSQL to efficiently store retrieve and process Big Data for Analytics.
3. Implement several Data Intensive tasks using the Map Reduce Paradigm
4. Apply several newer algorithms for Clustering Classifying and finding associations in Big Data.

UNIT - 1

Big Data Platforms

Big Data Platforms for the Internet of Things: network protocol- data dissemination –current state of art- Improving Data and Service Interoperability with Structure, Compliance, Conformance and Context Awareness: interoperability problem in the IoT context- Big Data Management Systems for the Exploitation of Pervasive Environments - Big Data challenges and requirements.

UNIT - 2

YA TRAP – Necessary and sufficient condition for false authentication prevention - Adaptive Pipelined Neural Network Structure in Self-aware Internet of Things: self-healing systems Role of adaptive neural network- Spatial Dimensions of Big Data: Application of Geographical Concepts and Spatial Technology to the Internet of Things- Applying spatial relationships, functions, and models.

UNIT - 3

Fog Computing

Fog Computing: A Platform for Internet of Things and Analytics: a massively distributed number of sources - Big Data Metadata Management in Smart Grids: semantic inconsistencies - role of metadata.

UNIT - 4

Web Enhanced Building

Toward Web Enhanced Building Automation Systems: heterogeneity between existing installations and native IP devices - loosely-coupled Web protocol stack –energy saving in smart building- Intelligent Transportation Systems and Wireless Access in Vehicular Environment Technology for Developing Smart Cities: advantages and achievements.

UNIT - 5

Technologies for Healthcare

Emerging Technologies in Health Information Systems: Genomics Driven Wellness Tracking and Management System (GO-WELL) – predictive care – personalized medicine.

UNIT - 6

Sustainability Data and Analytics

Sustainability Data and Analytics in Cloud-Based M2M Systems - potential stakeholders and their complex relationships to data and analytics applications - Social Networking Analysis - Building a useful understanding of a social network - Leveraging Social Media and IoT to Bootstrap Smart Environments: lightweight Cyber Physical Social Systems - citizen actuation.

TEXT/REFERENCE BOOKS

1. Stackowiak, R., Licht, A., Mantha, V., Nagode, L.,” Big Data and the Internet of Things Enterprise Information Architecture for A New Age”, Apress, 2015. 2. Dr. John Bates, “Thingalytics - Smart Big Data Analytics for the Internet of Things”, john Bates, 2015.
2. Dr. John Bates, “Thingalytics - Smart Big Data Analytics for the Internet of Things”, john Bates, 2015.

BTETPE703F	Cyber Security	3 Credits

Course Objectives:

- For secured and under control since the information stored and conveyed is ultimately an invaluable resource of the business.
- The growing number of the computer Network(internet/intranet) attacks and sophistication in attack technologies has made this task still more complicated
- To update the knowledge of the personnel manning networks and systems on the network security issues and solutions.

Course Outcomes:

Students should be able to understand.

1. The difference between threat, risk, attack and vulnerability.
2. How threats materialize into attacks.
3. Where to find information about threats, vulnerabilities and attacks.
4. Typical threats, attacks and exploits and the motivations behind them.

UNIT - 1

Introduction to Cyber Security

Overview of Cyber Security, Internet Governance – Challenges and Constraints, Cyber Threats – Cyber Warfare-Cyber Crime-Cyber terrorism-Cyber Espionage, Need for a Comprehensive Cyber Security Policy, Need for a Nodal Authority, Need for an International convention on Cyberspace.

UNIT - 2

Cyber Security Vulnerabilities and Cyber Security Safeguards

Cyber Security Vulnerabilities-Overview, vulnerabilities in software, System administration, Complex Network Architectures, Open Access to Organizational Data, Weak Authentication, Unprotected Broadband communications, Poor Cyber Security Awareness. Cyber Security Safeguards- Overview, Access control, Audit, Authentication, Biometrics, Cryptography, Deception, Denial of Service Filters, Ethical Hacking, Firewalls, Intrusion Detection Systems, Response, Scanning, Security policy, Threat Management.

UNIT - 3

Securing Web Application, Services and Servers

Introduction, Basic security for HTTP Applications and Services, Basic Security for SOAP Services, Identity Management and Web Services, Authorization Patterns, Security Considerations, Challenges.

UNIT - 4

Intrusion Detection and Prevention

Intrusion, Physical Theft, Abuse of Privileges, Unauthorized Access by Outsider, Malware infection, Intrusion detection and Prevention Techniques, Anti-Malware software, Network based Intrusion detection Systems, Network based Intrusion Prevention Systems, Host based Intrusion prevention Systems, Security Information Management, Network Session Analysis, System Integrity Validation.

UNIT - 5

Cryptography and Network Security

Introduction to Cryptography, Symmetric key Cryptography, Asymmetric key Cryptography, Message Authentication, Digital Signatures, Applications of Cryptography. Overview of Firewalls- Types of Firewalls, User Management, VPN Security Security Protocols: - security at the Application Layer- PGP and S/MIME, Security at Transport Layer- SSL and TLS, Security at Network Layer-IPSec.

UNIT - 6

Cyberspace and the Law, Cyber Forensics

Introduction, Cyber Security Regulations, Roles of International Law, the state and Private Sector in Cyberspace, Cyber Security Standards. The INDIAN Cyberspace, National Cyber Security Policy 2013 Introduction to Cyber Forensics, Handling Preliminary Investigations, Controlling an Investigation, Conducting disk-based analysis, Investigating Information-hiding, Scrutinizing E-mail, Validating E-mail header information, Tracing Internet access, Tracing memory in real-time.

TEXT/REFERENCE BOOKS

1. Charles P. Pfleeger Shari Lawrence Pfleeger Jonathan Margulies, Security in Computing, 5th Edition , Pearson Education , 2015

2. George K.Kostopoulous, Cyber Space and Cyber Security, CRC Press, 2013.
3. Martti Lehto, Pekka Neittaanmäki, Cyber Security: Analytics, Technology and Automation edited, Springer International Publishing Switzerland 2015.
1. Nelson Phillips and Enfinger Steuart, ―Computer Forensics and Investigations‖, Cengage Learning, New Delhi, 2009.

BTETPE704A	Consumer Electronics	3 Credits

Course Objectives:

- To acquaint students with the practical knowledge of designing and developing consumer electronic systems and products and introduce the latest trends and technologies.

Course Outcomes:

Students will be able to:

1. List technical specification of electronics Audio system (microphone and speaker)
2. Trouble shoots consumer electronics products like TV, washing machine and AC.
3. Identify and explain working of various color TV transmission blocks.
4. Adjust various controls of color TV receiver and troubleshoot it.
5. Use various functions of Cam coder and shoot a video and take snapshots and save them in appropriate format.

UNIT - 1

Communication devices

Mobile handsets, Android technology, 2G, 3G Mobiles, i-phone, EPABX

UNIT - 2

Mass Communication devices

Color Television, Antenna, HDTV, LCD TV,LED TV, 3D Technology In TV, Interactive TV, DTHTV, Plasma TV, Video Conferencing, FAX Machine, PA System, Dolby Digital Systems, Gesture Technology In TV.

UNIT - 3

Household e1cctronics devices

Washing Machine, Microwave Oven, Types Applications, Electronics Weighing Balance, Air Conditioner, Vacuum Cleaner.

UNIT - 4

Printing and recording devices

LASER printer, Inkjet Printers, Photocopiers, Scanner, DVD/CD Player, Blue ray DVD Player.

UNIT - 5

Special purpose machines

Electronic Voting Machine, CFL, LED Lamps, Application and Advantages. Solar lamp, Water Purifier, Electronic Calculator, DVD Player, ATM

Security devices

Biometric attendance Monitoring System, Working, Biometric Sensors, Home Automation System.

UNIT - 6

Compliance:

Product safety and liability issues, standards related to electrical safety and standards related to fire hazards, e.g., UL and VDE. EM1/EMC requirements and design techniques for compliance, e.g. ESD, RF interference and immunity, line current harmonics and mains voltage surge.

TEXT/REFERENCE BOOKS

1. Television &Video Engineering-A. M. Dhake, TMH Publication.
2. Monochrome and Color TV - R. R. Gulati, Wiley Eastern publication.
3. Video demystified -Keith Jack, PI publication
4. Audio &Video Systems-R.G.Gupta
5. Audio and Video system - Principles, maintenance and Troubleshooting by R. Gupta
6. Arora C. P., "Refrigeration and Air conditioning", Tata McGraw-Hill, New Delhi, 1994
7. Color TV Theory &Practice -S. P. Bali. TMG Hill Publication.
8. Basic TV &Video Systems-Bernard Grobb.
9. Electronic Communication Systems, Kennedy, TMH.
10. Principles of Communication Engineering- Anokh Singh-TMH.
11. C. M. Wintzer, International Commercial EMC Standards, Interference Control Techno1ologies 1988.

12. P. A. Chatterton and M. A. Houlden, EMC: Electromagnetic Theory to Practical Design. Wiley, 1992.
13. J. A. S. Angus, Electronic Product Design, Chapman and Hall, 1996.
14. Y. J. Wind, Product Policy: Concepts, Methods, and Strategy, Addison-Wesley Pub. Co. 1982.

BTETPE704B	Analog Integrated Circuit Design	3 Credits

Course Objectives:

- Introduction to Circuit Simulation & EM Simulations.
- Deep Understanding of MOS Device Physics & Modeling.
- Understanding of few transistor circuits like common gate, common source & common drain amplifiers with their frequency response.
- Understanding of Operational Amplifier Design & Trade-offs.
- Advanced Op-Amps and OTAs.
- Temperature Compensated Biasing Schemes.

Course Outcomes:

After the successful completion of this course, Students will be able to:

1. Describe the models for active devices in MOS and Bipolar IC technologies.
2. Describe layout considerations for active and passive devices in analog ICs.
3. Analyze and design IC current sources and voltage references.
4. Describe the noise sources and models applicable to ICs.
5. Understand and appreciate the importance of noise and distortion in analog circuits.
6. Analyze integrated circuit noise performance.
7. Analyze and design IC operational amplifiers.

UNIT - 1

Introduction to Simulations

Introduction to Advanced Design System and Cadence Virtuoso, DC Simulations, AC Simulations, Harmonic Balance, Envelope Simulation, Electromagnetic Simulations- FEM, MOM, FDTD, Circuit Net listing.

UNIT - 2

MOSFET Device Physics & Modeling

MOSFET Structure, Threshold Voltage, Drain Current Equation, Transfer & Output Characteristics, Weak/Moderate/Strong Inversion, Linear/Triode/Saturation Region of Operation, Device Leakages and Losses, Short Channel Effects, High Frequency Small Signal Model of MOSFET, Cubic, BSIM and Materka Models of MOSFET.

UNIT - 3

Few Transistor Circuits

Current Mirrors, Common Source/Common Gate/Common Drain Amplifiers, Design and Analysis of CS/CG/CD Amplifiers, Cascode Amplifiers, Differential Gain Stage, Frequency Response & Design Trade-offs, Telescopic Cascode and Wide Swing Cascode Current Mirrors, PTAT, CTAT & Bandgap Bias Circuits.

UNIT - 4

Operational Amplifiers & OTAs

Design of Classical Op-Amps, Op-Amp Characteristics, Analysis and Trade-offs, Wideband Op-Amps, High Speed Op-Amps, Very High Gain Op-Amps, Operational Transconductance Amplifiers, Ultra Low Power OTAs for Medical Implants, Folded Cascode Op-Amps.

UNIT - 5

Biasing Schemes

Voltage and Current References, Vt reference bias, PTAT Current Reference, CTAT and Bandgap Voltage References, High Precision Voltage References, Voltage Level Shifters.

UNIT - 6

Non-Linear Circuits

Single and Balanced Diode Mixers, Translinear Cell, Gilbert Cell Mixers, Power Amplifiers, Even & Odd Order Mixing, In-Modulation (AM, PM Conversions) Distortions, Intermodulation Distortions, Intermodulation Products, ACPR & EVM.

TEXT/REFERENCE BOOKS

1. Tony Chan Carusone, David A. Johns, Kenneth W. Martin, “Analog Integrated Circuit

2. Design”, John Wiley & Sons
3. Keliu Shu, Edgar Sanchez-Sinencio, “CMOS PLL Synthesizers”, Springer
4. Jose Carlos Pedro, Nuno Borges Carvalho, “Intermodulation Distortion in Microwave and Wireless Circuits”, Artech House
5. Stephen A. Maas, “Microwave Mixers”, Artech House.

BTETPE704C	Soft Computing	3 Credits

Course Objectives:

- Introduce a relatively new computing paradigm for creating intelligent machines useful for solving complex real world problems.
- Insight into the tools that make up the soft computing technique: fuzzy logic, artificial neural networks and hybrid systems Techniques.
- To create awareness of the application areas of soft computing technique.
- Provide alternative solutions to the conventional problem solving techniques in image/signal processing, pattern recognition/classification, control system.

Course Outcomes:

After the successful completion of this course, students will be able to:

1. Use a new tool /tools to solve a wide variety of real world problems.
2. Find an alternate solution, which may offer more adaptability, resilience and optimization.
3. Identify the suitable antenna for a given communication system.
4. Gain knowledge of soft computing domain which opens up a whole new career option.
5. Tackle real world research problems.

UNIT - 1

Artificial Neural Network –I:

Biological neuron, Artificial neuron model, concept of bias and threshold, McCulloch- Pits Neuron Model, implementation of logical AND, OR, XOR functions Soft Topologies of neural networks, learning paradigms: supervised, unsupervised, reinforcement, Linear neuron model: concept of error energy, gradient descent algorithm and application of linear neuron for linear regression, Activation functions: binary, bipolar (linear, signup, log sigmoid, tan sigmoid)Learning mechanisms: Hebbian, Delta Rule o Perceptron and its limitations Draft.

UNIT - 2

Artificial Neural Network-II:

Multilayer perceptron (MLP) and back propagation algorithm o Application of MLP for classification and regression o Self- organizing Feature Maps, k- means clustering o Learning vector quantization Radial Basis Function networks: Cover's theorem, mapping functions(Gaussian, Multi-quadrics, Inverse multi quadrics, Application of RBFN for classification and regression o Hopfield network, associative memories.

UNIT - 3

Fuzzy Logic –I:

Concept of Fuzzy number, fuzzy set theory (continuous, discrete) o Operations on fuzzy sets, Fuzzy membership functions (core, boundary, and support), primary and composite linguistic terms, Concept of fuzzy relation, composition operation (T-norm,T-conorm) o Fuzzy if-then rules.

UNIT - 4

Fuzzy Logic –II:

Fuzzification, Membership Value Assignment techniques, De-fuzzification (Max membership principle, Centroid method, Weighted average method), Concept of fuzzy inference, Implication rules- Dienes-Rescher Implication, Mamdani Implication, Zadeh Implication, Fuzzy Inference systems -Mamdani fuzzy model, Sugeno fuzzy model , Tsukamoto fuzzy model, Implementation of a simple two-input single output FIS employing Mamdani model Computing.

UNIT - 5

Fuzzy Control Systems:

Control system design problem 1.5, Control (Decision) Surface, Assumptions in a Fuzzy Control System Design V, Fuzzy Logic Controllers Soft o Comparison with traditional PID control, advantages of FLC, Architecture of a FLC: Mamdani Type, Example Aircraft landing control problem.

UNIT - 6

Adaptive Neuro-Fuzzy Inference Systems (ANFIS):

ANFIS architecture, Hybrid Learning Algorithm, Advantages and Limitations of ANFIS Application of ANFIS/CANFIS for regression.

TEXT/REFERENCE BOOKS

1. Fundamentals of Neural Networks: Architectures, Algorithms and Applications, Laurene Fausett, Pearson Education, Inc, 2008.
2. Fuzzy Logic with Engineering Applications, Third Edition Thomas, Timothy Ross, John Wiley & Sons, 2010.
3. Neuro- Fuzzy and Soft Computing, J.S. Jang, C.T. Sun, E. Mizutani, PHI Learning Private Limited.
4. Principles of Soft Computing, S. N. Sivanandam, S. N. Deepa, John Wiley & Sons, 2007.
5. Introduction to the theory of neural computation, John Hertz, Anders Krogh, Richard Palmer, Addison –Wesley Publishing Company, 1991.
6. Neural Networks A comprehensive foundation,, Simon Haykin, Prentice Hall International Inc-1999.
7. Neural and Adaptive Systems: Fundamentals through Simulations, José C. Principe Neil R. Euliano, W. Curt Lefebvre, John-Wiley & Sons, 2000.
8. Pattern Classification, Peter E. Hart, David G. Stork Richard O. Duda, Second Edition, 2000.
9. Pattern Recognition, Sergios Theodoridis, Konstantinos Koutroumbas, Fourth Edition, Academic Press, 2008.
10. A First Course in Fuzzy Logic, Third Edition, Hung T. Nguyen, Elbert A. Walker, Taylor & Francis Group, LLC, 2008.
11. Introduction to Fuzzy Logic using MATLAB, S. N. Sivanandam, S. Sumathi, S. N. Deepa, Springer Verlag, 2007.

BTETPE704D	Advance Industrial Automation-1	3 Credits

Course Objectives:

- To identify potential areas for automation and justify need for automation.
- To select suitable major control components required to automate a process or an activity.

- To translate and simulate a real time activity using modern tools and discuss the benefits of automation.

Course Outcomes:

After the successful completion of this course, the student will be able:

1. To identify suitable automation hardware for the given application.
2. To recommend appropriate modeling and simulation tool for the given manufacturing application.

UNIT - 1

Introduction:

Automation in Production System, Principles and Strategies of Automation, Basic Elements of an Automated System, Advanced Automation Functions, Levels of Automations. Flow lines & Transfer Mechanisms, Fundamentals of Transfer Lines. (SLE: Analysis of Transfer Lines).

UNIT - 2

Material handling and Identification Technologies:

Overview of Material Handling Systems, Principles and Design Consideration, Material Transport Systems, Storage Systems, Overview of Automatic Identification Methods (SLE: Material Identification Methods).

UNIT - 3

Automated Manufacturing Systems:

Components, Classification and Overview of Manufacturing Systems, Manufacturing Cells, GT and Cellular Manufacturing, FMS, FMS and its Planning and Implementation, Quality Control Systems: Traditional and Modern Quality Control Methods, SPC Tools, Inspection Principles and Practices, Inspection Technologies. (SLE: Usage of SPC tools using excel or Minitab).

UNIT - 4

Control Technologies in Automation:

Industrial Control Systems, Process Industries versus Discrete-Manufacturing Industries, Continuous Versus Discrete Control, Computer Process and its Forms, (SLE: Sensors, Actuators and other Control System Components).

UNIT - 5

Computer Based Industrial Control:

Introduction & Automatic Process Control, Building Blocks of Automation Systems: LAN, Analog & Digital I/O Modules, SCADA Systems& RTU. Distributed Control System: Functional Requirements, Configurations & some popular Distributed Control Systems (SLE: Display Systems in Process Control Environment).

UNIT - 6

Modeling and Simulation for Plant Automation:

Introduction, need for system Modeling, Building Mathematical Model of a Plant, Modern Tools & Future Perspective. Industrial Control Applications: Cement, Thermal, Water Treatment & Steel Plants. (SLE: Cases Studies minimum one for Cement, Thermal, Water Treatment & Steel Plants applications).

TEXT/REFERENCE BOOKS

1. Automation, Production Systems and Computer Integrated Manufacturing- M.P.Groover, Pearson Education.5th edition, 2009.
2. Computer Based Industrial Control- Krishna Kant, EEE-PHI,2nd edition,2010
3. An Introduction to Automated Process Planning Systems- Tiess Chiu Chang & Richard A. Wysk.
4. Performance Modeling of Automated Manufacturing Systems,-Viswanandham, PHI, 1st edition, 2009.

BTETPE704E	Mechatronics	3 Credits

Course Objectives:

- Understand key elements of Mechatronics system, representation into block diagram.
- Understand concept of transfer function, reduction and analysis.
- Understand principles of sensors, its characteristics, interfacing with DAQ microcontroller.

- Understand the concept of PLC system and its ladder programming, and significance of PLC systems in industrial application.
- Understand the system modelling and analysis in time domain and frequency domain.
- Understand control actions such as Proportional, derivative and integral and study its significance in industrial applications.

Course Outcomes:

1. Identification of key elements of mechatronics system and its representation in terms of block diagram.
2. Understanding the concept of signal processing and use of interfacing systems such as ADC, DAC, digital I/O.
3. Interfacing of Sensors, Actuators using appropriate DAQ micro-controller.
4. Time and Frequency domain analysis of system model (for control application).
5. PID control implementation on real time systems.
6. Development of PLC ladder programming and implementation of real life system.

UNIT - 1

Introduction to Sensors & Actuators

Introduction to Mechatronics, Measurement characteristics: -Static and Dynamic Sensors: Position Sensors: -Potentiometer, LVDT, Encoders; Proximity sensors:-Optical, Inductive, Capacitive; Motion Sensors:-Variable Reluctance; Temperature Sensor: RTD, Thermocouples; Force / Pressure Sensors:-Strain gauges; Flow sensors: -Electromagnetic Actuators: Stepper motor, Servo motor, Solenoids.

UNIT - 2

Block Diagram Representation

Open and Closed loop control system, identification of key elements of mechatronics systems and represent into block diagram (Electro-Mechanical Systems), Concept of transfer function, Block diagram reduction principles, Applications of mechatronics systems:-Household, Automotive, Shop floor (industrial).

UNIT - 3

Data Acquisition & Microcontroller System

Interfacing of Sensors / Actuators to DAQ system, Bit width, Sampling theorem, Aliasing, Sample and hold circuit, Sampling frequency, ADC (Successive Approximation), DAC (R-2R), Current and Voltage Amplifier.

UNIT - 4

PLC

Programming Introduction, Architecture, Ladder Logic programming for different types of logic gates, Latching, Timers, Counter, Practical Examples of Ladder Programming, and Introduction to SCADA system.

UNIT - 5

Modelling and Analysis of Mechatronics System

System modelling (Mechanical, Thermal and Fluid), Stability Analysis via identification of poles and zeros, Time Domain Analysis of System and estimation of Transient characteristics: % Overshoot, damping factor, damping frequency, Rise time, Frequency Domain Analysis of System and Estimation of frequency domain parameters such as Natural Frequency, Damping Frequency and Damping Factor.

UNIT - 6

Control System

P, I and D control actions, P, PI, PD and PID control systems, Transient response:-Percentage overshoot, Rise time, Delay time, Steady state error, PID tuning (manual).

TEXT/REFERENCE BOOKS

1. K.P. Ramchandran, G.K. Vijyaraghavan, M.S. Balasundaram, Mechatronics: Integrated Mechanical Electronic Systems, Willey Publication, 2008
2. Bolton, Mechatronics -A Multidisciplinary approach, 4th Edition, Prentice Hall, 2009.
3. Alciatore & Histand, Introduction to Mechatronics and Measurement system, 4thEdition, McGraw Hill publication, 2011.
4. Bishop (Editor), Mechatronics –An Introduction, CRC Press, 2006.
5. Mahalik, Mechatronics –Principles, concepts and applications, Tata Mc - Graw Hill publication, New Delhi.

6. C. D. Johnson, Process Control Instrumentation Technology, Prentice Hall, New Delhi.

BTETPE704F	Electronics in Smart City	3 Credits

Course Objectives:

Course Outcomes:

UNIT - 1

Necessity of SMART CITY

The Smart City Philosophy, Development of Asian Cities, Megacities of India: Current Challenges, The India Story of Smart Cities, Conceptual Basis of a Smart City, Global Smart City Programs, Recommendations for Smart City Framework in GCC.

UNIT - 2

SMART CITY and IOT

Introduction to Internet of Things, applications in smart city & their distinctive advantages - smart environment, smart street light and smart water & waste management. What is an IOT? Role and scope of IOT in present and future marketplace.

UNIT - 3

SMART Objects

Smart objects, Wired – Cables, hubs, etc., Wireless – RFID, WiFi, Bluetooth, etc. Different functional building blocks of IOT architecture

UNIT - 4

Smart Cities: Distributed Intelligence and Central Planning

On the Interplay between Humans and Smart Devices, Theoretical Tools, Intelligence-Artificial Intelligence (Machine Intelligence), Information Dynamics, Synergetic, Information Dynamics and Allometry in Smart Cities.

UNIT - 5

Wireless Protocols for Smart Cities

IPv6 over Low-Power Wireless Personal Area Network: Features, Addressing, Packet fragmentation, Operation, Security. ZigBee: Architecture Objectives, Wireless Networking

Basics, Wireless Networking Assumptions, Bluetooth Low Energy, Constrained Application Protocol, Message Queue Telemetry Protocol.

UNIT - 6

Leveraging Smart City Projects for Benefitting Citizens: The Role of ICTs

Smart City and ICT: Using Technologies to Improve the Citizens' Quality of Life, Smart City Goals: The Impact on Citizens' Well-Being and Quality of Life, Critical Dimensions: Urbanization, Local Climate Change, and Energy Poverty, Environmental Issues: The Role of Local and Global Climate Chang.

TEXT/REFERENCE BOOKS

BTHM705	Financial Management	2 Credits

Course Objectives:

- To help the students to develop cognizance of the importance of Financial Management in corporate valuation
- To enable students to describe how people analyze the corporate leverage under different conditions and understand why people valuate different corporates in different manner.
- To provide the students to analyze specific characteristics of Supply Chain Industry and their future action for cash flow
- To enable students to synthesize related information and evaluate options for most logical and optimal solution such that they would be able to predict and control Debt Equity incurrence and improve results.

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. The students would be able to understand and define basic terminology used in finance and accounts
2. The students would be able to prepare& appraise Financial Statements and evaluate a company in the light of different measurement systems.
3. The students would be able to analyze the risk and return of alternative sources of financing.
4. Estimate cash flows from a project, including operating, net working capital, and capital spending.
5. To estimate the required return on projects of differing risk ,to estimate the cash flows from an investment project, calculate the appropriate discount rate, determine the value added from the project, and make a recommendation to accept or reject the project
6. To describe and illustrate the important elements in project finance Using financial calculator and Excel in a variety of problems.

UNIT - 1

Introduction to Financial Accounting, Book keeping & Recording: Meaning, Scope and importance of Financial Accounting. Financial Accounting - concepts and conventions, classification of accounts, Rules and principles governing Double Entry Book-keeping system, Meaning, Preparation of Journal, Ledger , Cash book & Trial balance.

UNIT - 2

Financial Statement Preparation, analysis & Interpretation: Preparation of financial statement and Profit & Loss Account, Balance Sheet. , Ratio Analysis - classification of various ratios.

UNIT - 3

Introduction To Financial Management: Concept of business finance, Goals & objectives of financial management, Sources of financing, Long Term financing- shares, debentures, term loans, lease & hire purchase, retained earnings, public deposits, bonds (Types, features & utility). Short Term Financing- bank finance, commercial paper, trade credit

UNIT - 4

Working Capital Management: Concept of working Capital, significance, types. Adequacy of working capital, Factors affecting working capital needs, financing approaches for working capital, Methods of forecasting working capital requirements, Methods of Forecasting.

UNIT - 5

Time Value of Money & Capital Budgeting: Concept of time value of money, Compounding & discounting; Future value of single amount & annuity, present value of single amount & annuity; Practical application of time value technique. Capital budgeting - Nature and significance, techniques of capital budgeting –Pay Back Method, Accounting rate of return, Internal Rate of Return, DCF, Net Present Value and profitability index.

UNIT - 6

Project Financing: Details of the company, its promoters and project finances required, profitability etc., Loan documentation-Appraisal of terms loans by financial institutions. Basic components of project finance.

TEXT & REFERENCE BOOKS

1. Financial Management by Khan & Jain, Text, Problem & Cases, Tata McGraw Hill Publication 5th Edition.

2. Tulsian Financial Management by Dr. P.C.Tulsian, S Chand Publication 5th Edition.

3. Taxman's Financial Management by Ravi M. Kishore, Taxmann 2017 Edition.

4. A Textbook of Financial , Cost & Management Accounting by Dr.P.Pariasamy, Himalaya Publishing House

5. Fundamentals of financial Management by Bhabhtosh Banerjee, PHI publication, 2nd Edition.

BTETPE801A **Introduction to Internet of Things** **4 Credits**

PROF. SUDIP MISRA Dept. of Computer Science and Engineering IIT Kharagpur
Course Duration: 12 week

Course Outline:
Internet of Things (IoT) is presently a hot technology worldwide. Government, academia, and industry are involved in di-erent aspects of research, implementation, and business with IoT. IoT cuts across di-erent application domain verticals ranging from civilian to defence sectors. These domains include agriculture, space, healthcare, manufacturing, construction, water, and mining, which are presently transitioning their legacy infrastructure to support IoT. Today it is possible to envision pervasive connectivity, storage, and computation, which, in turn, gives rise to building di-erent IoT solutions. IoT-based applications such as innovative shopping system, infrastructure management in both urban and rural areas, remote health monitoring and emergency notication systems, and transportation systems, are gradually relying on IoT based systems. Therefore, it is very important to learn the fundamentals of this emerging technology.

Course Plan:
Week 01 : Introduction to IoT, Sensing, Actuation, Basics of Networking.

Week 02 : Basics of Networking, Communication Protocols.

Week 03 : Communication Protocols, Sensor Networks

Week 04 : Sensor Networks, Machine-to-Machine Communications.

Week 05 : Interoperability in IoT, Introduction to Arduino Programming, Integration of Sensors and Actuators with Arduino.

Week 06 : Introduction to Python programming, Introduction to Raspberry.

Week 07 : Implementation of IoT with Raspberry Pi, Introduction to SDN.

Week 08 : SDN for IoT, Data Handling and Analytics, Cloud Computing

Week 09 : Cloud Computing, Sensor-Cloud.

Week 10 : Fog Computing, Smart Cities and Smart Homes

Week 11 : Connected Vehicles, Smart Grid, Industrial IoT

Week 12 : Industrial IoT, Case Study: Agriculture, Healthcare, Activity Monitoring

BTETPE801B **Computer Vision and Image Processing** **4 Credits**

Dr. M. K. Bhuyan
Professor, Indian Institute of Technology Guwahati,
Course Duration: 12 week

Course Outline:

The course familiarizes students with fundamental concepts and issues related to computer vision and major approaches that address them. The focus of the course is on image acquisition and image formation models, radiometric models of image formation, image formation in the camera, image processing concepts, concept of feature extraction and feature selection for pattern classification/recognition, and advanced concepts like object classification, object tracking, image-based rendering, and image registration. Intended to be a companion to a typical teaching course on computer vision, the course takes a problem-solving approach

Course Plan:

I Image Formation and Image Processing

Introduction to Computer Vision and Basic Concepts of Image Formation

Introduction and Goals of Computer Vision, Image Formation and Radiometry, Geometric Transformation, Geometric Camera Models, Image Reconstruction from a Series of Projections

Image Processing Concepts

Fundamentals of Image Processing, Image Transforms, Image Filtering, Colour Image Processing, Mathematical Morphology, Image Segmentation

II Image Features

Image Descriptors and Features

Texture Descriptors, Colour Features, Edge Detection, Object Boundary and Shape Representations, Interest or Corner Point Detectors, Histogram of Oriented Gradients (HOG), Scale Invariant Feature Transform (SIFT), Speeded up Robust Features (SURF), Saliency

III Recognition

Fundamental Pattern Recognition Concepts

Introduction to Pattern Recognition, Linear Regression, Basic Concepts of Decision Functions, Elementary Statistical Decision Theory, Gaussian Classifier, Parameter Estimation, Clustering for Knowledge Representation, Dimension Reduction, Template Matching, Artificial Neural Network (ANN) for Pattern Classification, Convolutional Neural Networks (CNNs), Autoencoder

IV Applications

Applications of Computer Vision

Machine Learning Algorithms and their Applications in Medical Image Segmentation, Motion Estimation and Object Tracking, Face and Facial Expression Recognition, Gesture Recognition, Image Fusion, Programming Examples

BTETPE801C **Biomedical Signal Processing** **4 Credits**

Prof. Sudipta Mukhopadhyay ,IIT Kharagpur
Course Duration: 12 week

Course outline:

This course is prepared for the engineering students in their final year of undergraduate studies or in their graduate studies. Electrical Engineering students with a good background in Signals and Systems are prepared to take this course. Students in other engineering disciplines, or in computer science, mathematics, geo physics or physics should also be able to follow this course. While a course in Digital Signal Processing would be useful, it is not necessary for a capable student. The course has followed problem solving approach as engineers are known as problem solvers. The entire course is presented in the form of series of problems and solutions.

Course Plan:

Week 1: Preliminaries; Biomedical signal origin & dynamics (ECG)

Week 2: Biomedical signal origin & dynamics (EEG, EMG etc.)

Week 3: Filtering for Removal of artifacts Statistical Preliminaries; Time domain filtering (Synchronized Averaging, Moving Average)

Week 4: Filtering for Removal of artifacts contd. Time domain filtering (Moving Average Filter to Integration, Derivative-based operator), Frequency Domain Filtering (Notch Filter)

Week 5: Filtering for Removal of artifacts contd. Optimal Filtering: The Weiner Filter

Week 6: Filtering for Removal of artifacts contd. Adaptive Filtering Selecting Appropriate Filter

Week 7: Event Detection Example events (viz. P, QRS and T wave in ECG) Derivative based Approaches for QRS Detection Pan Tompkins Algorithm for QRS Detection

Week 8: Event Detection contd. Dicrotic Notch Detection Correlation Analysis of EEG Signal

Week 9: Waveform Analysis Illustrations of problem with case studies Morphological Analysis of ECG Correlation coefficient The Minimum phase correspondent and Signal Length

Week 10: Waveform Analysis contd. Envelop Extraction Amplitude demodulation The Envelogram Analysis of activity Root Mean Square value Zero-crossing rate Turns Count, Form factor

Week 11: Frequency-domain Analysis Periodogram

Week 12: Frequency-domain Analysis Averaged Periodogram Blackman-Tukey Spectral Estimator Daniellâ€™s Spectral Estimator Measures derived from PSD

BTETPE 802A **Industrial Automation and Control** **4 Credits**

Prof. S. Mukhopadhyay Department of Electrical Engineering IIT Kharagpur
Course Duration: 12 week

Course Plan:

Week 1: Introduction to Industrial Automation and Control , Architecture of Industrial Automation Systems, Introduction to sensors and measurement systems

Week 2: Temperature measurement, Pressure and Force measurements, Displacement and speed measurement, Flow measurement techniques , Measurement of level, humidity, pH etc

Week 3: Signal Conditioning and Processing, Estimation of errors and Calibration

Week 4: Introduction to Process Control, P-- I -- D Control, Controller Tuning.

Week 5: Implementation of PID Controllers, Special Control Structures : Feedforward and Ratio Control. Predictive Control, Control of Systems with Inverse Response, Cascade Control, Overriding Control, Selective Control, Split Range Control

Week 6: Introduction to Sequence Control, PLCs and Relay Ladder Logic Sequence Control : Scan Cycle, RLL Syntax , Structured Design Approach

Week 7: Sequence Control : Advanced RLL Programming ,The Hardware environment

Week 8 : Control of Machine tools : Introduction to CNC Machines , Analysis of a control loop

Week 9 : Introduction to Actuators : Flow Control Valves , Hydraulic Actuator Systems : Principles, Components and Symbols , Pumps and Motors, Proportional and Servo Valves

Week 10 : Pneumatic Control Systems : System Components , Controllers and Integrated Control Systems, Electric Drives : Introduction, Energy Saving with Adjustible Speed Drives , Step motors : Principles, Construction and Drives

Week 11: DC Motor Drives: Introduction, DC--DC Converters, Adjustible Speed Drives , Induction Motor Drives: Introduction, Characteristics, Adjustible Speed Drives ,Synchronous Motor Drives : Motor Principles, Adjustible Speed and Servo Drives

Week 12: Networking of Sensors, Actuators and Controllers : The Fieldbus ,The Fieldbus Communication Protocol , Introduction to Production Control Systems

BTETPE 802B Cryptography and Network Security 4 Credits

Dr. Debdeep Mukhopadhyay IIT Kharagpur

Course Duration: 12 week

Course Outline

The course deals with the underlying principles of cryptography and network security. It develops the mathematical tools required to understand the topic of cryptography. Starting from the classical ciphers to modern day ciphers, the course provides an extensive coverage of the techniques and methods needed for the proper functioning of the ciphers. The course deals with the construction and cryptanalysis of block ciphers, stream ciphers and hash functions. The course defines one way functions and trap-door functions and presents the construction and cryptanalysis of public key ciphers, namely RSA. The key exchange problem and solutions using the DiffieHellman algorithm are discussed. Message Authentication Codes (MAC) and signature schemes are also detailed. The course deals with modern trends in asymmetric key cryptography, namely using Elliptic Curves. The course concludes with the design rationale of network protocols for key exchange and attacks on such protocols

Course Plan:

Introduction and Mathematical Foundations

Introduction, Overview on Modern Cryptography, Number Theory, Probability and Information Theory

Classical Cryptosystems

Classical Cryptosystems, Cryptanalysis of Classical Cryptosystems, Shannon's Theory

Symmetric Key Ciphers

Symmetric Key, Ciphers Modern Block Ciphers (DES), Modern Block Cipher (AES)

Cryptanalysis of Symmetric Key Ciphers

Linear Cryptanalysis, Differential Cryptanalysis, Other Cryptanalytic Techniques, Overview on S-Box Design Principles, Modes of operation of Block Ciphers

Stream Ciphers and Pseudo-randomness

Stream Ciphers, Pseudorandom functions

Hash Functions and MACs

Hash functions: The Merkle Damgard Construction, Message Authentication Codes (MACs)

Asymmetric Key Ciphers: Construction and Cryptanalysis

More Number Theoretic Results ,The RSA Cryptosystem, Primality Testing, Factoring Algorithms , Other attacks on RSA and Semantic Security of RSA ,The Discrete Logarithm Problem (DLP) and the Diffie Hellman Key Exchange algorithm, The ElGamal Encryption Algorithm Cryptanalysis of DLP

Digital Signatures

Signature schemes

Modern Trends in Asymmetric Key Cryptography
Elliptic curve based cryptography

Network Security
Secret Sharing Schemes, A Tutorial on Network Protocols, Kerberos, Pretty Good Privacy (PGP) Secure Socket Layer (SSL), Intruders and Viruses, Firewalls

BTETPE 802C Digital IC Design 4 credits

PROF. JANAKIRAMAN Electrical and Electronics Engineering IIT Madras
Course Duration : 12 weeks

Course Outline: This is a most fundamental Digital Circuit Design course for pursing a major in VLSI. We do not deal with any Verilog coding during this course and instead discuss transistor level circuit design concepts in great detail.

Learning objectives of this course are:

- Characterize the key delay quantities of a standard cell
- Evaluate power dissipated in a circuit (dynamic and leakage)
- Design a circuit to perform a certain functionality with specified speed
- Identify the critical path of a combinational circuit
- Convert the combinational block to pipelined circuit
- Calculate the maximum (worst case) operating frequency of the designed circuit

Course Plan:

Week 1: The CMOS Inverter construction and Voltage Transfer Characteristics

Week 2: Resistance and Capacitance and transient response.

Week 3: Dynamic, Short Circuit and Leakage power – Stacking Effect

Week 4: Combinational Circuit Design and capacitance

Week 5: Parasitic Delay, Logical Effort and Electrical Effort

Week 6: Gate sizing and Buffering

Week 7: Asymmetric gate, Skewed gates, Ratio’ed logic

Week 8: Dynamic Gates and Domino logic and Static Timing Analysis

Week 9: Sequential circuits and feedback. Various D flip flop circuits – Static and Dynamic

Week 10: Setup and Hold Time measurement. Timing analysis of latch/ flop based systems

Week 11: Adders – Mirror adder, Carry Skip adder, Carry Select adder, Square Root adder

Week 12: Multipliers – Signed and Unsigned arithmetic, Carry Save Multiplier implementation

JAIDEV EDUCATION SOCIETY'S
J D COLLEGE OF ENGINEERING AND MANAGEMENT
KATOL ROAD, NAGPUR
Website: www.jdcoem.ac.in E-mail: info@jdcoem.ac.in
An Autonomous Institute, with NAAC "A" Grade
Department of Electronics and Telecommunication Engineering
"Rectifying Ideas, Amplifying Knowledge"
Session: 2022-23

Course Structure and Syllabus (Autonomous)

For

B. Tech. Fifth Semester in Electronics and Telecommunication Engineering

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				Credit
				L	T	P	CA	MSE	ESE	Total	
1	PCC	ET5T001	Digital Signal Processing	2	1	0	20	20	60	100	3
2	PCC	ET5T002	Microcontroller and Application	3	0	0	20	20	60	100	3
3	PCC	ET5T003	Control System Engineering	3	0	0	20	20	60	100	3
4	PEC	ET5E004	Professional Elective Course-I	3	0	0	20	20	60	100	3
5	OEC	ET5O001	OPEN Elective Course-I	4	0	0	20	20	60	100	4
6	ESC	ET5L005	Software Workshop Lab	0	0	2	60	0	40	100	1
7	PCC	ET5L001	Digital Signal Processing Lab	0	0	2	60	0	40	100	1
8	PCC	ET5L002	Microcontroller and Application Lab	0	0	2	60	0	40	100	1
9	Internship	ET5P001	Field Training-2	0	0	0	20	0	30	50	1
10	Project	ET5P002	Mini Project	0	0	2	20	0	30	50	1
11	MC	ET5T006	Consumer Affairs	2	0	0	10	15	25	50	Audit
			Total	**17**	**1**	**8**	**330**	**115**	**505**	**950**	**21**

ET5T001	Digital Signal Processing	3 Credit

Prerequisites: Basic knowledge of mathematics.

Course Objectives:

1. To study the basic concepts of digital signal processing.
2. To study analysis and processing of signals for different kind of applications and retrieval of information from signals.
3. To understand the physical significance of circular convolution and its relation with linear convolution.
4. To study designing of digital filters and its realization.
5. To study analysis of signals using the discrete Fourier transform (DFT) and Z-Transform.
6. To study behaviour of discrete time systems using Z-Transform.

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Represent discrete-time signals analytically and visualize them in the time domain.
2. Meet the requirement of theoretical and practical aspects of DSP with regard to sampling and reconstruction.
3. Apply the concepts of different transforms and analyze the discrete time signals and systems.
4. Realize the use of LTI filters for filtering different real world signals.
5. Justify the use of multi rate signal processing to estimate the wavelet transform.
6. Design and implement digital filter, multistage sampling rate converter for various applications.

Course Contents:

Module-1: DSP Preliminaries **[5 Hrs]**

Discrete time signals: Sequences; representation of signals on orthogonal basis; Sampling and reconstruction of signals, Basic elements of DSP and its requirements, advantages of Digital over Analog signal processing.

Module-2: Discrete Fourier Transform **[5 Hrs]**

DTFT, Definition, Frequency domain sampling, DFT, Properties of DFT, circular convolution, linear convolution, Computation of linear convolution using circular convolution, FFT, decimation in time and decimation in frequency using Radix-2 FFT algorithm

Module-3: Z transforms **[5 Hrs]**

Need for transform, relation between Laplace transform and Z transform, between Fourier transform and Z transform, Properties of ROC and properties of Z transform, Relation between pole locations and time domain behaviour, causality and stability considerations for LTI systems, Inverse Z transform, Power series method, partial fraction expansion method, Solution of difference equations.

Module-4: IIR Filter Design **[5 Hrs]**

Concept of analog filter design (required for digital filter design), Design of IIR filters from analog filters, IIR filter design by impulse invariance method, bilinear transformation method. Characteristics of Butterworth filters, Chebyshev filters, Butterworth filter design, IIR filter realization using direct form, cascade form and parallel form, Lowpass, High pass, Bandpass and Bandstop filters design using spectral transformation (Design of all filters using Lowpass filter)

Module-5: FIR Filter Design **[5 Hrs]**

Ideal filter requirements, Gibbs phenomenon, windowing techniques, characteristics and comparison of different window functions, Design of linear phase FIR filter using windows and frequency sampling method. FIR filters realization using direct form, cascade form and lattice form.

Module-6: Introduction to Multirate signal processing **[5 Hrs]**

Concept of Multirate DSP, Introduction to Up sampler, Down sampler and two channel filter bank, Sampling rate conversion by rational factor I/D, Application of Multirate signal processing in communication, Music processing, Image processing and Radar signal processing.

Text Books:

1. J.G. Proakis, D.G. Manolakis “Digital Signal Processing: Principles, algorithms and applications, Pearson Education.

2. S. K. Mitra, Digital Signal Processing: A computer based approach.TMH

3. S. salivahanan, A Vallavaraj, C. Gnanapriya , ‘Digital Signal Processing’, 2nd Edition McGraw Hill.

Reference Books.

1. A.V. Oppenheim and Schafer, Discrete Time Signal Processing, Prentice Hall, 1989.

2. J.R. Johnson, Introduction to Digital Signal Processing, Prentice Hall, 1992.

3. L.R. Rabiner and B. Gold, Theory and Application of Digital Signal Processing, Prentice Hall, 1992.

4. D.J.DeFatta, J. G. Lucas andW.S.Hodgkiss, Digital Signal Processing, John Wiley& Sons, 1988

5. A. Nagoor Kani, ‘Digital Signal Processing’, 2nd Edition McGraw Hill.

E-Resources:

1. https://nptel.ac.in/courses/117/102/117102060/
2. https://onlinecourses.nptel.ac.in/noc21_ee20/preview
3. https://www.tutorialspoint.com/digital_signal_processing/index.htm
4. https://lecturenotes.in/notes/15433-note-for-digital-signal-processing-dsp-by-vtu-rangers
5. http://ndl.iitkgp.ac.in/document/WGZ3c3g4Sk9LK3VrdjJRMk41NnFqOEtUOWY5d3MvTCtpbGp0OFBCcS95bz0

ET5T002	**Microcontroller and Application**	**3 Credit**

Prerequisites: Basic knowledge of Digital Circuits and microprocessor (ET3T004)

Course Objectives:

1. To understand the applications of Microcontrollers.
2. To understand need of microcontrollers in embedded system.
3. To understand architecture and features of typical Microcontroller.
4. To learn interfacing of real world input and output devices.
5. To study various hardware and software tools for developing applications.

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. **Remember** importance of microcontroller in designing embedded application and use of hardware and software tools.

2. **Understand** modern tools like Programmers, Debuggers, cross compilers and current IDE i.e. integrated development environment tools.

3. **Apply** knowledge of microcontroller to interface mechanical system to function in multidisciplinary system like robotics, Automobiles.

4. **Analyze** and formulate control and monitoring systems using microcontrollers.

5. **Evaluate** experiments based on interfacing of devices to real world applications.

6. **Design** real time cost effective controllers using microcontroller based system and develop interfacing to real world devices to serve engineering solution for Global, social and economic context.

Course Contents:

Module-1: Fundamentals of Microcontrollers **[6 Hrs]**

Introduction to the general structure of 8 and 16 bit Microcontrollers Harvard & Von Neumann architecture, RISC & CISC processors, Role of microcontroller in embedded system, Selection criteria of microcontroller Block diagram and explanation of 8051, Port structure, memory organization, Interrupt structure, timers and its modes, serial communication modes. Overview of Instruction set, Sample programs (assembly): Delay using Timer and interrupt, Programming Timer 0&1, Data transmission and reception using Serial port.

Module-2: Interfacing with 8051 PART I **[6 Hrs]**

Software and Hardware tools for development of microcontroller-based systems such as assemblers, compliers, IDE, Emulators, debuggers, programmers, development board, DSO, Logic Analyzer, Interfacing LED with and without interrupt, Keypads, Seven Segment multiplexed Display, LCD, ADC Interfacing. All Programs in assembly language and C.

Module-3: Interfacing with 8051 PART II **[6 Hrs]**

8051 timer programming, serial port and its programming, interrupt programming, LCD and keyboard interfacing, ADC and DAC interfacing, interfacing to external memory Interfacing of DAC, Temperature sensors, Stepper motor, Motion detectors, Relay, Buzzer, Optoisolators. All programs in assembly and C

Module-4: PIC Microcontroller Architecture **[6 Hrs]**

PIC 10, PIC12, PIC16, PIC18 series comparison, features and selection as per application PIC18FXX architecture, registers, memory Organization and types, stack, oscillator options, BOD, power down modes and configuration bit settings, timer and its programming, Brief summary of Peripheral support, Overview of instruction set, MPLAB IDE & C18 Compiler.

Module-5: Real World Interfacing Part I **[6 Hrs]**

Port structure with programming, Interrupt Structure (Legacy and priority mode) of PIC18F with SFRS, Interfacing of switch, LED, LCD (4&8 bits), and Key board, Use of timers with interrupts, CCP modes: Capture, Compare and PWM generation, DC Motor speed control with CCP: All programs in embedded C.

Module-6: Real World Interfacing Part II **[6 Hrs]**

Basics of Serial Communication Protocol: Study of RS232, RS 485, I2C, SPI, MSSP structure (SPI &I2C), UART, Sensor interfacing using ADC, RTC (DS1306) with I2C and EEPROM with SPI. Design of PIC test Board, Home protection System: All programs in embedded C.

Text Books:

1**.** Mazidi & Mazidi, The 8085 microcontroller & embedded system, using assembly and C,
2nd edi, pearson edu.
2. Calcut, 8051 microcontrollers: Applications based introduction, Elsevier.
3. Udyashankara V., Mallikarjunaswamy, 8051 microcontroller, TMH.
4. Han-way Huang, using The MCS-51 microcontroller, Oxford university press.

Reference Books:

1. M.Bates, "PIC Microcontrollers", Newnes, 2011

2. M.A. Mazidi, S. Naimi, S. Naimi, “The AVR Microcontroller and Embedded Systems: Using Assembly and C”, Prentice Hall, 2011.

3. M.A. Mazidi, R.D. McKinlay, J.G. Mazidi, “The 8051 Microcontroller: A Systems Approach”, Pearson, 2013.

E-Resources:

6. https://onlinecourses.nptel.ac.in/noc21_ee18/preview
7. https://onlinecourses.swayam2.ac.in/aic20_sp04/course
8. https://www.electronicshub.org/?s=microcontroller
9. https://www.exploreembedded.com/
10. www.atmel.com
11. https://www.express-technology.com/part-type/microcontrollers

ET5T003	**Control System Engineering**	**3 Credits**

Prerequisites: Basic knowledge of mathematics (Laplace transform)

Course Objectives:

1. To introduce the elements of control system and their modeling using various techniques.
2. To introduce methods for analyzing the time response, the frequency response and the stability of systems.
3. To introduce the concept of root locus, Bode plots, Nyquist plots.
4. To introduce the state variable analysis method.
5. To introduce concepts of PID controllers and digital and control systems.
6. To introduce concepts programmable logic controller.

Course Outcomes:

At the end of this course, students will be able to

1. **Categorize** different types of system and **identify** a set of algebraic equations to represent and model a complicated system into a more simplified form.

2. **Characterize** any system in Laplace domain to illustrate different specification of the system using transfer function concept.

3. **Interpret** different physical and mechanical systems in terms of electrical system to construct equivalent electrical models for analysis.

4. **Employ** time domain analysis to **predict** and **diagnose** transient performance parameters of the system for standard input functions.

5. **Formulate** different types of analysis in frequency domain to explain the nature of stability of the system.

6. **Identify** the needs of different types of controllers and compensator to ascertain the required dynamic response from the system.

Course Contents:

Module-1: Introduction to Control Problem **[7 Hrs]**

Industrial Control examples, Mathematical models of physical systems, Control hardware and their models, Transfer function models of linear time-invariant systems. Feedback Control: Open-Loop and Closed-loop systems. Benefits of Feedback, Block diagram reduction techniques, Signal flow graph analysis.

Module -2: Time Response Analysis **[6 Hrs]**

Standard test signals, Time response of first and second order systems for standard test inputs. Application of initial and final value theorem, Design specifications for second-order systems based on the time-response

Module -3: Stability Analysis **[7 Hrs]**

Concept of Stability, Routh-Hurwitz Criteria, Relative Stability analysis, Root-Locus technique. Construction of Root-loci, Dominant Poles, Application of Root Locus Diagram,

Module -4: Frequency-Response Analysis **[8 Hrs]**

Relationship between time and frequency response, Polar plots, Bode plots. Nyquist stability criterion, Relative stability using Nyquist criterion – gain and phase margin. Closed-loop frequency response.

Module -5: Introduction to Controller Design **[6 Hrs]**

Stability, steady-state accuracy, transient accuracy, disturbance rejection, insensitivity and robustness of control systems, Application of Proportional, Integral and Derivative Controllers, Designing of Lag and Lead Compensator using Root Locus and Bode Plot.

Module -6: State Variable Analysis **[7 Hrs]**

Concepts of state variables, State space model. Diagonalization of State Matrix, Solution of state equations, Eigenvalues and Stability Analysis, Concept of controllability and observability, Pole-placement by state feedback, Discrete-time systems, Difference Equations, State-space models of linear discrete-time systems. Stability of linear discretetime systems.

Text Books:

1. N. J. Nagrath and M. Gopal, "Control System Engineering", New Age International Publishers, 5th Edition, 2009.
2. Schaum's Outline Series, "Feedback and Control Systems" Tata McGraw-Hill, 2007.
3. John J. D‟Azzo & Constantine H. Houpis, "Linear Control System Analysis and Design", Tata McGraw-Hill, Inc., 1995.
4. Richard C. Dorf and Robert H. Bishop, "Modern Control Systems", Addison – Wesley, 1999.
5. R. A. Barapate, "Feedback Control System" Tech Max Publication, 11th revised Edition

Reference Books:

1. Norman S Nise, "Control Systems Engineering", Wiley Publications, 6th Edition.
2. M. Gopal, "Control System – Principles and Design", Tata McGraw Hill, 4th Edition, 2012.
3. Benjamin C. Kuo, "Automatic control systems", Prentice Hall of India, 7th Edition, 1995.
4. Ghosh, "Control Systems: Theory and Applications", Pearson India; 2nd edition, 2012.

Professional Elective Course - I

ET5E004A	**Introduction to Robotics and Computer Programming**	**3 Credit**

Prerequisites: Basics of Sensors and logical thinking and prior knowledge of programming

Course Objectives:

1. Robotics-Introduction-classification with respect to geometrical configuration
2. Industrial robots' specifications. Selection based on the Application
3. Introduction to Robot Programming Robot Programming-Introduction-Types

Course Outcomes:

1. Understand the basic components of robots.
2. Differentiate types of robots and robot grippers.
3. Explain robot programming methods
4. Understand the components of robot programming
5. Develop simple program to simulate robot movements
6. Develop robot program for specific application.

Course Contents:

Module-1: Robotics-Introduction **[6 Hrs]**

Robotics-Introduction-classification with respect to geometrical configuration (Anatomy), Controlled system & chain type: Serial manipulator & Parallel Manipulator. Components of Industrial robotics-prepossession of movement-resolution, accuracy & repeatability-Dynamic characteristics- speed of motion, load carrying capacity & speed of response-Sensors-Internal sensors: Position sensors,& Velocity sensors, External sensors: Proximity sensors, Tactile Sensors, & Force or Torque sensors. Grippers – Mechanical Gripper-Grasping force--mechanisms for actuation, Magnetic gripper vacuum cup gripper-considerations in gripper selection & design.

Module-2: Industrial Robots Specifications **[6 Hrs]**

Selection based on the Application. Kinematics-Manipulators Kinematics, Rotation Matrix, Homogeneous Transformation Matrix, D-H transformation matrix, D-H method of assignment of frames. Direct and Inverse Kinematics for industrial robots. Differential Kinematics for planar serial robots Robot Applications: Material transfer and machine loading/unloading, processing operations assembly and inspection. Concepts of safety in robotics, social factors in use of robots, economics of robots.

Module-3: Introduction to Robot Programming **[6 Hrs]**

Robot programming-Introduction-Types- Flex Pendant- Lead through programming, Coordinate systems of Robot, Robot controller- major components, functions-Wrist Mechanism-Interpolation-

Interlock commands Operating mode of robot, Jogging-Types, Robot specifications- Motion commands, end effector and sensors command.

Module-4: Rapid Language [6 Hrs]

RAPID language basic commands- Motion Instructions-Pick and place operation using Industrial robot manual mode, automatic mode, subroutine command based programming. Move master command language-Introduction, syntax, simple problems.

Module-5: Robotics Based Industrial Automation [6 Hrs]

Fixed Automation: Automated Flow lines, Methods of Work part Transport, Transfer Mechanism - Continuous transfer, intermittent transfer, Indexing mechanism, Operator-Paced Free Transfer Machine, Buffer Storage, Control Functions, Automation for Machining Operations, Design and Fabrication Considerations.

Module-6: Practical Study of Virtual Robot [6 Hrs]

Robot cycle time analysis-Multiple robot and machine Interference-Process chart-Simple problems- Virtual robotics, Robot studio online software- Introduction, Jogging, components, work planning, program modules, input and output signals-Singularities-Collision detection-Repeatability measurement of robot-Robot economics.

Text Books:

1. Groover M P, Industrial Robotics, Mc Graw Hill Ltd.
2. John J. Craig, Introduction to Robotics, Pearson Education Asia
3. Jazar, Theory of Applied Robotics, Springer.
4. S. R.Deb, “Robotics technology and flexible automation”, Tata McGraw Hill publishing company limited, 1994.
5. Mikell. P. Groover, “Industrial Robotics Technology”, Programming and Applications, McGraw Hill Co, 1995. [T3] Robotcs Lab manual, 2007.

Reference Books.

1. Ghosal, Robotics, Oxford india .
2. Cameron Hughes Tracey Hughes, Robot ProMikell. P. Groover, Industrial Robotics: Technology, Programming, and Applications 2nd Edition, McGraw Higher Ed. 2012, ISBN: 9781259006210,
3. Industrial Robotics Technology, Programming and Applications, McGraw Hill Co, 1995. 5) Robotics Lab manual, 2007.

4. Programming: A Guide to Controlling Autonomous Robots, 1/e First Edition, 2016, ISBN: 9789332577442 2) S. R. Deb, Robotics Technology and Flexible Automation, 2010. McGraw Hill ISBN: 9780070077911.

E-Resources

1. https://onlinecourses.nptel.ac.in/noc20_de11/preview
2. https://nptel.ac.in/courses/112/105/112105249/
3. https://robotacademy.net.au/masterclass/introduction-to-robotics

ET5E004B **Telecommunication Switching System** **3 Credit**

Prerequisites: Basic knowledge of networks, switching and signalling.

Course Objectives:

1. To understand properties, characteristics and behaviour of Telecommunication Switching Systems and Telecommunication Traffic.
2. To know and analyse different Switching Networks.
3. To introduce concepts of Network Synchronization and Management.
4. To design different Network using Cellular Telephone Concepts.

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Understand the main concepts of telecommunication network design.
2. Analyse and evaluate fundamental telecommunication traffic models.
3. Understand basic modern signalling system.
4. Analyse and Solve traditional interconnection switching system design problems.
5. Interpret concept of Network engineering.
6. Compare and Design telephone network, data network and integrated service digital network related to Cellular Telephone Concepts.

Course Contents:

Module-1: Telecommunication Switching Systems **[5 Hrs]**

Principles of manual switching system, electronic telephone, local and central battery system, trunk exchange, junction working. Automatic telephony: strowger exchange, line switches and selectors, ringing and tone circuit, subscriber uniselector circuit, trunking diagram, cross bar switching system Message switching, Circuit switching, manual switching and Electronic Switching. Digital switching: Switching functions, space division switching, time division switching, two dimensional switching, digital cross connect systems, digital switching in an analog environment

Module-2: Telecommunication Traffic **[5 Hrs]**

Unit of Traffic, Traffic measurement, a mathematical model, Lost- call systems: Theory, traffic performance, loss systems in tandem. Queuing systems: Erlang Distribution, probability of delay, Finite queue capacity, systems with a single server, Queues in tandem, delay tables and application of Delay formulae. Analysis: Traffic Characteristics: Arrival Distributions, Holding time Distribution. Loss Systems: Lost calls cleared, lost calls returning, lost calls Held, lost calls cleared.

Module-3: Switching Networks **[5 Hrs]**

Single Stage Networks, Grading: Principle, Design of progressive grading, other grading, Traffic capacity of grading, Applications of grading. Link Systems: General, Two stage networks, three stage networks. Grades of service of link systems: General, Two stage networks, three stage networks, Call packing, Rearrangeable networks, Strict sense non blocking networks, Sectionalized switching networks Control of Switching Systems: Call processing Functions: Sequence f operations, Signal exchanges, State transition diagrams. Common Control, Reliability, Availability and Security.

Module-4: Network Synchronization and Management **[5 Hrs]**

Timing: Timing Recovery, Clock Instability, Elastic Stores, Jitter measurements, systematic jitter. Timing Inaccuracy: Slips, Asynchronous Multiplexing, Waiting time jitter. Network Synchronization: Plesiochronous, pulse stuffing, mutual synchronization, Network master, Master – Slave synchronization, Hierarchical synchronization Processes. Network management: Routing control, Flow control.

Module-5: Networks **[5 Hrs]**

Data Networks: Data Transmission in PSTN, Data Communication Architecture, Link to link layers, End to End layers, Satellite based Data networks, LANs, MANs, Fiber optic networks, Data network Standards, Protocol stacks, Interworking. Integrated Services Digital Networks: ISDN, Network and protocol Architecture, Transmission Channels, User network interfaces, signaling, Numbering and Addressing, ISDN Standards, Broadband ISDN, Voice Data Integration

Module-6: Cellular Telephone Concepts **[5 Hrs]**

Mobile telephone services, cellular telephone, Frequency reuse, Interference, Cellular System topology, Roaming and handoffs, Cellular telephone network components, Cellular telephone calls processing. Cellular Telephone systems: Digital cellular telephone.

Text Books:

1. J. E. Flood, "Telecommunications Switching, Traffic and Networks", Pearson Education
2. John C. Bellamy, "Digital Telephony", Third Edition; Wiley Publications
3. Thiagarajan Vishwanathan, "Telecommunication Switching Systems and Networks"; PHI Publications.
4. Wayne Tomasi, "Electronic Communications Systems"; 5th Edition; Pearson Education

Reference Books.

5. P.Gnanasivam, "Telecommunication Switching and Networks "

6. Rappaport, ”Wireless communication”
7. Tannenbaum ”Data communication and networks” 4th Edition,TMH

E-Resources:

1. https://nptel.ac.in/content/storage2/courses/117105076/pdf/1.1%20Lesson%201.pdf
2. https://sites.google.com/a/mvn.edu.in/telecomm-switching-system/products-services
3. https://onlinecourses.nptel.ac.in/noc19_ee52/preview
4. https://www.vssut.ac.in/lecture_notes/lecture1528107908.pdf
5. https://www.iare.ac.in/sites/default/files/IARE_TSTA_LECTURE%20NOTES_0.pdf

ET5L005	**Software Workshop Lab**	**1 Credit**

Prerequisites: Basic knowledge of computer programming and Analog and Digital Electronics.

Course Objectives:

1. To instil in students the ability to formulate and solve engineering problems in electric and electronic circuits involving both steady state and transient conditions using MATLAB and pSpice.
2. Learn to use the pSpice simulation software tool for the analysis of Electrical and Electronic Circuits.
3. Learn to insert simple instructions to MATLAB, to find the solution of a system of linear algebraic equations, with constant (real and complex) coefficients

Course Outcomes:

At the end of the laboratory work, students will demonstrate the ability to:

1. Write MATLAB program for any given problem.

2) Plot various functions using different graphical techniques.
3) Make mathematical analysis for the given problem.
4) Get the complete expert hand on pSpice Software.
5) To draw, analyse and plot the electronic circuits using pSpice Software.

List of Experiments:

SCILAB

1. Introduction to SCILAB Environment
2. To study simple matrix and array manipulations using SCILAB
3. Programming using SCILAB
4. Calculus using SCILAB
5. To plot signals: discrete and continuous using SCILAB
6. Function programming and SCILAB
7. Signal Manipulation using SCILAB

Spice

1. Design and simulation of resistive circuit
2. Plotting of VI characteristics of diode
3. Plotting of VI characteristics of BJT/FET
4. Plotting of VI characteristics of UJT/SCR
5. Design and simulation of half wave & full wave rectifier
6. Design and simulation of clipper and clamper circuits
7. Simulation of frequency response of a transistorized RC coupled amplifier.

ET5L001	Digital Signal Processing Lab	1 Credit

Prerequisites: Basic knowledge of MATLAB or SCILAB software.

Course Objectives:

1. To understand principle & working of digital signal processing for various applications.
2. To understand Z transforms and discrete time Fourier transforms for the analysis of digital signals and systems.
3. To design and implement FIR & IIR filter and analysis of their frequency response

Course Outcomes:

At the end of the laboratory work, students will demonstrate the ability to:

1. Acquire the basic concepts of various digital signals by plotting them.
2. Analyse and process the signals in the discrete domain.
3. Apply the techniques, skills, and modern engineering tools like MATLAB and digital processors.
4. Write and simulate the MATLAB/SCILAB program for various applications.
5. Design the filters to suit requirements of specific applications.

List of Experiments:

0. Introduction to SCILAB. (Spoken tutorial)
1. To plot and represent following basic discrete time signals using MATLAB functions. : Unit impulse, unit step, ramp, real and complex exponential and its representations.
2. To plot linear convolution of discrete signals using MATLAB functions.
3. Write a program to compute cross-correlation and auto-correlation of the given sequences with corresponding plot.
4. Write a program to test stability of given discrete- time system.
5. To find Z transform of discrete time signal and its ROC with corresponding plot.
6. To find inverse Z transform of given discrete time signal.
7. Write a program to find frequency response of given system.
8. To compute DFT and IDFT of discrete time signals.
9. Write a program to find FFT and IFFT of given sequences.
10. Compute linear and circular convolution using DFT / IDFT method.
11. Designing of Digital IIR filter using MATLAB functions.

12. Designing of Digital FIR filter using window.

13. Designing of Digital FIR filter using GUI tool box.

14. To perform linear convolution and circular convolution on Processor kit.

15. To designing and implementation of High pass filter on DSP processor.

16. Study of sampling theorem, effect of under sampling. (Virtual lab:http://vlabs.iitkgp.ernet.in/dsp/)

17. Study of properties of Linear time-invariant system. (Virtual lab:http://vlabs.iitkgp.ernet.in/dsp/#)

18. Study of convolution: series and parallel system. (Virtual lab:http://vlabs.iitkgp.ernet.in/dsp/#)

19. Study of Discrete Fourier Transform (DFT) and its inverse. (Virtual lab:

http://vlabs.iitkgp.ernet.in/dsp/)

20. Study of Transform domain properties and its use. (Virtual lab:http://vlabs.iitkgp.ernet.in/dsp/#)

ET5L002	**Microcontroller and Application Lab**	**1 Credit**

Prerequisites: Basic knowledge of Microprocessor and microcontroller programming.

Course Objectives:

1. To perform a practical based on microcontroller based system.
2. To study assembly language programming skills.
3. Interface different peripherals with microcontroller with its use.

Course Outcomes:

At the end of the laboratory work, students will demonstrate the ability to:

1. The concept of Assembly languages structure and programming.
2. Interface various peripherals with 8051 microcontroller.
3. Simulate the programs on different software platforms.

List of Experiments:

1. Write and execute an assembly language program to perform addition & subtraction on 8 bit / 16 bit number for 8051using Keil uvision 4.
2. Write and execute an assembly language program to perform Multiplication & Division on 8 bit / 16 bit number for 8051using Keil uvision 4.
3. Write and execute 8051 assembly language program to find smallest byte in a string of bytes.
4. Write and execute 8051 assembly language program to exchange two data strings.
5. Write and execute 8051 assembly language program to generate square wave of 1 KHz (and any other frequency) on one of the pin of output port
6. Design & implementation of LED & Switch interfacing with 8051.
7. Design & implementation of 7 segment display interfacing with 8051.
8. Design & implementation of 16 x 2 LCD interfacing with 8051.
9. Design & implementation of DC Motor interfacing with 8051.
10. Design & implementation of Stepper Motor interfacing with 8051.
11. Design & implementation of 4 x 4 matrix keyboard interfacing with PIC Microcontroller.
12. Interfacing of 8051 Microcontroller with various display devices.
13. Interfacing of 8051 Microcontroller with ADC and DAC.
14. Interfacing of 8051 Microcontroller with DC motor.
15. To study the serial port communication with 8051 microcontroller.

ET5T006	Consumer Affairs	Audit

Objective: This paper seeks to familiarize the students with their rights and responsibilities as a consumer, the social framework of consumer rights and legal framework of protecting consumer rights. It also provides an understanding of the procedure of redress of consumer complaints, and the role of different agencies in establishing product and service standards. The student should be able to comprehend the business firms' interface with consumers and the consumer related regulatory and business environment.

Unit 1: Conceptual Framework **06 Lectures**

Consumer and Markets: Concept of Consumer, Nature of markets: Liberalization and Globalization of markets with special reference to Indian Consumer Markets, E-Commerce with reference to Indian Market, GST, and Digital consumer issues.

Experiencing and Voicing Dissatisfaction: Consumer buying process, Consumer Satisfaction/dissatisfaction-Grievances-complaint, Consumer Complaining Behaviour: Alternatives available to Dissatisfied Consumers; Complaint Handling Process: ISO 10000 suite

Unit 2: The Consumer Protection Law in India **06 Lectures**

Objectives and Basic Concepts: Consumer rights and UN Guidelines on consumer protection, Consumer goods, defect in goods, spurious goods and services, service, deficiency in service, unfair trade practice, and restrictive trade practice.

Unit 3: Grievance Redressal Mechanism under the Indian Consumer Protection Law **06 Lect.**

Who can file a complaint? Grounds of filing a complaint; Limitation period; Procedure for filing and hearing of a complaint; Disposal of cases, Relief/Remedy available; Temporary Injunction, Enforcement of order, Appeal, frivolous and vexatious complaints; Offences and penalties.

Unit 4: Role of Industry Regulators in Consumer Protection **06 Lectures**

i. Banking: RBI and Banking Ombudsman
ii. Insurance: IRDA and Insurance Ombudsman
iii. Telecommunication: TRAI
iv. Food Products: FSSAI
v. Electricity Supply: Electricity Regulatory Commission
vi. Real Estate Regulatory Authority

Text Books

1. Khanna, Sri Ram, Savita Hanspal, Sheetal Kapoor, and H.K. Awasthi. (2007) *Consumer Affairs,*

Universities Press.

2. Choudhary, Ram Naresh Prasad (2005). *Consumer Protection Law Provisions and Procedure*, Deep and Deep Publications Pvt Ltd.
3. G. Ganesan and M. Sumathy. (2012). *Globalisation and Consumerism: Issues and Challenges*, Regal Publications
4. Suresh Misra and Sapna Chadah (2012). Consumer Protection in India: Issues and Concerns, IIPA, New Delhi
5. Rajyalaxmi Rao (2012), *Consumer is King*, Universal Law Publishing Company
6. Girimaji, Pushpa (2002). *Consumer Right for Everyone* Penguin Books.
7. E-books :- www.consumereducation.in
8. Empowering Consumers e-book, www.consumeraffairs.nic.in
9. ebook, www.bis.org
10. *The Consumer Protection Act, 1986 and its later versions.*

Reference Books

1. Misra Suresh, (Aug 2017) "Is the Indian Consumer Protected? One India OnePeople.
2. Raman Mittal, Sonkar Sumit and Parineet Kaur (2016) Regulating Unfair Trade Practices: An Analysis of the Past and Present Indian Legislative Models, Journal ofConsumer Policy.
3. Chakravarthy, S. (2014). MRTP Act metamorphoses into Competition Act. CUTSInstitute for Regulation and Competition position paper. Available online at www.cuts-international.org/doc01.doc.
4. Kapoor Sheetal (2013) "Banking and the Consumer" Akademos (ISSN 2231-0584)
5. Bhatt K. N., Misra Suresh and Chadah Sapna (2010). Consumer, Consumerism andConsumer Protection, Abhijeet Publications.
6. Kapoor Sheetal (2010) "Advertising-An Essential Part of Consumer's Life-Its Legaland Ethical Aspects", Consumer Protection and Trade Practices Journal, October 2010.
7. Verma, D.P.S. (2002). Regulating Misleading Advertisements, Legal Provisions and Institutional Framework. Vikalpa. Vol. 26. No. 2. pp. 51-57.

Website:

www.ncdrc.nic.in
www.consumeraffairs.nic.in
www.iso.org
www.bis.org.in
www.consumereducation.in
www.consumer-voice.in
www.cercindia.org

JAIDEV EDUCATION SOCIETY'S

J D COLLEGE OF ENGINEERING AND MANAGEMENT

KATOL ROAD, NAGPUR

Website: www.jdcoem.ac.in E-mail: info@jdcoem.ac.in

An Autonomous Institute, with NAAC "A" Grade

Department of Electronics and Telecommunication Engineering

"Rectifying Ideas, Amplifying Knowledge"

Session: 2022-23

Course Structure and Syllabus (Autonomous)

For

B. Tech. Sixth Semester in Electronics and Telecommunication Engineering

Sr. No.	Category of Course	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				Credits
				L	T	P	CA	MSE	ESE	Total	
1	HSMC	ET6T001	Education, Technology and Society	2	0	0	20	20	60	100	2
2	PCC	ET6T002	Antennas and Wave Propagation	3	0	0	20	20	60	100	3
3	PCC	ET6T003	Computer Networks and Cloud Computing	3	0	0	20	20	60	100	3
4	PEC	ET6E004	Professional Elective Course-II	3	0	0	20	20	60	100	3
5	OEC	ET6O002	OPEN Elective Course-II	4	0	0	20	20	60	100	4
6	PCC	ET6L003	Computer Networks and Cloud Computing Lab	0	0	2	60	0	40	100	1
7	PCC	ET6L005	Electronic Design Engineering Lab	0	0	2	60	0	40	100	1
8	Project	ET6P001	Campus Recruitment Training (CRT)	0	0	2	50	0	0	50	1
9	Project	ET6P002	Skill Development	0	0	2	15	0	35	50	1
	Project	ET6P003	Mini Project	0	0	2	30	0	20	50	1
10	MC	ET6T006	Research Methodology	2	0	0	10	15	25	50	Audit
Total				**17**	**0**	**10**	**325**	**115**	**460**	**900**	**20**

ET6T001	Education, Technology and Society	2 Credits

Course Objectives:

The goal of the proposed course is to enable students:

1. To explore the various ways in which technology has and may in future affect not only the mode of delivery of education but also the very nature of education.
2. To understand the requirement of education for becoming an effective member of the society.
3. To understand the requirement of education to fulfil the potential of a learner to the fullest without too much thought of an individual's responsibility towards the contemporary society.

Course Outcomes:

On successful completion of this course, the students will be able to integrate their technical education for betterment of society as well motivates them to lead a good human life.

Course Contents:

Module 1- Necessity of Education **[5 Hrs]**

Necessity of education for human life, Impact of education on society

Module 2- Nature and Scope of Education **[5 Hrs]**

Nature and scope of education (Gurukul to ICT driven), Emotional intelligence Domains of learning, Approaches to learning, Learning outcomes.

Module 3- Role of Education in Technology **[5 Hrs]**

Role of education in technology advancement.

Module 4- Technology and Society **[5 Hrs]**

Technology and society; management of technology; technology transfer

Module 5- Ethical and Value Implications **[6 Hrs]**

Ethical and value implications of education and technology on individual and society

Text/ Reference Books:

1. Education and Social order by Bertrand Russel
2. Theories of learning by Bower and Hilgard
3. Technology and Society by Jan L Harrington

ET6T002	Antennas and Wave Propagation	3 Credit

Prerequisites: Basic knowledge of electromagnetic field.

Course Objectives:

1. To understand the applications of electromagnetic engineering.
2. To study transmission line characteristics.
3. To analyse and understand the Uniform plane wave propagation in various media.
4. To study the antennas, their principle of operation, analysis and their applications.
5. To study designing aspects of Antenna.

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Formulate the wave equation and solve it for uniform plane wave.
2. Describe transmission line characteristics.
3. Analyse and design antenna arrays.
4. Analyse the given wire antenna and its radiation characteristics.
5. Describe the operation of aperture and reflector antennas.
6. Identify the suitable antenna for a given communication system.

Course Contents:

Module-1: Uniform Plane Waves **[6 Hrs]**

Maxwell Equations in phasor form, Wave Equation, Uniform Plane wave in Homogeneous, free space, dielectric, conducting medium. Polarization: Linear, circular & Elliptical polarization, unpolarised wave. Reflection of plane waves, Normal incidence, oblique incidence, Electromagnetic Power and Poynting theorem and vector.

Module-2: Transmission Lines **[6 Hrs]**

Transmission line equations and their solution, Transmission line parameters, Characteristics impedance, Propagation constant, Attenuation constant and Phase constant, waveform distortion, Distortionless transmission lines, Loading of transmission lines, Reflection coefficient and VSWR, Equivalent circuits of transmission lines, Transmission lines at radio frequency, Open and short circuited lines, Smith chart, Stub matching.

Module-3: Wave Propagation & Antenna Fundamentals **[8 Hrs]**

Fundamental equations for free space propagation, Friis Transmission equation, Ground, sky & space wave propagations, Structure of atmosphere, Characteristics of ionized regions, Space link geometry, Characteristics of Wireless Channel: Fading, Multipath delay spread, Coherence Bandwidth, and Coherence Time.

Introduction, Types of Antenna, Radiation Mechanism, Antenna Terminology: Radiation pattern, sradiation power density, radiation intensity, directivity, gain, antenna efficiency, half power beam width, bandwidth, antenna polarization, input impedance, antenna radiation, efficiency, effective length, effective area, reciprocity.

Module-4: Wire Antennas **[4 Hrs]**

Analysis of Linear and Loop antennas: Infinitesimal dipole, Small dipole and Finite length dipole, Half wave length dipole, Small circular loop antenna. Complete Analytical treatment of all these elements.

Module-5: Antenna Arrays **[6 Hrs]**

Antenna Arrays: Two element array, Pattern multiplication N-element linear array, Uniform amplitude and spacing, Broad side and End-fire array, N-element array: Uniform spacing, Non-uniform amplitude, Array factor, Binomial and Dolph Tchebyshev array, Planar Array, Circular Array, Log Periodic Antenna, Yagi Uda Antenna Array.

Module-6: Antennas and Applications **[6 Hrs]**

Structural details, dimensions, radiation pattern, specifications, features and applications of following Antennas: Hertz & Marconi antennas, V- Antenna, Rhombic antenna. TW antennas. Loop antenna, Whip antenna, Biconical, Helical, Horn, Slot, Microstrip, Turnstile, Super turnstile & Lens antennas. Antennas with parabolic reflectors, Aperture antenna.

Text Books:

1. C. A. Balanis, "Antenna Theory - Analysis and Design", John Wiley.
2. K. D. Prasad, "Antenna & Wave Propagation", Satya Prakashan, New Delhi.
3. Mathew N O Sadiku, "Elements of Electromagnetics" 3rd edition, Oxford University Press.
4. John D Kraus, Ronald J Marhefka, Ahmad S Khan, Antennas for All Applications, 3rd Edition, the McGraw Hill Companies.
5. John D Kraus, "Antenna& Wave Propagation", 4th Edition, McGraw Hill, 2010.
6. Vijay K Garg, Wireless Communications and Networking, Morgan Kaufmann Publishers, An Imprint of Elsevier, 2008.

Reference Books:-

1. Antenna & Wave Propagation , Sisir K Das, Mc Graw Hill.

2. Harish A. R., Antenna and wave Propagation, Oxford University Press.
3. Antennas and Radio Propagation, R.E. Collins, Mc Graw –Hill.

E-Resources:-

1. https://nptel.ac.in/courses/108/101/108101092/
2. https://nptel.ac.in/courses/117/107/117107035/

ET6T003 Computer Networks and Cloud Computing 3 Credit

Prerequisites: Basic knowledge of Computer Networking

Course Objectives:

1. To develop an understanding of modern network architectures from a design and performance perspective.
2. To introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs).
3. To provide an opportunity to do network programming.
4. To provide WLAN measurement ideas.

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. **Understand** the terminology and concepts of the OSI reference model and the TCP-IP reference model.

2. **Analyze** the concepts of protocols, network interfaces, and design/performance issues in local area networks and wide area networks and Remember the wireless networking concepts.

3. **Understand** the contemporary issues in networking technologies and Apply network tools and network programming.

4. **Analyze** a given requirement of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) and design it based on the market available component.

5. **Apply** the network programming for a given problem related TCP/IP protocol.

6. **Create** DNS DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls using open source available software and tools.

Course Contents:

Module-1: Physical Layer [5 Hrs]

Data Communications, Networks, Network types, Protocol layering, OSI model, Layers in OSI model, TCP / IP protocol suite, Addressing, Guided and Unguided Transmission media. Switching: Circuit switched networks, Packet Switching, Structure of a switch.

Module-2: Data Link Layer [5 Hrs]

Introduction to Data Link Layer, DLC Services, DLL protocols, HDLC, PPP, Media Access Control: Random Access, Controlled Access, Channelization. Wired LAN: Ethernet Protocol, Standard Ethernet, Fast Ethernet, Giagabit Ethernet, 10 Gigabit Ethernet.

Module-3: Wireless LANS & Virtual Circuit Networks **[5 Hrs]**

Introduction, Wireless LANS: IEEE 802.11 project, Bluetooth, Zigbee, Connecting devices and Virtual LANS: Connecting devices, Virtual LANS.

Module-4: Network Layer **[5 Hrs]**

Switching, Logical addressing – IPV4, IPV6; Address mapping – ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols.

Module-5: Transport Layer **[5 Hrs]**

Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm.

Module-6: Application Layer **[5 Hrs]**

Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls, Basic concepts of Cryptography, Internet Protocols.

Text Books:

1. Data Communication and Networking, 5th Edition, Behrouz A. Forouzan, McGraw-Hill.
2. TCP/IP Protocol Suite, 4th Edition, Behrouz A. Forouzan, Tata McGraw-Hill.
3. Computer Networks, 8th Edition, Andrew S. Tanenbaum, Pearson New International Edition.

Reference Books:

1. Data and Computer Communication, 8th Edition, William Stallings, Pearson Prentice Hall India.
2. Internetworking with TCP/IP, Volume 1, 6th Edition Douglas Comer, Prentice Hall of India.
3. TCP/IP Illustrated, Volume 1, W. Richard Stevens, Addison-Wesley, United States of America.
4. Cloud Computing: Principles and Paradigms, Editors: Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Wiley,2011

E-Resources:

1. https://onlinecourses.swayam2.ac.in/cec21_cs04/course
2. https://onlinecourses.nptel.ac.in/noc21_cs14

Professional Elective Course - II

ET6E004A	Embedded Processor & it's Interfacing with RTOS	3 Credit

Prerequisites: Basics of Processor and Programming knowledge

Course Objectives:

4. Define and Classify Embedded System and understand role of each element of embedded system.
5. State special requirements and constraints (such as sustainability, reliability) that are imposed on embedded systems.
6. Understand 8-bit 8051 microcontroller architecture, External Memory, Counters & Timers,

Course Outcomes:

1. Define and Classify Embedded System and understand role of each element of embedded system. State special requirements and constraints (such as sustainability, reliability) that are imposed on embedded systems.
2. Serial Data Input/Output and Interrupts. Design example for interfacing Keys, LED/LCD Displays, ADC and DAC.
3. Conversant with Assembly and C language programming for 8051.Formulate and Develop efficient assembly/C code for embedded system
4. Describe ARM processor, its modes, exception handling, instruction pipelining and basic programming.
5. Understand concepts of RTOS and its functionalities. Model system tasks using specification techniques such as FSM, State chart, UML
6. Build a typical cost-effective real-world embedded system in team with appropriate hardware components and software algorithms.

Course Contents:

Module-1: Introduction to 8-Bit Microcontroller **[6 Hrs]**

8051 Architecture, I/O Pins, Ports, External Memory, Counters & Timers, Serial Data Input/Output, Interrupts Moving Data, Logical Operations, Arithmetic Operations, Jump And Call Instructions, Embedded "C" PIC, AVR Microcontroller Architecture Overview With Applications Examples.

Module-2: Applications of 8051 **[6 Hrs]**

8051 Microcontroller Design, Applications Like Keys, Switched And LED/LCD Displays, Pulse Measurement, ADC And DAC, Serial Data Communication, CAN, I2C And SPI Serial Bus Protocols.

Module-3: Real Time Operating Systems **[6 Hrs]**

Hard and Soft Real Time Systems, Introduction To RTOS, Process And Thread, System Call, Process Scheduling And Scheduling Algorithms, Resource Access Control, Deadlock And Its Prevention RTOS Case Study: RT-Linux And Win-CE, Device Driver Programming.

Module-4: RTOS Porting on ARM Board **[6 Hrs]**

ARM processor architecture and programming ARM Processor Architecture, Pipeline Characteristics, ARM Addressing Modes, ARM Instruction Set, Programming Techniques, Exception Modes and Handling, Thumb Instructions, Cortex Architecture Overview

Module-5: ARM Processor Architecture and Programming **[6 Hrs]**

ARM Processor Architecture, Pipeline Characteristics, ARM Addressing Modes, ARM Instruction Set, Programming Techniques, Exception Modes and Handling, Thumb Instructions, Cortex Architecture Overview**.**

Module-6: Embedded Software Design Techniques **[6 Hrs]**

Embedded Software Requirements, Software Modelling With FSM, State Charts And Petri- Nets, Examples Of Software Modelling, Various Data Structure (FIFO, LIFO And Stack) Handling.

Text Books:

1. Kenneth J. Ayala and Dhananjay V. Gadre, "The 8051 Microcontroller & Embedded System Using Assembly And C", Cenage Learning, India Edition, 2nd impression, 2010.
2. Mazidi A. M., Mazidi J. G. and McKinley R. D., "The 8051 Microcontrolier And Embedded Systems-Using Assembly And C", Pearson Education, 2nd Ed., 2008.
3. Raj Kemal, "Embedded Systems: Architecture, Programming and Design", Tata McGraw-Hill Publications, 2nd Ed., 2008
4. Sloss A. N., Symes D. and Wright C., "ARM System Developer's Guide", Morgan Kaufmann Publishers, 1st Ed., 3rd Reprint, 2006.

Reference Books.

1. Jonathan W. Valvano, "Embedded Microcomputer Systems: Real Time Interfacing"; Thomson Learning, INDIA Edition, 2nd Reprint, 2007
2. Alex Doboll and Edward H. Currie, "Introduction To Mixed-Signal Embedded Design"; Springer, 131 Ed., 2007.
3. Shibu K. V., "Introduction To Embedded System"; TMH, 1st Ed., 200

E-Resources

1. https://www.coursera.org/lecture/embedded-software-hardware/4-interacting-with-memory-hUTQp
2. https://nptel.ac.in/courses/117/106/117106111/
3. https://nptel.ac.in/courses/108/103/108103157/

ET6E004B	**AI: Knowledge Representation & Reasoning**	**3 Credits**

Prerequisites: Data Structures, Mathematics

Course Objectives:

1. The module aims to present the basic representation and reasoning paradigms used in AI in both theory and practice with careful attention to the underlying principles of logic, search, and probability.
2. It is also designed to show students practical examples of the use of AI in applications and to encourage further reading. The e-learning part enables students to practice self-learning.
3. The Assignments aim to give students a sound practical introduction to knowledge based systems and a basic introduction to modern paradigms of knowledge representation and belief networks.
4. The examples classes aim to provide an introduction to the underlying issues in cognitive emulation and to provide an opportunity for practical exercises in logic and probability.

Course Outcomes:

1. Understand various search methods
2. Use various knowledge representation methods
3. Understand various Game Playing techniques
4. Use Prolog Programming language using predicate logic

Course Contents:

Module-1: Introduction **[3 Hrs]**

What is AI? : The AI Problems, The Underlying Assumption, What Is An AI Techniques, The Level Of The Model, Criteria For Success, Some General References, One Final Word.

Module-2: Search Techniques **[5 Hrs]**

Problems, State Space Search & Heuristic Search Techniques, Defining The Problems As A State Space Search, Production Systems, Production Characteristics, Production System Characteristics, And Issues In The Design Of Search Programs, Additional Problems. Generate-And-Test, Hill Climbing, Best-First Search, Problem Reduction, Constraint Satisfaction, Means-Ends Analysis.

Module-3: Expending Predicate Logic **[5 Hrs]**

Representation Simple Facts in Logic, Representing Instance And Isa Relationships, Computable Functions And Predicates, Resolution.

Module-4: Representing Knowledge Using Rules **[5 Hrs]**

Procedural versus Declarative Knowledge, Logic Programming, Forward Versus Backward Reasoning.

Module-5: Game Playing **[5 Hrs]**

Overview, And Example Domain : Overview, MiniMax, Alpha-Beta Cut-off, Refinements, Iterative deepening, The Blocks World, Components Of A Planning System, Goal Stack Planning, Nonlinear Planning Using Constraint Posting, Hierarchical Planning, Reactive Systems, Other Planning Techniques.

Module-6: Introduction to Prolog **[5 Hrs]**

Syntax and Numeric Function, Basic List Manipulation Functions In Prolog, Functions, Predicates and Conditional, Input, Output and Local Variables, Iteration and Recursion, Property Lists and Arrays, Miscellaneous Topics, LISP and Other AI Programming Languages.

Text Books:

1. Artificial Intelligence – A Modern Approach (3rd Edition) By – Stuart Russell and Peter Norvig
2. Artificial Intelligence Engines: A Tutorial Introduction to the Mathematics of Deep Learning By – James V Stone
3. Artificial Intelligence By Example By – Denis Rothman
4. Artificial Intelligence and Machine Learning By – Chandra S.S.V

Reference Books.

1. “Artificial Intelligence” -By Elaine Rich And Kevin Knight (2nd Edition) Tata Mcgraw-Hill

2. Artificial Intelligence: A Modern Approach, Stuart Russel, Peter Norvig, PHI

3. Introduction to Prolog Programming By Carl Townsend.

4. “PROLOG Programming For Artificial Intelligence” -By Ivan Bratko(Addison-Wesley)

5. “Programming with PROLOG” –By Klocksin and Mellish

E-Resources:

1. https://www.journals.elsevier.com/artificial-intelligence/
2. https://www.technologyreview.com/2015/02/11/169210/our-fear-of-artificial-intelligence/
3. https://www.coursera.org/
4. https://www.courses.com/

ET6L003 Computer Networks and Cloud Computing Lab 1 Credit

Prerequisites: Basic knowledge of Semiconductor Physics and theoretical knowledge about the practical.

Course Objectives:

1. To Understand and select various cables and connectors used for Networking.
2. To establish peer to peer computers as well as Local Area Network Connectivity.
3. To effectively use available networking tools in Computer Communication Network.

Course Outcomes:

At the end of the laboratory work, students will demonstrate the ability to:

1. **Understand** the terminology and concepts of Networking.
2. **Analyze** the concepts of network interfaces and design/performance issues in local area networks and wide area networks.
3. **Understand** the contemporary issues in networking technologies and Apply network tools.
4. **Analyze** a given requirement of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) and design it based on the market available component.
5. **Apply** the network programming for a given problem related TCP/IP protocol.
6. **Create** DNS, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Firewalls using open source available software and tools.

List of Experiments:

1. To study network hardware components – Cables, NIC, Repeaters, Hubs, Bridges, Switches, Routers and Gateway.
2. To practise the colour code for different cables and Observe the Lan Tester.
3. To demonstrate data transmission using Ping protocol, tracert, IP configuration
4. To understand IP Address of the system and configure dhcp server.
5. To construct Peer to Peer Topology
6. To connect the computers in Local Area Network using Star Topology
7. To give IP Address of different classes in given Network id.
8. To give IP Address of different classes in given Network id and Subnet (IPv4 Subnetting)
9. To share a folder from a computer and access the shared folder from another computer (Windows File Sharing)
10. To understand the domain name server (DNS Server).
11. To implement FTP protocol.
12. To implement HTTP protocol

ET6L005	**Electronic Design Engineering Lab**	**1 Credit**

Prerequisites: Basic knowledge of electronics components identification, testing,

Course Objectives:

1. To make students familiar with measuring instruments like CRO, DSO, signal Generator.
2. To make students familiar with Interfacing Peripheral with computer.
3. To understand PCB Designing process
4. To enable students to design & fabricate their own Hardware.

Course Outcomes:

At the end of the laboratory work, students will demonstrate the ability to:

1. Use DSO and Spectrum Analyzer.
2. Interface peripherals with computer.
3. Design PCB using PCB designing software.
4. Design & fabricate mini project.

List of Experiments:

1. Study of Functioning of Spectrum Analyzer and Digital Storage oscilloscope.
2. Study of different Electronic components.
3. Printed Circuit Boards (PCB)

   Types, Layout procedure, artwork, Fabrication (In this, fabrications of small circuit Using discrete component on single side PCB is expected).
4. Interfacing of displays (LCD, LED, 7 Segment) with PCs
5. Hardware Mini Project
   - Hardware Mini project should consist of Circuit design, PCB fabrication, assembling & testing of small digital or analog application circuit.
   - Mini Project work should be carried out by a group of maximum three students.
   - Student should use standard software available for drawing circuit schematic, simulating the design and PCB (single/double sided) layout of circuit.
   - Project report should consist of details of work carried out including layouts, circuits, datasheets, list of components, cost.

Reference Books:

1 Electronic Instruments and Instrumentation Technology

2. A course in Electrical and Electronics Measurements and Instrumentation - A.K. Sawhney - Dhanpat Rai & Co.

3. Electronic Components and Materials - Dr. Madhuri A. Joshi - Shroff Publications Third Edition

4. Electrical and Electronic Measurements –Banerjee,PHI

5. Introduction to Measurements and Instrumentation, 4th edition- Ghosh PHI

6. Electronic Instrumentation and Measurement Techniques, W.D. Copper,PHI Web Resources: Refer online datasheets

7. Printed Circuit Boards: Design and Technology; Bosshart; Tata McGraw-Hill Education.

8. Integrated circuit fabrication technology; David J. Elliott; McGraw-Hill.

ET6P001	Campus Recruitment Training	1 Credit

About CRT Training Campus Recruitment training (CRT) at is designed to aid candidates in their preparation for Recruitment through Campuses or outside campuses (i.e On campus or off campus). Students in their final step of graduation looking for placement in reputed organizations can make use of this training to get trained to deliver their best in the selection processes of organizations.

Course Objectives

1. To enhance the problem solving skills, to improve the basic mathematical skills and to help students who are preparing for any type of campus recruitment drive.
2. To groom the students to the corporate level
3. To ensure that all eligible students are employed by the end of the final year of study.

Course Outcomes

At the end of the course students will be able to

1. Solve the problems easily by using Short-cut method with time management which will be helpful to them to clear the competitive exams for better job opportunity.
2. Analyze the Problems logically and approach the problems in a different manner.
3. Students will be able to apply mathematical analysis of data to make connections, draw conclusions and solve problems.
4. Students will learn a series of techniques through practical activities to develop presenting skills and enhance confidence to expand the potential of the individual.
5. Students can produce a resume that describes their education, skills, experiences and measurable achievements with proper grammar, format and brevity.
6. Students demonstrate an ability to target the resume to the presenting purpose
7. Demonstrate professional behavior(s) including preparedness, professional attire, and respectful presentation during interviews.

<u>Part I: - Quantitative Ability</u>

Unit 1: - 03 Hrs

Speed Maths Calculation, Number Systems, Ratio & Proportion, Percentage

Unit 2: - 03 Hrs

Profit – Loss & Discount, Simple Interest & Compound Interest, Simple Equation and Age’s

Unit 3:- 03 Hrs

Averages Mixture & Allegation, Time and work, Time Speed & Distance, Permutation–Combination & Probability.

Part Ii: - Reasoning Ability

Unit 1: - 03 Hrs

Coding Decoding, Blood Relation, Direction sense, Number Series, Analogy

Unit 2: - 03 Hrs

Sitting Arrangement Puzzles.

Unit 3:- 03 Hrs

Syllogism, Statement course of action, Statement arguments, Statement Assumptions, Miscellaneous Type of Reasoning

Part Iii: - Employability Skills

Unit 1: - Presentation Skills (02 Hrs)

What is a presentation? Essential characteristics of Good presentation.

Preparation of presentation: Identify the purpose, Analyze the audience, Design and organize the information, Medium of presentation and Visual aids

Delivering Presentation: rehearsal, body Language, Handling questions, Tips to fight stage fear.

Unit 2: - Job Interview Skills (02 Hrs)

Types of interviews, Focus of interview, dress code, importance of body language.

Probable interview questions, Telephonic and video interview, Strategies for success at interview.

Unit 3: - Resume Building (02 Hrs)

Meaning, Difference among Bio-data, Curriculum vitae and Resume.

CV writing tips, the content of Resume, Structure of Resume

Books

1. Prashant Sharma, Soft Skills Personality Development For Life Success. BPB Publication.
2. P. D. Chaturvedi & Mukesh Chaturvedi, Business Communication: Concepts, Cases, and Applications 2nd Edition. Pearson Education.
3. Barun Mitra, Personality Development and Soft Skills. Oxford University Press.
4. Dr.K.Alex, *Soft Skills Know yourself and Know the World*. S.ChandPublishing, 2014
5. R.S Agrawal, Quantitative Aptitude.
6. Arun Sharma, How to Prepare for Quantitative Aptitude.
7. R. S Agrawal, Verbal and Non Verbal Reasoning.
8. R.V.Praveen,Quantitative Aptitude and Reasoning, 2nd Revised Edition 2013, Prentice-Hall of India Pvt.Ltd.
9. G. K. Ranganath, C. S. Sampangiram and Y. Rajaram, A text Book of business Mathematics, 2008, Himalaya Publishing House.

ET6T006	**Research Methodology**	**Audit**

Prerequisites: Basic knowledge of communication engineering

Course Objectives:

1. To develop a research orientation among the scholars and to acquaint them with fundamentals of research methods.
2. To develop understanding of the basic framework of research process.
3. To identify various sources of information for literature review and data collection.
4. To understand the components of scholarly writing and evaluate its quality.

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Student will learn the meaning, objective, motivation and type of research
2. Student will be able to formulate their research work with the help of literature review
3. Student will be able to develop an understanding of various research design and techniques
4. Student will have overview knowledge of modeling and simulation of research work
5. Student will be able to collect the statistical data with different methods related to research work
6. Student will be able to write their own research work with ethics and non-plagiarized way

Course Contents:

Module-1: Objectives and Types of Research **[5 Hrs]**

Motivation and objectives, research methods vs methodology. Types of research – descriptive vs analytical, applied vs fundamental, quantitative vs qualitative, conceptual vs empirical. Introduction to drug discovery & development research, objectives, flowchart from discovery to post-marketing research, overview of research methodology in various areas of drug discovery and development research.

Module-2: Research Formulation **[5 Hrs]**

Defining and formulating the research problem, selecting the problem, necessity of defining the problem, importance of literature review in defining a problem, Literature review - primary and secondary sources, reviews, monographs, patents, research databases, web as a source, searching the web, critical literature review, identifying gap areas from literature review and research databases, development of working hypothesis.

Module-3: Research Design and Methods **[5 Hrs]**

Research design – basic principles, need of research design, features of good design, important concepts relating to research design, observation and facts, laws and theories, Prediction and explanation, research databases, development of models, developing a research plan – exploration, description, diagnosis, and experimentation.

Module-4: Execution of the Research, Data Collection and Analysis [5 Hrs]

Aspects of method validation, observation and collection of data, methods of data collection, sampling methods, data processing and analysis strategies and tools, data analysis with statistical packages (Sigma STAT, SPSS for Student t-test, ANOVA, etc), hypothesis testing, generalization and interpretation.

Module-5: Reporting and Thesis Writing [5 Hrs]

Structure and components of scientific reports, types of report, technical reports and thesis. Thesis writing – different steps and software tools (Word processing, etc) in the design and preparation of thesis, layout, structure (chapter plan) and language of typical reports, Illustrations and tables, bibliography, referencing and footnotes. Oral presentation – planning, software tools, creating and making effective presentation, use of visual aids, importance of effective communication.

Module-6: Research Ethics, IPR and Scholarly Publishing [5 Hrs]

Ethics – ethical issues, ethical committees (human & animal); IPR - intellectual property rights and patent law, commercialization, copy right, royalty, trade related aspects of intellectual property rights (TRIPS); Scholarly publishing – IMRAD concept and design of research paper, citation and acknowledgement, plagiarism, reproducibility and accountability.

Text Books:

1. Kothari, C.R. Research Methodology (Methods and Techniques), New Age Publisher.
2. Best and Kahn, Research Methodology, PHI Limited.
4 Fundamentals of modern statistical methods by Rand R.wilcox.

Reference Books.

1. Kerlinger, Foundation of Research.
2. Power Analysis for Experimental research A Practical Guide for the Biological, Medical and social Sciences by R. Barker Bausell, Yi-Fang Li Cambridge University Press.
3. Design of Experience: Statistical Principles of Research Design and Analysis, by Robert O. Kuehl Brooks/cole.
4. Sinha, S.C. and Dhiman, A.K., 2002. Research Methodology, Ess Ess Publications. 2 volumes.
5. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. An introduction to Research Methodology, RBSA Publishers.

E-Resources:

1. https://nptel.ac.in/courses/121/106/121106007/
2. https://onlinecourses.swayam2.ac.in/cec20_hs17/preview
3. https://www.youtube.com/watch?v=QddNp6nYEqU

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2021 - 22 (Odd Sem)

VISION	MISSION
"To develop competent and committed Electrical Engineers to serve the society "	1. To impart quality education in the field of Electrical Engineering. 2. To be excellent learning centre through research and industry interaction.

Teaching Scheme

Branch code: EE

I Semester

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				Credit
				L	T	P	CA	MSE	ESE/Ext. Pra.	Total	
1	HSMC	HU2T001	Communication Skills	2	0	0	60	0	40	100	2
2	BSC	MA2T001	Engineering Mathematics- II	3	1	0	20	20	60	100	4
3	BSC	EE2T002	Engineering Chemistry	3	1	0	20	20	60	100	4
4	ESC	EE2T003	Engineering Graphics	1	0	0	20	20	60	100	1
5	HSMC	HU2L001	Communication Skills Lab.	0	0	4	60	0	40	100	2
6	BSC	EE2L002	Engineering Chemistry Lab	0	0	2	60	0	40	100	1
7	ESC	EE2L003	Engineering Graphics Lab	0	0	4	60	0	40	100	2
8			Induction Programme	3 Weeks							
9	ESC	EE2T004	Basic Civil and Mechanical Engineering	2	0	0	10	15	25	50	Audit
				11	**2**	**10**					**16**

II Semester

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				Credit
				L	T	P	CA	MSE	ESE/Ext. Pra.	Total	
1	HSMC	HU1T002	Introduction to Computer programming	2	0	0	20	20	60	100	2
2	BSC	MA1T001	Engineering Mathematics- I	3	1	0	20	20	60	100	4
3	BSC	EE1T005	Engineering Physics	3	1	0	20	20	60	100	4
4	ESC	EE1T006	Energy and Environment Engineering	3	0	0	20	20	60	100	3
5	HSMC	HU1L002	Introduction to Computer programming Lab	0	0	4	60	0	40	100	2
6	ESC	WS1L001	Workshop Practices	0	0	4	60	0	40	100	2
7	BSC	EE1L005	Engineering Physics Lab	0	0	2	60	0	40	100	1

8			Societal Internship/ Field Training	Report submission						50	1
9	ESC	EE1T007	Basic Electrical and Electronics Engineering	2	0	0	10	15	25	50	Audit
				13	**2**	**10**					**19**
				25							

III Semester

Sr. No.	Subject Category	Subject Code	Course Title	Teaching Scheme			Evaluation Scheme				Credits
				L	T	P	CA	MSE	ESE	TOTAL	
1	HSMC	EE3T001	Engineering Economics	2	0	0	20	20	60	100	2
2	BSC	EE3T002	Engineering Mathematics –III	3	1	0	20	20	60	100	4
3	ESC	EE3T003	Fundamentals of Electrical Engineering	3	1	0	20	20	60	100	4
4	PCC-EE	EE3T004	Network Analysis and synthesis	3	0	0	20	20	60	100	3
5	PCC-EE	EE3T005	Electrical Machine I	2	1	0	20	20	60	100	3
6	PCC-EE	EE3T006	Measurement and Instrumentation	2	1	0	20	20	60	100	3
7	PCC-EE	EE3L004	Network Analysis and synthesis Lab	0	0	2	60	0	40	100	1
8	PCC-EE	EE3L005	Electrical Machine I Lab	0	0	2	60	0	40	100	1
9	PCC-EE	EE3L006	Measurement and Instrumentation Lab	0	0	2	60	0	40	100	1
10	PROJ-EE	EE3P001	Field trainning/ Internship/ industrial visit	0	0	0	0	0	50	50	1
11	MC	EE3T007	Universal Human Values -II	2	0	0	10	15	25	50	Audit
				17	**4**	**6**	**310**	**135**	**555**	**1000**	
								Total Credits			**23**

IV Semester

Sr. No.	Subject Category	Subject Code	Course Title	Teaching Scheme			Evaluation Scheme				Credits
				L	T	P	CA	MSE	ESE	**TOTAL**	
1	HSMC	EE4T001	Advanced Physics	2	0	0	20	20	60	100	2
2	BSC	EE4T002	Numerical method and probability	2	1	0	20	20	60	100	3
3	ESC	EE4T003	Power Station Practice	4	0	0	20	20	60	100	4
4	PCC-EE	EE4T004	Electronic Devices and circuits	3	0	0	20	20	60	100	3
5	PCC-EE	EE4T005	Power System I	2	1	0	20	20	60	100	3
6	PCC-EE	EE4T006	Electrical Machine II	3	0	0	20	20	60	100	3
7	BSC	EE4L002	Numerical method and probability Lab	0	0	2	60	0	40	100	1
8	PCC-EE	EE4L005	Power System I Lab	0	0	2	60	0	40	100	1
9	PCC-EE	EE4L006	Electrical Machine II Lab	0	0	2	60	0	40	100	1
10	PROJ-EE	EE4P002	Field trainning/ Internship/ industrial visit	0	0	0	0	0	50	50	1
11	MC	EE4T007	Innovation and entrepreneurship Development	2	0	0	10	15	25	50	Audit

18	**2**	**6**	**310**	**135**	**555**	**1000**	
				Total Credits			**22**

V Semester

Sr. No.	Subject Category	Subject Code	Course Title	Teaching Scheme			Evaluation Scheme				Credits
				L	T	P	CA	MSE	ESE	TOTAL	
1	PCC-EE	EE5T001	Power Electronics	3	0	0	20	20	60	100	3
2	PCC-EE	EE5T002	Control System I	2	1	0	20	20	60	100	3
3	PCC-EE	EE5T003	Power System II	3	0	0	20	20	60	100	3
4	PEC-EE	EE5TE01	**Elective I**	3	0	0	20	20	60	100	3
5	PEC-EE	EE5TE02	**Elective II**	3	0	0	20	20	60	100	3
6	OEC-EE	EE5TO01	**Open Elective I**	4	0	0	20	20	60	100	4
7	PCC-EE	EE5L001	Power Electronics Lab	0	0	2	60	0	40	100	1
8	PCC-EE	EE5L002	Control System I Lab	0	0	2	60	0	40	100	1
9	PCC-EE	EE5L003	Power System II Lab	0	0	2	60	0	40	100	1
10	PROJ-EE	EE5P003	Mini Project (Phase I)	0	0	2	0	0	50	50	2
11	MC	EE5T004	Consumer Affairs	2	0	0	10	15	25	50	Audit
				20	**1**	**8**	**310**	**135**	**555**	**1000**	
							Total Credits				**24**

VI Semester

Sr. No.	Subject Category	Subject Code	Course Title	Teaching Scheme			Evaluation Scheme				Credits
				L	T	P	CA	MSE	ESE	TOTAL	
1	PCC-EE	EE6T001	Microprocessor and microcontroller	3	0	0	20	20	60	100	3
2	PCC-EE	EE6T002	Advanced Control System	3	0	0	20	20	60	100	3
3	PEC-EE	EE6TE03	**Elective III**	3	0	0	20	20	60	100	3
4	PEC-EE	EE6TE04	**Elective IV**	3	0	0	20	20	60	100	3
5	OEC-EE	EE6TO01	**Open Elective II**	4	0	0	20	20	60	100	4
6	PCC-EE	EE6L001	Microprocessor and microcontroller Lab	0	0	2	60	0	40	100	1
7	PCC-EE	EE6L003	Cad Lab	0	0	2	60	0	40	100	1
8	PROJ-EE	EE6P004	Mini Project phase II	0	0	2	0	0	50	50	2
9	MC	EE6T003	Research Methodology	2	0	0	10	15	25	50	Audit
				15	**0**	**6**	**210**	**95**	**395**	**700**	
								Total Credits			**20**

Prof. A. V.Joshi
Member Secretary
Board of Studies, EE Dept

Dr.S.R.Vaishnav
Chairman
Board of Studies, EE Dept

JAIDEV EDUCATION SOCIETY'S

JD COLLEGE OF ENGINEERING AND MANAGEMENT

KATOL ROAD, NAGPUR

Website:www.jdcoem.ac.in E-mail:info@jdcoem.ac.in

Education to Eternity

An Autonomous Institute, with NAAC "A" Grade

Department of Electrical Engineering

AY-2021-22

|| ज्ञानम् सर्वार्थ साधनम् ||

VISION	MISSION
"To develop competent and committed Electrical Engineers to serve the society"	1. To impart quality education in the field of Electrical Engineering. 2. To be excellent learning centre through research and industry interaction.

Teaching Scheme

Branch code: EE

I Semester

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				Credit
				L	T	P	CA	MSE	ESE/Ext. Pra.	Total	
1	HSMC	HU2T001	Communication Skills	2	0	0	60	0	40	100	2
2	BSC	MA2T001	Engineering Mathematics- II	3	1	0	20	20	60	100	4
3	BSC	EE2T002	Engineering Chemistry	3	1	0	20	20	60	100	4
4	ESC	EE2T003	Engineering Graphics	1	0	0	20	20	60	100	1
5	HSMC	HU2L001	Communication Skills Lab.	0	0	4	60	0	40	100	2
6	BSC	EE2L002	Engineering Chemistry Lab	0	0	2	60	0	40	100	1
7	ESC	EE2L003	Engineering Graphics Lab	0	0	4	60	0	40	100	2
8			Induction Programme	3 Weeks							
9	ESC	EE2T004	Basic Civil and Mechanical Engineering	2	0	0	10	15	25	50	Audit
				11	**2**	**10**					**16**

II Semester

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				Credit
				L	T	P	CA	MSE	ESE/Ext. Pra.	Total	
1	HSMC	HU1T002	Introduction to Computer programming	2	0	0	20	20	60	100	2
2	BSC	MA1T001	Engineering Mathematics- I	3	1	0	20	20	60	100	4
3	BSC	EE1T005	Engineering Physics	3	1	0	20	20	60	100	4
4	ESC	EE1T006	Energy and Environment Engineering	3	0	0	20	20	60	100	3
5	HSMC	HU1L002	Introduction to Computer programming Lab	0	0	4	60	0	40	100	2
6	ESC	WS1L001	Workshop Practices	0	0	4	60	0	40	100	2
7	BSC	EE1L005	Engineering Physics Lab	0	0	2	60	0	40	100	1
8			Societal Internship/ Field Training	Report submission						50	1

9	ESC	EE1T007	Basic Electrical and Electronics Engineering	2	0	0	10	15	25	50	Audit
				13	**2**	**10**					**19**
				25							

III Semester

Sr. No.	Subject Category	Subject Code	Course Title	Teaching Scheme			Evaluation Scheme				Credits
				L	T	P	CA	MSE	ESE	TOTAL	
1	HSMC	EE3T001	Engineering Economics	2	0	0	20	20	60	100	2
2	BSC	EE3T002	Engineering Mathematics –III	3	1	0	20	20	60	100	4
3	ESC	EE3T003	Fundamentals of Electrical Engineering	3	1	0	20	20	60	100	4
4	PCC-EE	EE3T004	Network Analysis and synthesis	3	0	0	20	20	60	100	3
5	PCC-EE	EE3T005	Electrical Machine I	2	1	0	20	20	60	100	3
6	PCC-EE	EE3T006	Measurement and Instrumentation	2	1	0	20	20	60	100	3
7	PCC-EE	EE3L004	Network Analysis and synthesis Lab	0	0	2	60	0	40	100	1
8	PCC-EE	EE3L005	Electrical Machine I Lab	0	0	2	60	0	40	100	1
9	PCC-EE	EE3L006	Measurement and Instrumentation Lab	0	0	2	60	0	40	100	1
10	PROJ-EE	EE3P001	Field trainning/ Internship/ industrial visit	0	0	0	0	0	50	50	1
11	MC	EE3T007	Universal Human Values -II	2	0	0	10	15	25	50	Audit
				17	**4**	**6**	**310**	**135**	**555**	**1000**	
								Total Credits			**23**

IV Semester

Sr. No.	Subject Category	Subject Code	Course Title	Teaching Scheme			Evaluation Scheme				Credits
				L	T	P	CA	MSE	ESE	**TOTAL**	
1	HSMC	EE4T001	Advanced Physics	2	0	0	20	20	60	100	2
2	BSC	EE4T002	Numerical method and probability	2	1	0	20	20	60	100	3
3	ESC	EE4T003	Power Station Practice	4	0	0	20	20	60	100	4
4	PCC-EE	EE4T004	Electronic Devices and circuits	3	0	0	20	20	60	100	3
5	PCC-EE	EE4T005	Power System I	2	1	0	20	20	60	100	3
6	PCC-EE	EE4T006	Electrical Machine II	3	0	0	20	20	60	100	3
7	BSC	EE4L002	Numerical method and probability Lab	0	0	2	60	0	40	100	1
8	PCC-EE	EE4L005	Power System I Lab	0	0	2	60	0	40	100	1
9	PCC-EE	EE4L006	Electrical Machine II Lab	0	0	2	60	0	40	100	1
10	PROJ-EE	EE4P002	Field trainning/ Internship/ industrial visit	0	0	0	0	0	50	50	1
11	MC	EE4T007	Innovation and entrepreneurship Development	2	0	0	10	15	25	50	Audit
				18	**2**	**6**	**310**	**135**	**555**	**1000**	

Total Credits	**22**

V Semester

Sr. No.	Subject Category	Subject Code	Course Title	Teaching Scheme			Evaluation Scheme				Credits
				L	T	P	CA	MSE	ESE	TOTAL	
1	PCC-EE	EE5T001	Power Electronics	3	0	0	20	20	60	100	3
2	PCC-EE	EE5T002	Control System I	2	1	0	20	20	60	100	3
3	PCC-EE	EE5T003	Power System II	3	0	0	20	20	60	100	3
4	PEC-EE	EE5TE01	**Elective I**	3	0	0	20	20	60	100	3
5	PEC-EE	EE5TE02	**Elective II**	3	0	0	20	20	60	100	3
6	OEC-EE	EE5TO01	**Open Elective I**	4	0	0	20	20	60	100	4
7	PCC-EE	EE5L001	Power Electronics Lab	0	0	2	60	0	40	100	1
8	PCC-EE	EE5L002	Control System I Lab	0	0	2	60	0	40	100	1
9	PCC-EE	EE5L003	Power System II Lab	0	0	2	60	0	40	100	1
10	PROJ-EE	EE5P003	Mini Project (Phase I)	0	0	2	0	0	50	50	2
11	MC	EE5T004	Consumer Affairs	2	0	0	10	15	25	50	Audit
				20	**1**	**8**	**310**	**135**	**555**	**1000**	
							Total Credits				**24**

VI Semester

Sr. No.	Subject Category	Subject Code	Course Title	Teaching Scheme			Evaluation Scheme				Credits
				L	T	P	CA	MSE	ESE	TOTAL	
1	PCC-EE	EE6T001	Microprocessor and microcontroller	3	0	0	20	20	60	100	3
2	PCC-EE	EE6T002	Advanced Control System	3	0	0	20	20	60	100	3
3	PEC-EE	EE6TE03	**Elective III**	3	0	0	20	20	60	100	3
4	PEC-EE	EE6TE04	**Elective IV**	3	0	0	20	20	60	100	3
5	OEC-EE	EE6TO01	**Open Elective II**	4	0	0	20	20	60	100	4
6	PCC-EE	EE6L001	Microprocessor and microcontroller Lab	0	0	2	60	0	40	100	1
7	PCC-EE	EE6L003	Cad Lab	0	0	2	60	0	40	100	1
8	PROJ-EE	EE6P004	Mini Project phase II	0	0	2	0	0	50	50	2
9	MC	EE6T003	Research Methodology	2	0	0	10	15	25	50	Audit
				15	**0**	**6**	**210**	**95**	**395**	**700**	
								Total Credits			**20**

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Chairman
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Education to Eternity

JAIDEV EDUCATION SOCIETY'S

J D COLLEGE OF ENGINEERING AND MANAGEMENT

An Autonomous Institute, with NAAC "A" Grade

At: Khandala, Post- Valni, Kalmeshwar Road, Nagpur

Department Of Electrical Engineering

"Igniting minds to illuminate the world"

Session: 2021-22

Course Structure and Syllabus (Autonomous)

For

B. Tech. Electrical Engineering Programme

VISION AND MISSION OF INSTITUTE

VISION

To be a centre of excellence imparting professional education satisfying societal and global needs.

MISSION

Transforming students into lifelong learners through quality teaching, training and exposure to concurrent technologies. Fostering conducive atmosphere for research and development through well-equipped laboratories and qualified personnel in collaboration with global organizations.

VISION AND MISSION OF THE DEPARTMENT

VISION

To be the eminent department known for producing globally proficient electrical graduates possessing finest human values, to achieve sustainable socio-economic development

MISSION

To transform students into academically and technically sound electrically sound engineers.
To enhance teaching learning process by dedicated qualified professionals.
To promote research and development with current techniques through well developed educational environment.

PROGRAM EDUCATIONAL OBJECTIVES (PEO's)

PEOs	ATTRIBUTES
PEO 1	To prepare the graduates for professional careers with strong fundamental knowledge in science, mathematics, English and Engineering sciences and capable to develop core competency in electrical engineering domain or enable to pursue higher education.
PEO 2	The graduates can comprehend, analyze, design and create novel ideas and provide solutions to electrical engineering problems that are technically sound, economically feasible and socially acceptable.
PEO 3	The graduates will be leaders with strong communication and interpersonal skills, capability to work efficiently in multidisciplinary teams, understanding of ethical and environmental concerns in engineering practices and deal with social and safety issues along with respect for intellectual property.

Dr.S.R.Vaishnav
Chairman
Board of Studies, EE Dept

PROGRAM OUTCOMES (PO's)

POs	ATTRIBUTES
1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3	**Design/ development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life -long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOS):

At the end of Electrical Engineering program the student will have following Program specific outcomes.

PSO1: Interpret, identify and analyze problems in electrical domain and demonstrate this knowledge to develop, control and assess electrical systems.

PSO2: Solve ethically and professionally various Electrical Engineering problems in societal and environmental context and communicate effectively.

PSO3: Apply modern software tools for design, simulation and analysis of electrical systems to engage in life-long learning and to successfully adapt in multi disciplinary environments

Recommendations for conducting one theory course of curriculum through online Teaching / Learning

1. Only Swayam / NPTEL platform is allowed.

2. One defined subject per semester in online mode and BOS should declare that one subject for online mode based on availability of NPTEL offering before commencement of the semester.

3. Student will be allowed to appear for NPTEL / Institute level / University Examination as applicable.

4. In order to ensure learning, NPTEL lectures to be telecast in the class by including it in regular time table if required.

5. 75% assignment submission is mandatory for these online classes also like regular lecture attendance.

6. One faculty to be allotted for this subject, who will discuss and solve student's doubts. Allot 3 hrs/week load to teacher who is allotted to work as facilitator of online course.

7. For Autonomy Students: For online mode the student should submit all assignment given by nptel then his/her score has weightage of 40% for CA & MSE. And if student clear the nptel final exam and producing certificate then 60% weghtage should be given as ESE, otherwise he/she has to appear for Makeup exam of Institute.

If student cannot enroll for NPTEL then he/she has to study online videos / material and these students should appear for Mid Semester, CA-I , CA-II and End sem exams of the Institute.

8. For DBATU students: For online mode he has to appear for CA-I, CA-II, Mid sem exam of the institute and End sem exam of University.

If student can't enroll for NPTEL then he/she has to study online videos / material and these students should appear for Mid Semester, CA-I , CA-II of the institute and End sem exams of the University.

10. If the credits of NPTEL/ SWAYAM courses do not match with the existing subject proper scaling will be done)

This system will ensure real learning; avoid any problem arising due to cancellation of NPTEL exam as it happened in this semester. At least for first year and in the unpredictable situation of covid pandemic these provisions will avoid any last moment chaos.

Course Structure and Syllabus

For

B. Tech. Electrical Engineering Programme

Curriculum for Semester- I [First Year]

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				Credit
				L	T	P	CA	MSE	ESE/Ext. Pra.	Total	
1	HSMC	HU1T002	Introduction to Computer programming	2	0	0	20	20	60	100	2
2	BSC	MA1T001	Engineering Mathematics- I	3	1	0	20	20	60	100	4
3	BSC	EE1T005	Engineering Physics	3	1	0	20	20	60	100	4
4	ESC	EE1T006	Energy and Environment Engineering	3	0	0	20	20	60	100	3
5	HSMC	HU1L002	Introduction to Computer programming Lab	0	0	4	60	0	40	100	2
6	ESC	WS1L001	Workshop Practices	0	0	4	60	0	40	100	2
7	BSC	EE1L005	Engineering Physics Lab	0	0	2	60	0	40	100	1
8			Induction Programme	3 Weeks							
9	ESC	EE1T007	Basic Electrical and Electronics Engineering	2	0	0	10	15	25	50	Audit
				13	**2**	**10**					**18**

HU1T002	Introduction to Computer Programming	4 Credit

COURSE OBJECTIVES:

1. To understand the importance of Programming
2. To understand the application of C Programming.
3. To investigate the key concepts of C Programming.
4. To enable students build a applications based on C programming

COURSE OUTCOME:

CO1: Define the algorithms, flowcharts, array, pointer, structure, function, and python.

CO2: Discuss and differentiate between variables, operators, statements, loops, array dimensions.

CO3: Demonstrate working programs using functions, loops, conditional statements, array, pointer, structure and files in C and python language.

CO4:Distinguish between different steps of programming and prioritize levels of programming.

CO5:Find errors and predict outcome in C and python programming.

CO6:Compose and develop any application using C and python programming.

Unit I: Basic of Programming Language (6 Hrs)

HLL, LLL, Language translator, Error checking, Debugging, Programming processes, Flowcharts, Algorithms along with asymptotic notation.

Unit II: Types, Operators and Expressions in C language (6 Hrs)

Variable names, Data types, sizes, constants, declarations, arithmetic operators, relational and logical operators, type conversions, increment and decrement operators, bitwise operators, assignment operators and expressions, conditional expressions precedence and order of evaluation.

Unit III: Control Flow: (6 Hrs)

Statements and Blocks. If-else, else-if, switch, Loops: while and for, do-while break and continue go to and Labels. Initializing arrays, Initializing character arrays, multidimensional arrays, Introduction to pointers.

Unit IV: Functions and Pointers in Python (6 Hrs)

Functions and Program Structure: Basic of functions, functions returning non-integers external variables scope rules.

Pointers in Python: Pointers to integers, characters, floats, arrays.

Unit V: **(6 Hrs)**

Structures in Python: Basics of structures, structures with functions, arrays of structures.

File handling in Python: Basics of file handling.

Text Books

1. Let Us C by Yashavant Kanetkar.
2. Let Us C Solutions by Yashavant Kanetkar
3. Data Structure through C by Yashavant Kanetkar.

Reference Books

1. C Programming: A Modern Approach (2nd Edition) - K. N. King (2008). A good book for learning C.
2. Programming in C (4th Edition) - Stephen Kochan (2014). A good general introduction and tutorial.
3. C Primer Plus (5th Edition) - Stephen Prata (2004)
4. A Book on C - Al Kelley/Ira Pohl (1998).
5. The C Book (Free Online) - Mike Banahan, Declan Brady, and Mark Doran (1991).

HU1L002	Introduction to Computer Programming Lab	2 Credit

List of Practical:-

1 A simple program to display a message “Hello World” on screen.
2 Write a Program to print addition, subtraction Multiplication and Division of a entered number.
3 Write a Program to LCM of the entered number..
4 Write a program to find GCD of the entered number.
5 Write a program to find the greatest among three number.
6 Write a any menu driven program using if…else statement.
7 Write a any menu driven program using Switch case statement.
8 Write a program to find count of even no ,count of odd number , sum of even no and sum of odd number between 1 to 50.
9 Write a Program to generate prime number up to inputted number.
10 Write a program to check entered no is Armstrong no or not.
11 Write a program to find transpose of a matrix.
12 Write a Program to find multiplication of a two matrix elements.
13 Write a Program to find length of a string.(with and without using a library function)
14 Write a Program to find addition of two numbers using pointer.
15 Open ended Program. (How to execute C program on Linuxoperating system)
16 Write a Python program to print “Hello World”.
17 Write a Python program to display the current date and time.
18 Write a Python program which accepts the radius of a circle from the user and compute the area.
19 Write a Python program to find reverse of the entered number.
20 Write a Python program to get the Python version you are using

MA1T001	Engineering Mathematics-1	4 Credit

COURSE OBJECTIVES

1. To understand the importance of Mathematics
2. To understand the application of Mathematics in engineering and in real life.
3. To investigate the key concepts of Mathematics.
4. To enable students to analyse a problem

COURSE OUTCOMES

At the end of the course students will be able to

1. Describe rank, Bernoulli's theorem, Taylor's and Maclaurin's theorems for functions of two variables, , Euler's Theorem for functions containing two and three variables, Lagrange's theorem
2. Illustrate the examples of ordinary differential equation, partial differential equation, matrices.
3. Solve questions related to ordinary differential equation, partial differential equation, matrices and their applications.
4. Apply the knowledge of matrices, ordinary differential equation, partial differential equation, and their applications to real world problems.
5. Interpret the results of matrices, ordinary differential equation, partial differential equation and their applications.
6. Design a method or modal on matrices, ordinary differential equation, and partial differential equation.

Unit 1: Linear Algebra- Matrices [09 Hours]

Determinants & Matrix, Inverse of Matrix by adjoint method, Inverse by partitioning method, solution of system of linear equations, Rank of Matrix, Consistency of linear system of equation.

Unit 2: Ordinary Differential Equations of First Order and First Degree and Their Applications [09 Hours]

Linear equations; Reducible to linear equations (Bernoulli's equation); Exact differential equations; Equations reducible to exact equations; Applications to orthogonal trajectories, mechanical systems and electrical systems.

Unit3: Linear Differential Equations with Constant Coefficients [09 Hours]

Introductory remarks - complementary function, particular integral; Rules for finding complementary functions and particular integrals; Method of variation of parameters; Cauchy's homogeneous and

Legendre’s linear equations.

Unit 4:Partial Differentiation **[09 Hours]**

Partial derivatives of first and higher orders; Homogeneous functions , Euler’s Theorem for functions containing two and three variables (with proofs); Total derivatives; Change of variables.

Unit 5:Applications of Partial differentiation **[09 Hours]**

Jacobians - properties; Taylor’s and Maclaurin’s theorems (without proofs) for functions of two variables; Maxima and minima of functions of two variables; Lagrange’s method of undetermined multipliers.

Text Books

1) Higher Engineering Mathematics by B. S. Grewal, Khanna Publishers, NewDelhi.

2) Advanced Engineering Mathematics by Erwin Kreyszig, John Wiley & Sons, NewYork.

3)A Course in Engineering Mathematics (Vol I) by Dr. B. B. Singh, Synergy Knowledgeware,Mumbai.

4) A Text Book of Applied Mathematics (Vol I & II) by P. N. Wartikar and J. N. Wartikar, Pune Vidyarthi Griha Prakashan, Pune.

5) Higher Engineering Mathematics by H. K. Das and Er. RajnishVerma, S. Chand & CO. Pvt.Ltd., New Delhi.

Reference Books

1) Higher Engineering Mathematics by B. V. Ramana, Tata McGraw-Hill Publications, New Delhi.

2) A Text Book of Engineering Mathematics by Peter O’ Neil, Thomson Asia Pte Ltd. , Singapore.

3) Advanced Engineering Mathematics by C. R. Wylie & L. C. Barrett, Tata Mcgraw-Hill Publishing Company Ltd., New Delhi.

ET1T005	Engineering Physics	4 Credit

COURSE OBJECTIVES:-

1. To provide a firm grounding in the basic physics principles and concept to resolve many Engineering and technological problems.
2. To understand and study the Physics principles behind the developments of Engineering materials.

COURSE OUTCOMES

At the end of the course students will be able to

1. Define the concept of laser, optical fiber, Hall effect, electron Ballistics, Bethe's law, Brewster law, polarization, electromagnetic wave.
2. Illustrate different types of laser, and optical fiber, Band-theory, Effect of electric and magnetic fields, Electric and Magnetic focusing, Interference in thin films, Interference in Wedge shape thin film and electromagnetic wave.
3. Apply the concept of Three and four level laser, pumping, population inversion, Numerical aperture, Attenuation and dispersion, V-I characteristics of PN-junction diode, CRO, Interference in thin films and electromagnetic waves.
4. Analyze the different types of laser and optical fiber, semiconductors, Motion of charged particles in uniform electric and magnetic fields, polarization, relation between electric and magnetic fields of an electromagnetic wave.
5. Interpret different types of laser, and optical fiber, PN- junction diode, Bipolar Transistor action, Velocity filter, polarization, wave plate.
6. Develop models based on laser, optical fiber.

Unit-I: Laser & Optical Fibre **[08 Hrs]**

Interaction of radiation with matter, Population Inversion and Optical resonance cavity , Three and four level laser, Ruby laser, He-Ne laser, Semiconductor laser , Properties and engineering applications of laser.

Optical fibers: Propagation by total internal reflection, structure and classification (based on material, refractive index and number of modes), Modes of propagation in fiber, Acceptance angle, Numerical aperture, Attenuation and dispersion.. Applications: I) As a Sensors - i) Temperature Sensor ii)

Pollution / Smoke detector iii) Liquid level sensor. II) As a Detectors- i) PIN detector ii) Avalanche Detector.

Unit-II: Semiconductor Physics **[09Hrs]**

Band-theory based classification of solids into insulators, semiconductors and conductors, Fermi-Dirac distribution Function, Intrinsic semiconductors: Germanium and silicon; Fermi- energy, Typical energy band diagram of an intrinsic semi-conductor, Extrinsic semiconductors, Current conduction in semiconductors.

PN- junction diode; Unbiased, Forward biased& Reverse biased mode with Energy band diagram , Diode rectifier equation, Bipolar Transistor action, Hall effect, Hall coefficient & Hall Angle

Unit-III: Electron Ballistics **[08 Hrs]**

Lorentz force, Motion of changed particles in uniform electric and magnetic fields (parallel, perpendicular and at an acute angle), Effect of electric and magnetic fields on kinetic energy of charged particle, Crossed electric and magnetic field configurations, Velocity filter, Electrostatic and magneto static deflection.

Bethe's law, Electric and Magnetic focusing, Construction & working of Electrostatic lens, Devices: CRT, CRO, Block Diagram, Function & working of each block.

Unit-IV: Wave Optics **[08 Hrs]**

Interference in thin films, Interference in Wedge shape thin film, Newton's rings, Anti-reflection coating, advanced applications of interference in thin film.

Polarization by reflection, Brewster's law, polarization by double refraction, Nicol prism, elliptically and circularly polarized light, Quarter wave plate and half wave plate.

Unit-V: Electromagnetic waves **[06 Hrs]**

The wave equation; Plane electromagnetic waves in vacuum, their transverse nature and polarization; relation between electric and magnetic fields of an electromagnetic wave; energy carried by electromagnetic waves and examples.

Text Books:

1. Fundamentals of Physics: David Halliday, Robert Resnick and Jerle Walker, John-WileyIndia (8e, extended)
2. A text book of Engineering Physics: M. N. Avadhanulu, S. Chand & Co.
3. Nano the Essentials: Understanding Nanoscience and Nanotechnology, T.Praddep; TMH Publications.

4. Introduction to Nanotechnology:Pooly& Owens; Willey Publication
5. Text Book of Optics: Brijlal and Subramanyam (S. Chand and Company)
6. Laser: M. N. Avadhanulu, S. Chand & Co.

Reference Books:

1. LASERS: Theory and Applications: Thyagarajan K and Ghatak A.K.
2. Nanomaterials& Nanotechnologies and Design:M.F.Ashby, Paulo Ferreira and Daniel L.Schodek, Elsevier Publications.
3. University Physics: Young and Freedman (Pearson Education).
4. Optics: Jenkins and White (Tata Mcgraw Hill)

ET1L005	Engineering Physics Lab	1 Credit

List of Experiment

2. Newton's rings - Determination of radius of curvature of Plano convex lens / wavelength of light
3. Wedge Shaped film - Determination of thickness of thin wire
4. Laser - Determination of wavelength of He-Ne laser light
5. Magnetron Tube - Determination of 'e/m' of electron
6. Hall Effect - Determination of Hall Coefficient
7. Measurement of Band gap energy of Semiconductors
8. Study of I-V characteristics of P-N junction diode
9. Experiment on fibre optics
10. Input, output and current transfer characteristics of PNP/NPN transistor in CB and CE mode
11. Study of Cathode Ray Oscilloscope

ET1T006	Energy and Environment Engineering	3 Credit

COURSE OBJECTIVES

1. To understand the importance of Energy and Environment

2. To understand the application of energy saving tool in real life.

3. To investigate the key concepts of Energy and Environment

COURSE OUTCOMES

At the end of the course students will be able to

1) Describe different kind of pollution eg. Water pollution, air pollution, soil pollution etc.

2) Understand the importance of ecosystem for human beings..

3) Discover innovative method of power generation.

4) Correlate the cost of various method of power generation.

5) Judge the quality of air.

Unit 1 **[4 hrs]**

Air Pollution: Environment and Human health - Air pollution, Particulate emission: sources- effects-control measures -, air quality standards, and measurement of air pollution. Disposal of solid wastes, Bio-medical wastes effects- control measures

Unit 2 **[4 hrs]**

Water Pollution and Conservation: Water pollution- types of pollutants, effects- control measures, Water conservation and its methods, rainwater harvesting,methods of rainwater harvesting Surface runoff harvesting, Rooftop rainwater harvesting, Noise pollution ,effects and control measures, -Thermal pollution , Soil pollution ,Nuclear hazard.

Unit 3 **[4 hrs]**

Conventional Power Generation: Steam power station, Nuclear power plant , Gas turbine power plant- Hydro power station: Schematic arrangement, advantages and disadvantages, Thermo electric and thermionic generators, Environmental aspects for selecting the sites and locations of power plants.

Unit 4 **[4 hrs]**

Renewable Power Generation: Solar, Wind, Biogas and Biomass, Ocean Thermal energy conversion (OTEC), Tidal, Geothermal energy, Magneto Hydro Dynamics (MHD): Schematic arrangement, advantages and disadvantages.

Unit 5 **[4 hrs]**

Energy conservation: Scope for energy conservation and its benefits Energy conservation Principle , Maximum energy efficiency, Maximum cost effectiveness, Methods and techniques of energy conservation in ventilation and air conditioners, refrigerator, compressors, pumps, fans and blowers, Energy conservation in electric furnaces, ovens and boilers, lighting techniques. Triffs and economic aspects in power generation.

Reference/Text Books:

1. A Chakrabarti, M. L Soni, P. V. Gupta, U. S. Bhatnagar, A Text book of Power System Engineering, DhanpatRai Publication.
2. Rai. G. D., Non-Conventional Energy Sources, Khanna Publishers, Delhi, 2006.
3. Rao S., Parulekar B.B., Energy Technology-Non conventional, Renewable and Conventional, Khanna Publishers, Delhi, 2005.
4. Glynn Henry J., Gary W. Heinke, Environmental Science and Engineering, Pearson Education, Inc, 2004.
5. J. M. Fowler, Energy and the Environment, McGraw-Hill, 2 nd Edition, 1984.
6. Gilbert M. Masters, Introduction to Environmental Engineering and Science, 2nd Edition, Prentice Hall, 2003.

WS1L001	Workshop Practices	2 Credit

Instructions to the student:

Each student is required to maintain a „workshop journal" consisting of drawing / sketches of the jobs and a brief description of tools, equipment, and procedure used for doing the job.

Contents:

a**) Carpentry:** Technical Terms related to wood working, Types of wood, Joining materials, Types of joints - Mortise and Tenon, Dovetail, Half Lap, etc., Methods of preparation and applications, Wood working lathe, safety precautions.

b) Welding: Arc welding - welding joints, edge preparation, welding tools and equipment, Gas welding - types of flames, tools and equipment, Resistance welding - Spot welding, joint preparation, tools and equipment, safety precautions.

c) Fitting: Fitting operation like chipping, filing, right angle, marking, drilling, tapping etc., Fitting hand tools like vices, cold chisel, etc. Drilling machine and its operation.

e) Machine shop: Lathe machine, types of lathes, major parts, cutting tool, turning operations (Demo), safety precautions

List of Practical:

1. Wood sizing exercises in planning, marking, sawing, chiselling and grooving to make half lap joint and cross lap joint.
2. A job involving cutting, filing to saw cut, filing all sides and faces, corner rounding, drilling and tapping on M. S. plates.
3. Exercise in Arc welding (MMAW) to make a square butt joint.
4. A demo job on turning of a Mild Steel cylindrical job using centre lathe.

Electrical workshop:-

1) To wire for a stair case arrangement using a two-way switch.

2) To measure electrical quantities-voltage current, power & power factor in RLC circuit.

ET1T007	Basics of Electrical and Electronics Engineering	Audit

COURSE OBJECTIVES

1. To provide a basic information and use of electrical and electronics components.
2. To understand and study the materials used for the preparation of electrical and electronics components.
3. To provide basic knowledge of operation and functionality of electrical and electronics components.

COURSE OUTCOMES:

CO1: Define fundamentals of electrical system and choose measuring instruments for measurement of electrical quantities & describe the concept PN junction diode and its characteristics.

CO2: Classify wiring system and compare energy resources for electrical energy generation & elaborate the transistor configuration in CE, CB & CC mode.

CO3: Plan and organize the utilization of energy resources of electrical system & apply transistor characteristics to construct Amplifier devices.

CO4: Compare different sources of electrical system & distinguish various logic gates and simplify the Boolean's equations.

CO5: Justify the utilization of various electrical and electronics components into electrical and electronics circuitries.

CO6: Construct various circuits using Resistors, capacitors, inductors, PN junction diode, Zener diode, transformers, transistors and logic gates.

Unit 1: Elementary Electrical Concepts and Circuit Components (8 Hrs)

Fundamental of Electrical system: Potential difference, Ohm's law, Effect of temperature onresister, resistance temperature coefficient, **Electrical wiring system**: Study of different wire gauges and their applications in domestic and industry.

Resistors: colour code, type of resistors, material used for resistors, resistance wires, resistance standards, frequency errors in resistors.

Capacitors: Capacitance standards, variable capacitors, frequency errors in capacitors. Loss angle and power factor of capacitors.

Inductors: standards of inductance, mutual inductance, self-inductance, variable inductance, inductors for high and low frequency work, frequency errors in inductors.

Unit 2: Measurement of Electrical Quantities, Measuring Instruments & Energy Resources (7 Hrs)

Measurement of Voltage, Current, and Power (1ph and 3ph), Introduction to PMMC instrument, Ohmmeter, galvanometer, potentiometers, power factor meter and frequency meters. Study of circuit breakers & Actuators (MCB & Fuse, Power Contactors & Aux contactors, Electro-Mechanical & Solid state Relays). **Energy Resources and Utilization**: Conventional and nonconventional energy resources; Introduction to electrical energy generation from different resources, transmission, distribution and utilization, Concept of Supply Demand, Power Factor, Need of unity factor.

Unit3: Introduction to diodes, diode circuit and Transducers (8 Hrs)

The P-N Junction Diode, V-I characteristics, Diode as Rectifier, specifications of Rectifier Diodes, Half Wave, Full wave, Bridge rectifiers, Equations for IDC VDC VRMS, IRMS, Efficiency and Ripple Factor for each configuration. Zener Diode, Characteristics, Specifications, Zener Voltage Regulator, Types of Diodes: LED, Photodiode. Introduction to transducer, Classification of transducers, characteristics and choice of transducers.

Unit 4: Semiconductor Devices and Applications: (7 Hrs)

Transistors: Introduction, Classification, CE, CB, and CC configurations, α, β, concept of gain and bandwidth. Operation of **BJT** in cut-off, saturation and active regions (DC analysis). BJT as an amplifier, biasing techniques of BJT, BJT as a switch.

Introduction to Digital Electronics: Number System, Basic logic Gates, Universal Gates, Boolean Postulates, De-Morgan Theorems

Reference/Text Books:

1. V. N. Mittal and Arvind Mittal, Basic Electrical Engineering, McGraw-Hill Publication.
2. Brijesh Iyer and S. L. Nalbalwar, A Text book of Basic Electronics, Synergy Knowledgeware Mumbai, 2017. ISBN:978-93-8335-246-3
3. Vincent DelToro, Electrical engineering Fundamentals, PHI Publication, 2nd Edition, 2011.
4. A Textbook of Basic Electrical and Electronics Engineering, J.B.Gupta, Katson Publication.
5. A Textbook of Basic Electrical Engineering by S.B. Bodkhe, N.M.Deskar, Professional Publishing House Pvt. Ltd
6. D. P. Kothari and Nagrath, Theory and Problems in Electrical Engineering, PHI Publication, 2011.

7. B. L. Theraja, Basic Electronics, S. Chand Limited, 2007.
8. Millman Halkias, Integrated Electronics-Analog and Digital Circuits and Systems, McGraw-Hill Publication, 2000.
9. Donald Neaman, Electronic Circuit Analysis and Design, McGraw-Hill Publication, 3rd Edition.
10. Donald Neaman, Electronic Circuit Analysis and Design, McGraw-Hill Publication, 3rd Edition.
11. Printed Circuit Boards Design & Technology, Walter C. Bosshart, McGraw-Hill Publication.

Note: Students are advised to use internet resources whenever required

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				Credit
				L	T	P	CA	MSE	ESE/Ext. Pra.	Total	
1	HSMC	HU2T001	Communication Skills	2	0	0	60	0	40	100	2
2	BSC	MA2T001	Engineering Mathematics-II	3	1	0	20	20	60	100	4
3	BSC	EE2T002	Engineering Chemistry	3	1	0	20	20	60	100	4
4	ESC	EE2T003	Engineering Graphics	1	0	0	20	20	60	100	1
5	HSMC	HU2L001	Communication Skills Lab.	0	0	4	60	0	40	100	2
6	BSC	EE2L002	Engineering Chemistry Lab	0	0	2	60	0	40	100	1
7	ESC	EE2L003	Engineering Graphics Lab	0	0	4	60	0	40	100	2
8			Societal Internship/ Field Training	Credit to be given in III Sem.							
9	ESC	EE2T004	Basic Civil and Mechanical Engineering	2	0	0	10	15	25	50	Audit
				11	**2**	**10**					**16**
				23							

Curriculum for Semester- II [First Year]

HU2T001	Communication Skills	2 Credit

COURSE OBJECTIVES:

The main objective of the subject is to enhance the employability skills of engineering studentsas well as communication skills at work place.

The sub-objectives are:

1) To develop students' reading skills and pronunciation.
2) To develop technical communication skills through drafting, letter writing, and précis writing.
3) To develop literary skills through essay writing.
4) To develop public speaking skills of the students.
5) To expose the students to the ethics of English language by teaching grammar

COURSE OUTCOMES:

At the end of the course students will be able to

1) Better reading comprehension, pronunciation, and functional English grammar.
2) Write letters and resumes
3) Organize their thoughts for effective presentation and writing.
4) Learn skills to present themselves well in an interview, and handle a Group Discussion

Unit 1: Communication and Communication Processes (06 hrs)

Introduction to Communication, Types and functions of Communication, Barriers to Communication and overcoming them, Role of Communication Skills in Society

Reading: Introduction to Reading, Barriers to Reading, Types of Reading: Skimming, Scanning, Intensive and Extensive, Strategies for Reading Comprehension.

Listening: Importance of Listening, Types of Listening, and Barriers to Listening.

Unit 2: Study of Sounds in English and Vocabulary Building (06 hrs)

Introduction to phonetics, Study of Speech Organs, Study of Phonemic Script, Articulation ofDifferent Sounds in English.

Vocabulary Building: The concept of Word Formation, Root words from foreign languages and their use in English, Use of prefixes and suffixes from foreign languages in English to form derivatives, Synonyms, antonyms, and standard abbreviations

Unit 3: English Grammar (06 hrs)

Grammar: Forms of Tenses, Articles, Prepositions, Use of Auxiliaries and Modal Auxiliaries, Sentence Structures, Use of phrases and clauses in sentences, Importance of proper punctuation,Common Errors. Misplaced modifiers

Unit 4: Professional Verbal Communication (06 hrs)

Components of an effective talk, Idea of space and time in public speaking, Tone of voice, Body language, Timing and duration of speech, Audio-Visual Aids in speech. Presentation Skills, Group Discussion and Job Interviews

Unit 5: Developing Business Writing Skills, Styles and Practice (06 hrs)

Writing Emails, Report Writing: Format, Structure and Types, Letter Writing**:** Types, Parts, Layouts, Writing Job Application Letter and Resume.

Nature and Style of sensible Writing and Practice: Describing, Defining, Classifying, Providing examples or evidence, writing introduction and conclusion, Writing Practices: Comprehension, Précis Writing, Essay Writing

Text book:

Mohd. Ashraf Rizvi, Communication Skills for Engineers, Tata McGraw Hill

Reference Books:

1) Sanjay Kumar, PushpLata, Communication Skills, Oxford University Press, 2016

2) Meenakshi Raman, Sangeeta Sharma, Communication Skills, Oxford University Press, 2017

3) Teri Kwal Gamble, Michael Gamble, Communication Works, Tata McGraw Hill Education, 2010

4) Anderson, Kenneth. Joan Maclean and Tossny Lynch. Study Speaking: A Course in Spoken English for Academic Purposes. Cambridge: CUP, 2004.

5) Aswalthapa, K. Organisational Behaviour, Himalayan Publication, Mumbai (1991).

6) Atreya N and Guha, Effective Credit Management, MMC School of Management, Mumbai (1994).

7) Balan,K.R. and Rayudu C.S., Effective Communication, Beacon New Delhi (1996).

8) Bellare, Nirmala. Reading Strategies. Vols. 1 and 2. New Delhi. Oxford University Press, 1998.

9) Bhasker, W. W. S &Prabhu, N. S.: English through Reading, Vols. 1 and 2. Macmillan, 1975.

10) Black, Sam. Practical Public Relations, E.L.B.S. London (1972).

11) Blass, Laurie, Kathy Block and Hannah Friesan. Creating Meaning. Oxford: OUP, 2007.

12) BoveeCourtland,L and Thrill, John V. Business Communication, Today McGraw Hill, New York, Taxman Publication (1989).

HU2L001	Communication Skills Lab	2 Credit

List of Practical Sessions (Any 10 PR sessions can be conducted):

1) Pronunciation, Intonation, Stress and Rhythm(02 hrs)
2) Introduction to Phonemic symbols (02 hrs)
3) Articulation of sounds in English with proper manner (02 hrs)
4) Practice and exercises on articulation of sounds (02 hrs)
5) Read Pronunciations/transcriptions from the dictionary (02 hrs)
6) Practice and exercises on pronunciations of words (02 hrs)
7) Introduce yourself (02 hrs)
8) Importance of Business Communication with the help of a case study.(02hrs)
9) Listening Skills/ Comprehension(02 hrs)
10) Common Everyday Situations: Conversations and Dialogues(02 hrs)
11) Communication at Workplace(02 hrs)
12) Rapid reading sessions (02 hrs)
13) Draft Email(02 hrs)
14) Resume Writing(02hrs)
15) Drafting Business Letter(02 hrs)
16) Preparing technical paper using IEEE format(02 hrs)
17) Extempore (02 hrs)
18) Elocution (02 hrs)
19) Group discussion (02 hrs)
20) Participating in a debate (02 hrs)
21) Presentation techniques (02 hrs)
22) Interview techniques , Job Interviews, Telephonic Interviews(02hrs)
23) Mock interviews and practice sessions(02 hrs)

MA2T001	Engineering Mathematics-II	4 Credit

COURSE OBJECTIVES

1. To understand the importance of Mathematics
2. To understand the application of Mathematics in engineering and in real life.
3. To investigate the key concepts of Mathematics.
4. To enable students to analyse a problem

COURSE OUTCOMES

At the end of the course students will be able to

1. Describe concept of complex numbers, integral calculus & multiple integrals, Fourier series & transform, vector differential calculus, vector integral calculus.
2. Illustrate the concept of complex numbers, integral calculus & multiple integrals, Fourier series & transform, vector differential calculus, vector integral calculus by using examples.
3. Apply the knowledge of complex numbers, integral calculus & multiple integrals, Fourier series & transform, vector differential calculus, vector integral calculus to solve the engineering problems.
4. Analyse the problems and results of complex numbers, integral calculus & multiple integrals, Fourier series & transform, vector differential calculus, vector integral calculus to solve the engineering problems.
5. Evaluate the problems by using complex numbers, integral calculus & multiple integrals, Fourier series & transform, vector differential calculus, vector integral calculus to solve the engineering problems.
6. Create the methods or model by using complex numbers, integral calculus & multiple integrals, Fourier series & transform, vector differential calculus, vector integral calculus to solve the engineering problems.

Unit 1: Complex Numbers **[09 Hours]**

Definition and geometrical representation; De-Moivre'stheorem (without proof); Roots of Complex numbers by using De-Moivre'stheorem; Circular functions of complex variable ,definition; Hyperbolic functions; Relations between circular and hyperbolic functions; Real and Imaginary parts of circular and hyperbolic functions; Logarithm of Complex quantities.

Unit 2: Integral calculus & Multiple Integrals **[09 Hours]**

Beta, Gamma functions; tracing of the curves given in Cartesian, parametric & polar forms. Double integration in Cartesian and polar co-ordinates; Evaluation of double integrals by changing the order of integration and changing to polar form; Triple integral

Unit3: Fourier Series & Transform[09 Hours]

Fourier Series , Definition and Properties (excluding FFT), Fourier Integral Theorem, Relation with Laplace Transform, Applications of Fourier Transform to Solve Integral Equations.

Unit4: Vector Differential Calculus [09 Hours]

General rules of vector Differentiation; Scalar and vector fields: Gradient, divergence and curl; Solenoidal and irrotational vector fields; Vector identities

Unit5: Vector Integral Calculus [09 Hours]

Vector Integration: line integral, surface integral and volume integral; Green's lemma, Gauss' divergence theorem and Stokes' theorem (without proofs).

Text Books

1) Higher Engineering Mathematics by B. S. Grewal, Khanna Publishers, NewDelhi.
2) Advanced Engineering Mathematics by Erwin Kreyszig, John Wiley & Sons, NewYork.
3)A Course in Engineering Mathematics (Vol I) by Dr. B. B. Singh, Synergy Knowledgeware, Mumbai.
4) A Text Book of Applied Mathematics (Vol I & II) by P. N. Wartikar and J. N. Wartikar, Pune Vidyarthi Griha Prakashan, Pune.
5) Higher Engineering Mathematics by H. K. Das and Er. RajnishVerma, S. Chand & CO. Pvt.Ltd., New Delhi.

Reference Books

1) Higher Engineering Mathematics by B. V. Ramana, Tata McGraw-Hill Publications, New Delhi.
2) A Text Book of Engineering Mathematics by Peter O' Neil, Thomson Asia Pte Ltd. , Singapore.
3) Advanced Engineering Mathematics by C. R. Wylie & L. C. Barrett, Tata Mcgraw-Hill Publishing Company Ltd., NewDelhi.

ET2T002	Engineering Chemistry	4 Credit

COURSE OBJECTIVES

1. To understand the importance of Chemistry
2. To understand the application of Chemistry in engineering and in real life.
3. To investigate the key concepts of Chemistry knowledge
4. To enable students to analyse a Chemistry problem so that appropriate problem solving techniques may be applied

COURSE OUTCOMES

At the end of the course students will be able to

1. Describe various properties of water, fuel, transition metal ions and their magnetic properties, Debye-Hückel theory, Quinonoid theory, various electrode, polymer and batteries
2. Illustrate the various types of water, Ostwald's theory of acid-base indicator, polymer, various batteries, and fuel cell.
3. Analyze the question on water characteristics, electrochemistry and various types of instrumental titration, various batteries and fuel cell.
4. Apply the Knowledge of zeolite process, Ion exchange process, Hot Lime ,Soda process, acid base concept, fuel cell and batteries..
5. Develop a Modal on softening of water, standardization of acid and base by various instruments, polymers, fuel cell and batteries..
6. Organize water as per quality, and fuel, types of electrodes, polymers and fuel cell and batteries.

Unit1: Water Treatment **6 Hrs**

Introduction, hard and soft water, softening of water , Zeolite process, Ion exchange process, Hot Lime ,Soda process, water characteristics- Hardness, Domestic water treatment

Unit2: Fuels **6 Hrs**

Introduction, classification of fuel, essential properties of fuel, characteristics of good fuel, solid fuel-Coal, Various types of Coal, Analysis of coal-Proximate and Ultimate analysis, liquid fuel- Refining of Petroleum.

Unit3: Electrochemistry **8 Hrs**

Introduction-basic concepts, Transport number and its determination by Moving Boundary method, Debye-Hückel theory, Conductometric titrations, Ostwald's theory of acid-base indicator, Quinonoid theory, Electrodes , Glass electrode, Quinhydrone electrode.

Unit4: Advanced Polymeric Materials: **8 Hrs**

Introduction to reactions involving substitution, addition, elimination, cyclization and ring opening. Liquid crystals and liquid crystal polymers (thermotropic and lyotropic), phases of thermotropic polymers: nematic, smectic, cholesteric; advantages, disadvantages and applications

Unit5: Battery Technology: **6 Hrs**

Classification of batteries: Primary, Secondary- Electricity storage density, power density, energy efficiency, cycle life, shelf life. Rechargeable alkaline storage batteries, Ni-metal hydride,
Lithium ion batteries and H2-O2 Fuel cell.

Text Books:

1. A Text book of Engineering Chemistry, Dr. S. S. Dara, Dr. S. S. Umre,S. Chand and Company Ltd., Twelfth/ 2011
2. Selected Topics in Inorganic Chemistry, Dr. Wahid U. Malik, Dr. G. D. Tuli and Dr. R. D. Madan, S. Chand and Company Ltd., Seventh/2001

Reference Books:

Engineering Chemistry, P. C. Jain and Monika Jain, Dhanpatrai Publishing Company Ltd., 15th Ed/ 2009

Principles of Physical Chemistry, B. R. Puri, L. R. Sharma and Madan S. Pathania, Vishal Publishing Company, First/2002

Chemistry, John E McMurry and Robert C Fay, Pearson, First/2008

EL2L002	Engineering Chemistry Lab	1 Credit

List of Experiments: (Perform any 8, 10 Experiments)

1. Determination of Hardness of water sample by EDTA method.
2. Determination of flash point by Pensky Martin Apparatus
3. Determination of Dissolve Oxygen by Iodometric method.
4. Determination of percent purity of Bleaching Powder.
5. pH , metric Titration (any one type of Acid Base titration)
6. Conductometric Titration (any one type of Acid Base titration)
7. Surface tension: Determination of relative surface tension of liquid with respect to water using drop number method.
8. Viscosity:Determination of relative viscosity of liquid with respect to water using Ostwald's viscometer method.
9. To determine the normality in Normal term and Strength in gms/lit of HCl solution by titrating with Na_2CO_3 solution.
10. To find out Morality, Normality and Strength of the given $KMnO_4$ solution by titrating against N/10 Mohr's solution.
11. Determination of Acid value of an oil sample.
12. Determination of Saponification value of an oil sample.

Reference Books:

1. Systematic experiments in Chemistry, A. Sethi, New Age International Publication, New Delhi.
2. Practical Inorganic Chemistry, A. I. Vogel, ELBS Pub.
3. Practical in Engineering Chemistry, S. S. Dara.

ET2T003	Engineering Graphics	1 Credit

COURSE OBJECTIVES

1. To understand the concepts like dimensioning, conventions and standards related to engineering graphics in order to become professionally efficient
2. To understand theory of projection and simple machine parts in first and third angle of projection systems.
3. To understand the key concepts CAD software.
4. To enable students to analyze a 2-dimensional & 3-dimensional problem.

COURSE OUTCOMES:

1. Define various concepts like dimensioning, conventions and standards related to engineering graphics in order to become professionally efficient.
2. Interpret drawings of simple machine component in first and third angle of projection systems
3. Apply theory of projections in projection of lines, projection of planes and projection of solid.
4. Classify solid geometry in different positions.
5. Assess the two dimensional and three dimensional drawing in CAD software.
6. Create the three dimensional engineering objects into two dimensional drawings and vice versa using CAD software

Unit I Introduction to Computer Aided Drawing [03 hrs]

Theory of CAD software, Demonstration knowledge, layout of the software, standard tool bar/menus and description of most commonly used tools bars, Navigational tools. Creation of 2D/3D environment. Commands and creation of co-ordinate points, lines, axes, polyline, square, rectangle, polygons, splines, circles, ellipse, text, move, copy, offset, mirror, rotate, trim, extend, break, chamfer, fillet, zoom, pan, curves, constraints viz. tangency, parallelism, inclination and perpendicularity. Dimensioning, line conventions, lettering. Line properties, 3D modeling& topology of engineering component.

Unit II Drawing standards & Orthographic Projections: [03 hrs]

Drawing standard SP: 46, type of lines, lettering, dimensioning. Basic geometrical construction, drawing of regular polygon, Theory of projection, introduction to orthographic projection, drawing of orthographic views of objects from their isometric views by using first angle method of projection.

Unit III Projections of Points & Projections of Straight Lines: [03 hrs]

Projection of point lying in four quadrants. Projections of lines parallel and perpendicular to one or both planes, projections of lines inclined to one or both reference planes.

Unit IV Projections of Planes & Projections of Solids: [03 hrs]

Projections of planes parallel and perpendicular to one or both planes, projection of planes inclined to one or both planes.

Types of solids, Projection of solid when axis is perpendicular to one of the reference planes, when axis is inclined to one and parallel to other reference plane, when axis is inclined to both the reference planes

Unit V Isometric Projections [03 hrs]

Isometric projections: Isometric scale, drawing of isometric projections from given orthographic views.

Text Books:

1. N. D. Bhatt, Engineering Drawing, Charotar Publishing House, 46th Edition, 2003.
2. Dhananjay A. Jolhe, Engineering Drawing with an Introduction to AutoCAD, McGraw Hill Education, 2017

Reference Books:

1. K. V. Nataraajan, A text book of Engineering Graphic, Dhanalakshmi Publishers, Chennai, 2006.
2. K. Venugopal and V. Prabhu Raja, Engineering Graphics, New Age International (P) Ltd, 2008.
3. Engineering Drawing, R. K. Dhawan, S. Chand Publication, 1998.
4. Engineering Graphics, A. R. Bapat, Allied Publishers, 2004.
5. Fundamentals of Engineering Drawing, Luzadder& Duff, Eastern Economy, 11th Edition.

ET2L003	Engineering Graphics Lab	2 Credit

COURSE OBJECTIVES:

The objective of the course is to enable students to

1. Provide basic foundation in CAD software.
2. Understand the fundamentals used to create and manipulate geometric models.
3. Get acquainted with the basic CAD software for to design geometric modeling.

COURSE OUTCOMES:

1. Define basic structure of CAD workstation, CAD commands, Memory types, input/output devices and display devices to become professionally efficient to operate CAD software.
2. Explain drawing of simple machine component in CAD software.
3. Acquire the knowledge of geometric modeling in CAD software.
4. Analyze the steps required in CAD software for 2-dimensional and 3-dimensional models.
5. Assess the two dimensional and three dimensional drawing in CAD software.
6. Create the three dimensional engineering objects into two dimensional drawings and vice versa using CAD software.

List of Practical:

1. Introduction of CAD software and to study and practice basic draw commands exists in the CAD software.
2. Lines, lettering and dimensioning. (Drafting work)
   Identify the different types of Lines in the given object, draw lettering and give the Required dimensions in the given object.
3. Geometric Construction. (Drafting work)
4. Orthographic projections first sheet. (Using CAD software)
5. Orthographic projections second sheet. (Using CAD software)
6. Projections of straight lines. (Drafting work)

7. Projections of planes & solids. (Drafting work)
8. Isometric Projections first sheet. (Using CAD software)
9. Isometric Projections second sheet. (Using CAD software)
10. Design of basic hardware components using CAD Software.
11. Design of advance hardware components using CAD Software.
12. Design of assembly drawing using CAD Software.
13. Design of assembly drawing with animation and rendering using CAD Software.

ET2T004	Basic Civil and Mechanical Engineering	Audit

COURSE OBJECTIVES

1. To understand the basic stream of Mechanical engineering and Civil Engineering.
2. To understand the concepts of product manufacturing, Energy engineering, design engineering, Automobile engineering, construction technique and civil surveying.
3. To have basic knowledge of Casting, Machining, Designing, Manufacturing, different materials for building construction and surveying.

COURSE OUTCOMES:

Students would be able to

1. Define basic stream of Mechanical & Civil Engineering.
2. Explain the concepts of product manufacturing, Energy engineering, design engineering, Automobile engineering, construction technique and civil surveying.
3. Apply Basic knowledge of Casting, Machining, Designing, Manufacturing & Civil Construction technique.
4. Analyzed the different mechanical system and properties of construction & surveying material.
5. Interpret the problem in mechanical system and civil structure.
6. Solve the problem in mechanical system and civil structure.

Part I Basic Civil Engineering

Unit 1: Introduction to civil engineering

Various branches introduction to civil engineer in various construction activities basic engineer properties and various materials: earth bricks timber, stone, sand Aggregate cement motor steel bituminous glass FRP composite material.

Unit 2: Building component and planning material

Foundation and superstructure function of foundation type of shallow and deep foundation suitability in different situation plinth wall lintels beam column slab roof staircase floor door window and study of building plans ventilation and basic plumbing and sanitation

Unit 3: Surveying

Principal of surveying element of distance angular measurement plotting of area base line and off set introduction of plane table survey introduction to levelling concept of bench mark reduce level and counting

Part II Basic Mechanical Engineering

Unit 1: Introduction to Mechanical Engineering, Introduction to Laws of Thermodynamics with simple examples pertaining to respective branches, IC Engines: Classification, Applications, Basic terminology, 2 and 4 stroke IC engine working principle, Power Plant: Types of Power plant; Gas power plant, Thermal power plant, Nuclear power plant, Automobiles: Basic definitions and objectives

Unit 2: Design Basics, Machine and Mechanisms, Factor of safety, Engineering Materials: types and applications, basics of fasteners, machining and machinability. Introduction to lathe machine, drilling machine, milling machine, basics of machining processes such as turning, drilling and milling. Introduction to casting

Text Books:

1. AnuragKandya, “Elements of Civil Engineering”, Charotar Publishing, Anand
2. M. S. Palani Gamy, “Basic Civil Engineering”, Tata Mc-Graw Hill Publication
3. G. K. Hiraskar, “Basic Civil Engineering”, DhanpatRai Publications
4. GopiSatheesh, “Basic Civil Engineering”, Pearson Education

Reference Books:

1. M. G. Shah, C. M. Kale, and S. Y. Patki, “Building Drawing”, Tata McGraw Hill
2. Sushil Kumar, “Building Construction”, Standard Publishers Distributors
3. Kanetkar T. P. and Kulkarni S. V., “Surveying and Levelling”, Vols. I, II and III, Vidyarthi
4. GruhPrakashan, Pune
5. B. C. Punmia, “Surveying”, Vol.- I, Vol.-II, Vol.-III, Laxmi Publications
6. P. K. Nag “Engineering Thermodynamics”, Tata McGraw Hill, New Delhi 3rd ed. 2005
7. A. Ghosh, A K Malik, “Theory of Mechanisms and Machines”, Affiliated East West Press Pvt. Ltd. New Delhi.

8. SeropeKalpakaji and Steven R Schimd "A manufacturing Engineering and Technology" Addison WsleyLaongman India 6th Edition 200
9. V. B. Bhandari, "Design of Machine Elements", Tata McGraw Hill Publications, New Delhi.

Curriculum for Semester- III [Second Year]

Sr. No.	**Subject Category**	**Subject Code**	**Course Title**	**Teaching Scheme**			**Evaluation Scheme**				**Credits**
				L	T	P	CA	MSE	ESE	TOTAL	
1	HSMC	EE3T001	Engineering Economics	2	0	0	20	20	60	100	2
2	BSC	EE3T002	Engineering Mathematics –III	3	1	0	20	20	60	100	4
3	ESC	EE3T003	Theory of electrical engineering	3	1	0	20	20	60	100	4
4	PCC-EE	EE3T004	Network Analysis	3	0	0	20	20	60	100	3
5	PCC-EE	EE3T005	Electrical Machine I	2	1	0	20	20	60	100	3
6	PCC-EE	EE3T006	Measurement and Instrumentation	2	1	0	20	20	60	100	3
7	PCC-EE	EE3L004	Network Analysis Lab	0	0	2	60	0	40	100	1
8	PCC-EE	EE3L005	Electrical Machine I Lab	0	0	2	60	0	40	100	1
9	PCC-EE	EE3L006	Measurement and Instrumentation Lab	0	0	2	60	0	40	100	1
10	PROJ-EE	EE3P001	Field trainning/ Internship/ industrial visit	0	0	0	0	0	50	50	1
11	MC	EE3T007	Innovation and entrepreneurship Development	2	0	0	10	15	25	50	Audit
				17	**4**	**6**	**310**	**135**	**555**	**1000**	
								Total Credits			**23**

EE3T001	Engineering Economics	2 Credit

COURSE OBJECTIVE

1. To learn the basics of Economics.
2. Ability to take Economically Sound Decision.
3. Ability To understand the interaction of World Economy.
4. To be able to work in an Industrial atmosphere.

COURSE OUTCOME

1. Remember and define basics of the Economics
2. Understand Mechanism of Price Fixation
3. Identify Time value of Money.
4. Analyze and classify basic Factors of Production
5. Interpret Indian Economy and Globalization .
6. Plan To become Self Employed

COURSE CONTENTS:

UNIT 1: [05 hrs]

Introduction, Micro And Macro Economics .Economics and its relation with other subjects, Nature of Economic laws. Basic Economic problems, Basic Economic terms, Engineering and Economics

UNIT 2: [05 hrs]

Meaning of demand ,Factors affecting demand, Law of Elasticity ,Types of elasticity, Practical applications of Laws of Elasticity ,Demand Forecasting, Techniques of Demand forecasting. Law of supply, Role of demand and Supply in Price Fixation.

UNIT 3: [04 hrs]

Time value of Money ,Capital Budgeting ,Traditional and modern methods of Payback, IRR, ANR, Case studies

UNIT 4: **[05 hrs]**

Factors of Production, Concepts of cost, Break even Analysis, Law of variable Proportions ,Internal and External Economies of scale, Depreciation.

UNIT 5: **[05 hrs]**

ENTERPRISE Meaning and definition, factors required for growth of Enterprise, Institutions to support the growth of MSME's, Sources of finance for MSME's and scope for self Employment Opportunities.

UNIT 6: **[04 hrs]**

Features of Indian Economy, Fiscal and Monetary policy, LPG, Inflation, Banking,
World Economic bodies

Text Books:

1. Chopra P. N., Principle of Economics, Kalyani Publishers
2. Dewett K. K., Modern economic theory, S. Chand
3. H. L. Ahuja., Modern economic theory, S. Chand
4. Dutt Rudar & Sundhram K. P. M., Indian Economy
5. SMALL-SCALE INDUSTRIES AND ENTREPRENEURSHIP by Vasant DEASAI,

Reference Books:

1. Dewett K.K. Elemntary Economic Theory.
2. Entrepreneurial Development By S.S.Khanka.
3. Financial Management: Theory and Practice: Author: Prasanna Chandra, Mc Graw Hill India .

EE3T002	Engineering Mathematics –III	4 Credit

COURSE OBJECTIVES:

1. The basic concept of Laplace Transform , Fourier Transform, Function of Complex variable.
2. Ability to solve the problem on Laplace transform Fourier integral , Parseval's identity.
3. Apply the knowledge of the Laplace Transform ,Fourier Transform , Partial differential equation, function of complex variable to real life problem.

COURSE OUTCOMES:

At the end of this course students will demonstrate the ability to

1.Remember properties of Laplace transform , Convolution Theorem, Fourier integral theorem , Parseval‟s identity , Cauchy's integral theorem , Cauchy's residue theorem

2.Describe properties of Laplace transform , Convolution Theorem, Fourier integral theorem , Parseval‟s identity , Cauchy's integral theorem , Cauchy's residue theorem .

3.Illustrate the examples using Laplace transform, Fourier Transform, Partial differential equation, Function of Complex Variables, Matrices.

4.Apply the knowledge of Laplace transform ,Z-transform, function of complex variable, Advance partial differential equation.

5.Analyze the question on Laplace transform, Fourier Transform, Partial differential equation , Function of Complex Variables

6.Create a modal using Laplace transform, Fourier Transform, Partial differential equation, Function of Complex Variables, Matrices.

COURSE CONTENTS

UNIT 1 : Matrices **[07 hrs]**

Characteristics equation, Eigen values and Eigen vectors, Statement and Verification of Cayley Hamilton Theorem [without proof], Reduction to Diagonal form, Sylvester's theorem [without proof.]

UNIT 2: Laplace Transform **[07 hrs]**

Definition , conditions for existence; Properties of Laplace transforms; Transforms of some special functions- periodic function, Heaviside-unit step function.

UNIT 3: Inverse Laplace Transform **[07 hrs]**

Introductory remarks ; Inverse transforms of some elementary functions ; Partial fraction method and Convolution Theorem for finding inverse Laplace transforms ; Applications to find the solutions of differential equations

UNIT 4: Z- Transform **[07 hrs]**

Defination, Convergence of Z-transform and Properties, Inverse Z-transform by Partial Fraction Method, Residue Method (Inversion Integral Method), Solutions of Difference Equations with Constant Coefficients by Z- transform.

UNIT 5: Advance Partial Differential equations **[07 hrs]**

Introduction Partial differential equation, method of separation of variables, Application of partial differential equations .(Heat equation ,wave equation , Laplace Equation)

UNIT 6: Functions of Complex Variables **[07 hrs]**

Analytic functions; Conjugate functions; Cauchy- Riemann equations in Cartesian and polar forms; Harmonic functions in Cartesian form, Cauchy's integral theorem; Bilinear transform Cauchy's integral formula; Residues; Cauchy's residue theorem (All theorem without proofs)

Text Books:

1. Higher Engineering Mathematics by B. S. Grewal, Khanna Publishers, New Delhi.
2. Advanced Engineering Mathematics by Erwin Kreyszig, John Wiley & Sons, New York.
3. A Course in Engineering Mathematics (Vol III) by Dr. B. B. Singh, Synergy Knowledge ware, Mumbai.
4. A Text Book of Applied Mathematics (Vol I & II) by P. N. Wartikar and J. N. Wartikar, Pune Vidyarthi Griha Prakashan, Pune.
5. Higher Engineering Mathematics by H. K. Das and Er. Rajnish Verma, S. Chand & CO. Pvt. Ltd., New Delhi.

Reference Books:

1. Higher Engineering Mathematics by B. V. Ramana, Tata McGraw-Hill Publications, New Delhi.
2. A Text Book of Engineering Mathematics by Peter O' Neil, Thomson Asia Pte Ltd., Singapore.

3. Advanced Engineering Mathematics by C. R. Wylie & L. C. Barrett, Tata Mcgraw-Hill Publishing Company Ltd., New Delhi.
4. Integral Transforms and Their Engineering Applications by Dr. B. B. Singh, Synergy . Knowledge ware, Mumbai.
5. Integral Transforms by I. N. Sneddon, Tata McGraw-Hill, New York.

EET3003	Theory of Electrical Engineering	4 Credit

COURSE OBJECTIVE

Students will learn:

1 Remember fundamental principles of electrical and magnetic circuit

2 Understand simplified methods such as series parallel reductions, voltage and current dividers, and the mesh - node method.

3 To apply laws of electric and magnetic system.

4 To analyze electrical circuit, magnetic circuit and illumination system

5 To utilize various lighting system and electric system and evaluation of same.

6 Design parameters of electrical circuit, magnetic circuit and illumination system.

COURSE OUTCOMES

Upon completion of this course, the students shall be able to,

1. Remember the basic laws of electric and magnetic circuits also Define various A.C. and D.C Quantities
2. Understand and interpret the sinusoidal electrical quantities mathematically as well as graphically in the form of waveforms/phasors and illustrate the 1-phase/3-phase AC circuits.
3. Apply knowledge to calculate the power loss, voltage drop of electric and magnetic circuit also identify illumination required and the knowledge related with its need.
4. Analyze various electric, magnetic circuit and distinguish between properties.
5. Evaluate lighting system, recommend various lighting as per requirement also able to Explain A.C. fundamentals.
6. Design lighting system and also able to give solutions on single phase, poly phase and magnetic circuit unknown quantities.

Course Contents:

Unit 1: D. C. Circuits (Only Independent sources) [08 hrs]

Ohm's law, resistances in series and parallel, current and voltage division rules, Kirchhoff’s law, ideal and practical voltage and current sources. Mesh and Nodal analysis (Super node and super Mesh excluded). Source transformation. Star delta transformation. Superposition theorem.

Unit 2: Electromagnetism **[10 hrs]**

Magnetic effect of electrical current cross and dot convention, right hand thumb rule and cork screw rule, nature of magnetic field of long straight conductor, concepts of solenoid and torrid. Concepts of m.m.f, flux, flux density, reluctance, permeability and field strength, their units and relationship. Simple series and parallel magnetic circuits. , comparison between electrical and magnetic circuits , force on current carrying conductor placed in magnetic field, Fleming's left hand rule.

Faraday's law of electromagnetic induction, Fleming's right hand rule, statically and dynamically induced EMF's self and mutual inductance coefficient of coupling, energy stored in magnetic field.

Unit 3: A.C. Fundamentals **[12 hrs]**

Sinusoidal voltage and currents, their mathematical and graphical representation, concept of cycle period, frequency, instantaneous, peak, average, r.m.s. values, peak factor , and form factor, phase difference, lagging, leading and in phase quantities and phasor representation. Rectangular and polar representation of phasors. Study of A.C circuits of pure resistance, inductance and capacitance and corresponding voltage- current phasor diagrams, voltage , current and power waveforms.

Unit 4: Single phase and poly phase A. C. circuits **[12 hrs]**

Single phase AC Circuits: Study of series and parallel R-L, R-C, R-L-C circuits, concept of impedance and admittance for different combinations, wave form and relevant voltage current phasor diagrams. Concept of active, reactive, apparent, complex power and power factor, resonance in series and parallel RLC circuit. Q- factor and bandwidth.

Polyphase AC circuits: Concept of three phase supply and phase sequence. Balanced and unbalanced loads voltage current and power relations in three phase balance star and delta loads and their phasor diagrams.

Unit 5: Electrostatics **[07 hrs]**

Electrostatics: electrostatic field, electric flux density, electric field strength, absolute permittivity, relative permittivity and capacitance, composite dielectric capacitors, capacitors in series and parallel, energy stored in capacitors, charging and discharging of capacitors and concept of time constant.

Unit 6 : Illumination and Electrical Energy Tariff **[07Hrs]**

Definitions of luminous flux, luminous intensity, candle power, illumination, luminance, luminous efficiency (lumens/watt) of different types of lamps, working principle of Fluorescent/ Sodium Vapour/ Mercury vapour & CFL Lamps. Simple numerical to determine number of lamps to attain a given average lux level in an area.

Types of Tariff, One part (KWH based) tariff with simple numerical: (Students should be able to calculate the domestic electricity charges.)

Text Books:

1. Elements of Electrical sciences: P. Mukhopadhyay, N. Chand & Bros Roorkee (1989).
2. Electrical Technology: B. L. Thareja, S. Chand Publications.
3. Basic Electrical Engineering: S. B. Bodkhe, N. M. Deshkar, P. P. H. Pvt. Ltd.

Reference Books:

1. V. N. Mittal and Arvind Mittal;, " Basic Electrical Engineering" McGraw Hill
2. Vincent DelToro, " Electrical engineering Fundamentals", PHI second edition 2011
3. Bolestaad, :"Electronics Devices and Circuits Theory", Pearson Education India
4. Edward Hughes, " Electrical Technology,", Pearson Education
5. D.P. Kothari and Nagrath " Theory and Problems in electrical Engineering", PHI edition 2011.

EE3T004	Network Analysis	3 Credit

COURSE OBJECTIVE

Students will learn:

1. The fundamental principles of electrical circuit analysis
2. To become adept at using various methods of circuit analysis, including simplified methods such as series parallel reductions, voltage and current dividers, and the mesh - node method.
3. To appreciate the consequences of linearity, in particular the principle of superposition and Thevenin - Norton equivalent circuits.
4. To analyze energy storage elements.
5. To utilize Laplace transforms for circuit analysis.
6. To analyze four terminal networks using two-port parameters.

Course Outcomes:

Students should be able to:

1. Define basic concepts and principles related to Circuit Analysis
2. Identify the super mesh & super nodal problems.
3. Apply a variety of circuit analysis methods including theorems and Laplace transform
4. Solve two port network problems.
5. To design and develop network equations and their solutions.
6. Select best possible method of circuit analysis for a given situation

COURSE CONTENTS

Unit 1: Terminal Element Relationships **[06 Hrs]**

V-I relationship for Inductance and Capacitance - Constant Flux Linkage Theorem and Constant Charge Theorem. Dependent and Independent Sources, Active & Passive Elements, Source Transformation, Duality.

Unit 2: Mesh And Nodal analysis **[08 Hrs]**

Mesh analysis of circuits containing resistors, inductors, capacitors, transformers, and both independent and dependent sources to determine current, voltage, power, and energy. Concept of super mesh, mutual inductance, coefficient of coupling, Dot convention, dot marking in coupled coils. Nodal analysis of circuits containing resistors, inductors, capacitors, transformers, and both independent and dependent sources to determine current, voltage, power, and energy. Concept of super node.

Unit 3: Network Theorems **[07 Hrs]**

Linearity theorem, Thevinin's theorem, Norton's theorem, Maximum power transfer theorem, Reciprocity theorem, Compensation theorem, Tellegen's theorems (Both AC & DC)

Unit 4: Time Domain Analysis of Circuits **[07 Hrs]**

Linear Differential Equations for Series RC, Parallel RC, Series RL, Parallel RL, Series RLC, Parallel RLC and Coupled Circuits- Complete Solution for step/impulse/sinusoid voltage/current inputs. Natural Response-Transient Response-Time Constant-Rise and Fall times-Concept of D.C. steady state and sinusoidal steady state-Frequency Response of simple circuits from steady state solution-Solution of two mesh circuits by differential equation method Determination of initial conditions

Unit 5: Laplace Transform & Properties **[07 Hrs]**

Review of Laplace Transform & Properties Partial fractions, Concept of initial and final condition, Singularity functions, Waveforms synthesis, Steady state and transient state analysis of RL, RC, RLC network with and without initial conditions with Laplace transforms. Network Functions: Driving points and transfer functions, poles, zeros of transfer function, their properties.

Unit 6: Two Port Networks **[07 Hrs]**

Two port networks, characterizations in terms of impedance, admittance, hybrid and transmission parameters, Conditions for symmetry and Reciprocal, inter relationships among parameter sets Reciprocity Theorem-Interconnection of Two port networks: Series, Parallel and Cascade connection.

Ref Books:

1. Mac.E Van Valkenburg, "Network Analysis"
2. Franklin Fa-Kun. Kuo, "Network Analysis & Synthesis", John Wiley & Sons.
3. M. L. Soni, J. C. Gupta, "A Course in Electrical Circuits and Analysis"
4. Mac.E Van Valkenburg, "Network Synthesiss"

5. Joseph A. Edminister, Mahmood Maqvi, “Theory and Problems of Electric Circuits”, Schaum's Outline Series
7. Sudhakar Shyammohan Tata Mc Graw Hill 2005, “Circuit and Network Analysis”\

EE3L004	Network Analysis Lab	1 Credit

COURSE OBJECTIVE

Students will learn:

8. The fundamental principles of electrical circuit analysis
9. To become adept at using various methods of circuit analysis, including simplified methods such as series parallel reductions, voltage and current dividers, and the mesh - node method.
10. To appreciate the consequences of linearity, in particular the principle of superposition and Thevenin - Norton equivalent circuits.
11. To analyze energy storage elements.
12. To utilize Laplace transforms for circuit analysis.
13. To analyze four terminal networks using two-port parameters.

COURSE OUTCOMES

Students should be able to:

1. Define basic concepts and principles related to Circuit Analysis
2. Identify the super mesh & super nodal problems.
3. Verifies principles of network
4. Solve two port network problems.
5. To Analyze RLC Circuit

List of Practical

1 To Study & Verify Superpostion theorem
2 To Study & Verify Thevinion’s theorem
3 To Study & Verify Norton’s theorem
4 To Study & Verify maximum power transfer theorem
5 To Study & Verify reciprocating theorem
6 Determination of transient response of current in RL & RC circuits with step voltage input
7 Analysis of RL/ RC and RLC circuits

8 Determination of driving point and transfer functions of a two port ladder network and verify with theoretical values

9 Determination of z and h parameters (dc only) for a network and computation of Y and ABCD parameters.

EE3T005	Electrical Machine-I	3 Credit

COURSE OBJECTIVE

The course objective is to impart knowledge of,

1. The basic principle of transfer of electrical power, operation, construction of Single phase and Three phase transformers, their classification, connections and phasor diagrams.
2. The basic principle, construction, operation, Performance characteristics, steady state analysis and applications of DC generators and motors.
3. The basic principle, construction, operation, Performance characteristics, steady state analysis, Speed control and applications of Single Phase and Three phase Induction motors.

COURSE OUTCOMES

Upon completion of this course, the students shall be able to,

1. Recall the basic laws and rules of electromagnetic induction, electric and magnetic circuits.
2. Understand constructional features, working principles of electrical machines and explain different types of starting & speed control methods of electric motors.
3. Apply knowledge to calculate the power loss, voltage regulation, efficiency of transformer and operating speed of electric motor and choose type of motor, its starting and speed control methods with respect to applications.
4. Analyse performance indices, vector diagrams of electrical machines and examine the need of parallel operation, O.C. & S.C. test, Polarity test on transformer, and blocked rotor test on induction motors.
5. Evaluate braking methods of DC, and induction motor.
6. Design motoring system able to give solutions for single phase, three phase and DC supply with respect to supply available and load requirements.

COURSE CONTENTS

Unit 1: Single Phase Transformer **[05 Hrs]**

Transformer construction, classification, principle and operation of single phase transformer, Excitation phenomenon in transformers, Ideal and practical transformer, equivalent circuits, NO load and ON load operation, Phasor diagrams, Power and Energy Efficiency, Voltage regulation, Polarity test, Parallel operation, O.C. & S.C. test on single phase transformer, Effect of load on power factor, Applications-Auto transformers, Variable frequency transformer, Voltage and Current transformers, Welding transformers, Pulse transformer and applications.

Unit 2: Three Phase Transformer **[05 Hrs]**

Constructional features, principle and operation of three phase transformer, Regulation, Efficiency, Three winding transformers and its equivalent circuit, Magnetizing current and harmonics, Winding identifications, Various connections with vector group, On load tap changing of transformers, O.C. & S.C. test on three phase transformer, Determination of equivalent circuit parameters calculation using O.C. & S.C. test, Parallel operation of three phase transformer, Scott Connection, Back to Back test, Type and routine tests.

Unit 3: DC Generator **[05 Hrs]**

Construction, Magnetic structure, Principle and operation, Field and Armature systems, Field and Armature windings (Both Lap and Wave Types), EMF Equation,Armature reaction - Demagnetizing and Cross magnetizing mmfs and their estimation; Remedies to overcome the armature reaction, commutation, straight line commutation, inter-poles, compensating winding, Causes of bad commutation and remedies, Building of Emf in D.C. Shunt generator, Characteristics and Applications of Different types of D.C. Generators.

Unit 4: DC Motor **[05 Hrs]**

Principles of working, Significance of back emf, Torque Equation, Types, Characteristics and Applications of various types of D.C. Motors, Starting of DC Motors, Speed control of Series, Shunt and Compound motors, Power flow in DC machines, Losses and Efficiency, Condition for Maximum Efficiency, Braking of DC Motors, Effect of saturation and armature reaction on losses &Applications

Unit 5: Three Phase Induction Motor **[04Hrs]**

Types of 3-∅ induction motor and production of torque. Torque-slip characteristics, Torque-speed characteristics & Applications, NO load blocked rotor test, Losses & efficiency, Double cage motor, Operating characteristics & Influence of machine parameter on the performance of motor, Various methods of starting of 3 phase I.M, Methods of speed control of I.M., Braking Methods-Braking regenerative braking, Plugging, Dynamic braking, Crawling & cogging.

Unit 6: Single Phase Induction Motor **[04Hrs]**

Construction, Double Field revolving theory of Single phase induction motor, Types of IM on the basis of self-starting methods: Split phase induction motor: Capacitor start inductor motor, Capacitor start capacitor run induction motor (two value capacitor method), Permanent split capacitor (PSC) motor; Shaded pole induction motor; Phasor diagrams, Losses and Efficiency, Load characteristics & Applications.

Text Books:

1. Electrical Machines: Dr. P.S. Bimbhra
2. Electrical Machines: Ashfaq Hussain; Dhanpat Rai Publication
3. A Text Book of Electrical Technology: B. L. Theraja (Vol. II)
4. Electrical Machines 2nd -1993 :Dr. P. K. Mukherjee and S. Chakravarti, Dhanpat Rai Publications (P) Ltd
5. Electrical Machines 3rd -2010: J.Nagrath and Dr. D.P.Kothari; Tata McGraw Hill

Reference Books:

1. Performance & Design of A.C. Machine: M. G. Say
2. Laboratory Courses in Electrical Engineering: Tarnekar, Kharbanda, Bodkhe& Naik
3. D.C. Machines: Langsdorf
4. Electrical Machines and Transformers: Nasser Syed
5. Laboratory manual for Electrical machines: Dr. D.P. Kothari and Prof. Umre; S. S.CHAND publications.

EE3L005	Electrical Machine-I Lab	1 Credit

COURSE OBJECTIVE

The course objective is to impart knowledge of,

1. The basic principle of transfer of electrical power, operation, construction of Single phase and Three phase transformers, their classification, connections and phasor diagrams.
2. The basic principle, construction, operation, Performance characteristics, steady state analysis and applications of DC generators and motors.
3. The basic principle, construction, operation, Performance characteristics, steady state analysis, Speed control and applications of Single Phase and Three phase Induction motors.

COURSE OUTCOMES

Upon completion of this course, the students shall be able to,

1. Define the basic laws and rules of Transformer and Electric machines.
2. Demonstrate the constructional features of Transformer and Electrical Machines and illustrate the different machine parameters for transformer and Electrical Machines.
3. Identify the parameters like power loss, voltage regulation, efficiency of transformer and operating speed of electric motor and select the type of motor, its starting and speed control methods with respect to applications.
4. Examine the performance indices, vector diagrams of different electrical machines and inspect the need of parallel operation, O.C. & S.C. test, Polarity test on transformer, and blocked rotor test on induction motors.
5. Interpret different methods of braking for different electrical motors.
6. Develop the motoring system able to give solutions for single phase, three phase and DC supply with respect to supply available and load requirements.

List of Experiments:

1 To verify turns ratio of Transformer.

2 To perform polarity test on Single Phase Transformer.

3 To determine equivalent circuit diagram of transformer through O.C & S.C Test.

4 To determine efficiency by direct loading test on Single Phase Transformer.

5 To verify V-I relationship & draw Phasor diagram of 1.Star-Star 2.Star-delta 3.delta-star 4.Delta-Delta connection of single phase transformer.

6 To study the construction of field and armature of DC Machine.

7 To determine external characteristics of DC Generator.

8 To perform Load test on DC shunt motor.

9 To perform speed control of DC shunt motor using armature and field control method.

EE3T006	Measurement And Instrumentation	3 Credit

COURSE OBJECTIVE

Students will learn:

1. Remembering the fundamental principles of electrical instruments and measurements
2. Classification of various electrical measuring instruments
3. Make a use of operating principles of various electrical measuring instruments.
4. To distinguish between variety of measuring instruments available.
5. To utilize various electrical measuring instruments for different measurements.
6. Estimate various parameters of electrical measuring instruments.

COURSE OUTCOMES

Upon completion of this course, the students shall be able to,

1. Remember the different types of instruments used in electrical measurements.
2. Understand the operating principles of various electrical measuring instruments.
3. Apply knowledge of variety of instruments available for required parameter and identify the appropriate one.
4. Analyze and classify different electrical measuring instruments on basis of type of electrical/ physical quantity to be measured.
5. Evaluate different electrical measuring instruments
6. Test and solve various problems on electrical measuring instruments

UNIT 1: General principles of measurements **[05 hrs]**

Measurement system measurement standards , characteristics - errors in measurement. Calibration of meters- significance of IS standards of Instruments. Classification of meters - operating forces - essentials of indicating instruments - deflecting, damping, controlling torques. Ammeters and voltmeters - moving coil, moving iron, constructional details and operating, principles shunts and multipliers , extension of range.

UNIT 2: Measurement of resistance **[05 hrs]**

Classification of resistance. Measurement of medium resistances , ammeter and voltmeter method, substitution method, Wheatstone bridge method.

Measurement of low resistances , Potentiometer method and Kelvin's double bridge method. Measurement of high resistance: Loss of Charge Method, Direct Deflection Method, Price's Guard wire method. Measurement of earth resistance.

UNIT 3: AC bridges **[05 hrs]**

Generalized treatment of four-arm AC bridges. Sources and detectors. Maxwell's bridge, Hay's bridge Anderson bridge, Owens Bridge for self inductance measurement. Heaviside's bridge for mutual inductance measurement. De Sauty Bridge, Schering bridge for capacitance measurement. Wien's bridge frequency measurements. Sources of error in bridge measurements and precautions. Screening of bridge components.

UNIT 4: Introduction to high voltage and high current measurements **[04 hrs]**

Measurement of high DC voltages - measurement of high AC voltages - electrostatic voltmeters , sphere gaps - DC Hall effect sensors - high current measurements. Study of Phasor Measurement Units (PMU). Current transformers and potential transformers , principle working, ratio and phase angle errors , numerical problems, Clamp on meters

UNIT 5: Measurement of Power & Energy **[05 hrs]**

Principle of Measurement of active, reactive and apparent power single and in polyphase circuits. Measurement of Energy in single and polyphase circuits. Electrodynamometer Wattmeters, Construction, Working, Errors in wattmeter, Single phase Energy meter, Theory and operation , compensation and adjustment. Testing and calibration of single-phase energy meter by phantom loading

UNIT 6: Transducers **[04 hrs]**

Definition and classification - common transducers for measurement of displacement, velocity, flow, liquid level, force, pressure, strain and temperature - basic principles and working of LVDT, electromagnetic and ultrasonic flow meters, piezoelectric transducer, load cell, strain gauge, RTD, Thermistors, thermocouple, Need for instrumentation system, data acquisition system.

Text Book:

1. Sawhney A.K., A course in Electrical and Electronic Measurements & instrumentation, DhanpatRai .

2. J. B. Gupta, A course in Electrical & Electronic Measurement & Instrumentation., S K Kataria& Sons

3. Kalsi H. S., Electronic Instrumentation, 3/e, Tata McGraw Hill, New Delhi, 2012

References:

1. Golding E.W., Electrical Measurements & Measuring Instruments, Wheeler Pub.

2. Cooper W.D., Modern Electronics Instrumentation, Prentice Hall of India

3. Stout M.B., Basic Electrical Measurements, Prentice Hall

4. Oliver & Cage, Electronic Measurements & Instrumentation, McGraw Hill

5. E.O Doebelin and D.N Manik, Doebelin's Measurements Systems, sixth edition, McGraw Hill Education (India) Pvt. Ltd.

6. P.Purkait, B.Biswas, S.Das and C. Koley, Electrical and Electronics Measurements and Instrumentation, McGraw Hill Education (India) Pvt. Ltd.,2013

EE3L006	**Measurement and Instrumentation Lab**	**1 Credit**

COURSE OBJECTIVE

Students will learn:

1. Remembering the fundamental principles of electrical instruments and measurements
2. Classification of various electrical measuring instruments
3. Make a use of operating principles of various electrical measuring instruments.
4. To distinguish between variety of measuring instruments available.
5. To utilize various electrical measuring instruments for different measurements.
6. Estimate various parameters of electrical measuring instruments.

COURSE OUTCOMES

Upon completion of this course, the students shall be able to,

1. Choose correct instrument for measuring given electrical/ physical quantity.
2. Compare various methods and instruments available for measurement of single quantity.
3. Apply understanding about instrumentation concepts which can be applied to electrical measurements.
4. Analyse the testing and measuring set up for electrical systems
5. Evaluate efficiency of different instruments
6. Design circuit for measuring given quantity.

List of Practical:-

1. To measure low resistance by Kelvin's double bridge
2. To measure medium resistance by Wheatstone bridge
3. To measure self inductance by Hay's bridge
4. To measure capacitance by De Sauty Bridge
5. To calibrate a given single phase induction type energy meter.
6. To Study and Calibrate Three Phase Wattmeter.
7. To measure active and reactive power in three phase balanced load by one wattmeter method

8. To find the effect of various parameters on output of given LVDT
9. To Study the change in resistance of RTD probe depending on the process temperature and to Study the dynamic response of RTD probe.
10. To Study the change in EMF of a thermocouple in response to the process temperature.
11. To study impulse voltage generator
12. To study impulse current generator

Note : Some practicals will be conducted through simulations tools.

EE3T007	**Innovation and Entrepreneurship Development**	**Audit**

Course Outcomes:

At the end of the Course, Student will be able to:

1. Discover the creative / innovative side within her/him.
2. Hone entrepreneurial and leadership skills within his/her personality.
3. Develop new ways of thinking and Learn the entire innovation cycle from Ideation to GoToMarket.
4. Study frameworks, strategies, techniques and business models for conceived ideas.
5. Develop skills for evaluating, articulating, refining, and pitching a new product or service.

Course Contents:

Introduction to Innovation, Personal thinking preferences, 'Innovation' mind set, Everyday creativity and eliminating mental blocks, Introduction to Innovation, Creative thinking techniques, Innovation types, Idea management and approaches, Teaming techniques for creativity, Idea Conception, Idea Scoping, Self-Evaluation, Idea Brainstorming sessions, Idea Verification, Market Evaluation, Concept Evaluation, Idea Verification, Prototype Evaluation, Protection/Patent review, Innovation Case Study, Idea Presentations, Idea Incubation, Product and Market Plan, Product and Market Development, Innovation Case Studies, Idea Incubation and Product Launch, Marketing and selling, Post Launch Review

Reference Books:

1. Jeff Dyer, Hal Gregersen, Clayton M. Christensen, " The Innovator's DNA: Mastering the Five Skills of Disruptive Innovators, Harvard Business Review Press, 2011.

2. Paddy Miller, Thomas Wedell-Wedellsborg, "Innovation as Usual: How to Help Your People Bring Great Ideas to Life, Harvard Business Review Press, Kindle Edition.

Sr. No.	Subject Category	Subject Code	Course Title	Teaching Scheme			Evaluation Scheme				Credits
				L	T	P	CA	MSE	ESE	**TOTAL**	
1	HSMC	EE4T001	Constitution of India	2	0	0	20	20	60	100	2
2	BSC	EE4T002	Numerical method and probability	2	1	0	20	20	60	100	3
3	ESC	EE4T003	Power Station Practice	4	0	0	20	20	60	100	4
4	PCC-EE	EE4T004	Electronic Devices and circuits	3	0	0	20	20	60	100	3
5	PCC-EE	EE4T005	Power System I	2	1	0	20	20	60	100	3
6	PCC-EE	EE4T006	Electrical Machine II	3	0	0	20	20	60	100	3
7	BSC	EE4L002	Numerical method and probability Lab	0	0	2	60	0	40	100	1
8	PCC-EE	EE4L005	Power System I Lab	0	0	2	60	0	40	100	1
9	PCC-EE	EE4L006	Electrical Machine II Lab	0	0	2	60	0	40	100	1
10	PROJ-EE	EE4P002	Field training/ Internship/ industrial visit	0	0	0	0	0	50	50	1
11	MC	EE4T007	Universal Human Values	2	0	0	10	15	25	50	Audit
				18	**2**	**6**	**310**	**135**	**555**	**1000**	

Total Credits	22

Curriculum for Semester- IV [Second Year]

EE4T001	Constitution of India	Credit 2

COURSE OBJECTIVES

1. Understand the concept of Constitution and its importance.
2. Know the need and importance of protecting Constitution.
3. Familiarize students (Prospective engineers) with elementary knowledge of laws that would be of utility in their profession.
4. To be supplemented by the historical development of laws wherever required.

COURSE OUTCOME

1. To define Constitution and basic knowledge about Indian Constitution.
2. To demonstrate Constitution and its importance.
3. To identify constitution law and constitutionalism

4. Classify Responsibilities, Fundamental Duties and its legal status values of an engineer.
5. To evaluate the Parliamentary Form of Government in India.
6. To create awareness on Constitutional Scheme in India

COURSE CONTENTS:

COURSE CONTENT

Unit 1: Introduction to constitution law and constitutionalism [06 hrs]

Meaning of the constitution law and constitutionalism. Historical perspective of the Constitution of India. Salient features and characteristics of the Constitution of India. Scheme of the fundamental rights.

Unit 2: The Fundamental Duties and its legal status [06 hrs]

The scheme of the Fundamental Duties and its legal status. The Directive Principles of State Policy – Its importance and implementation. Federal structure and distribution of legislative and financial powers between the Union and the States.

Unit 3: The constitution powers [06 hrs]

Parliamentary Form of Government in India – The constitution powers and status of the President of India. Amendment of the Constitutional Powers and Procedure. The historical perspectives of the constitutional amendments in India. Emergency Provisions : National Emergency, President Rule, Financial Emergency

Unit 4: Constitutional Scheme in India [06 hrs]

Local Self Government – Constitutional Scheme in India. Scheme of the Fundamental Right to Equality. Scheme of the Fundamental Right to certain Freedom under Article 19. Scope of the Right to Life and Personal Liberty under Article 21

Text Books:

1. The Constitutional Law Of India 9th Edition, by Pandey. J. N.
2. The Constitution of India by P.M.Bakshi
3. Constitution Law of India by Narender Kumar
4. Bare Act by P. M. Bakshi

EE4T002	Numerical method and probability	Credit 3

Course Outcome

1. Define approximation and errors in numerical differentiation and Integration.
2. Evaluate the roots of the equation using Bracketing methods: Bisection methods, Open methods: Newton Raphson method
3. Apply the Cramer's rule, Gauss- Elimination Method, pivoting, scaling, Heun's method, Runge–Kutta Method,to engineering problem.
4. Analyze the question Newton's Cotes Integration Formulas: Trapezoidal Rule, Simpson's rule, engineering applications Numerical differentiation using Finite divide Difference method.
5. Compute the linear and non linear equation, regression, Interpolation and ordinary differential equation using MATLAB programming
6. Develop computer program for linear and non linear equation.

Course Contents:

Unit 1: Error Analysis [08 Hours]
Significant figures, round-off, precision and accuracy, approximate and true error, truncation error and Taylor series, machine epsilon, data uncertainties, error propagation, importance of errors in computer programming.

Unit 2: Roots of Equations [06 Hours]
Motivation, Bracketing methods: Bisection methods, Open methods: Newton Raphson method, Engineering applications.

Unit 3: Numerical Solution of Algebraic Equations [07 Hours] :
Cramer's rule, Gauss- Elimination Method, pivoting, scaling, engineering applications, Heun's method, Runge–Kutta Method, engineering applications.

Unit 4: Numerical Integration and Differentiation [06 Hours]
Motivation, Newton's Cotes Integration Formulas: Trapezoidal Rule, Simpson's rule, engineering applications Numerical differentiation using Finite divide Difference method

Unit 5: Curve Fitting and Interpolation [08 Hours]
Motivation, Least Square Regression: Linear Regression, Polynomial regression. Interpolation: Newton's Divide Difference interpolation, engineering applications.Motivation, Euler's and Modified Euler's Method.

Unit 6: Introduction to MATLAB Programming : [07 Hours]
Array operations ,Loops and execution control lecture ,working with file: Scripts and function ,Plotting and program output. Overview of programming language, Algorithms and Flowchart of method based on each unit,Development of at least one computer program based on each unit.

Texts:

1. Steven C Chapra, Reymond P. Canale, "Numerical Methods for Engineers", TataMcGraw Hill Publications, 2010.
2. E.Balagurusamy, "Numerical Methods", TataMcGraw Hill Publications,1999.

References:

1. V. Rajaraman, "Fundamental of Computers", Prentice Hall of India,NewDelhi,2003.
2. S. S. Sastri,"IntroductoryMethodsofNumericalMethods",PrenticeHallofIndia,NewDelhi,
3 rdedition,2003. 3. K. E. Atkinson, "An Introduction to Numerical Analysis",Wiley,1978.
4. M.J. Maron, "Numerical Analysis: A Practical Approach", Macmillan, New York, 1982

EE4L002	**Numerical method and probability**	**Credit 1**

Course Outcome

1. Define approximation and errors in numerical differentiation and Integration.

2. Evaluate the roots of the equation using Bracketing methods: Bisection methods, Open methods: Newton Raphson method
3. Apply the Cramer's rule, Gauss- Elimination Method, pivoting, scaling, Heun's method, Runge–Kutta Method,to engineering problem.
4. Analyze the question Newton's Cotes Integration Formulas: Trapezoidal Rule, Simpson's rule, engineering applications Numerical differentiation using Finite divide Difference method.
5. Compute the linear and non linear equation, regression, Interpolation and ordinary differential equation using MATLAB programming

Develop computer program for linear and non linear equation.

List of Experiments

1. Program for plotting a circle centre at the point (4,3) with a radius=2 and also 3D circle.
2. Program to plot filled in black circle at x=50, y=55 and with radius =1.
3. Program to plot a sphere
4. Program to plot a straight line
5. Program to plot an ellipsoid
6. Program to plot a cylinder
7. Program for finding roots of f(x)=0 by bisection method.
8. Program for finding roots of equation by newton raphson method.
9. Program for solving numerical integration by simpson's 1/3 rule.
10. Program for solving ordinary differential equation by runge kutta method.

EE4T003	**Power Station Practice**	**Credit 4**

COURSE OBJECTIVE

Students will learn:

1 Remember fundamental principles of power plant system

2 Understand various power plant and its practices

3 To apply Economic Operation of Power Systems.

4 To analyze Economic Operation of Power Systems

5 To utilize concept of power plant operations and demand also evaluation of same.

6 Design parameters of basics of power plant operation and its economy.

COURSE OUTCOMES

Upon completion of this course, the students shall be able to,

1. Remember the basic operations of various power plants.
2. Understand and interpret the requirements and basics of power plant installation and site selection.
3. Apply knowledge to Economic Operation of Power Systems and the knowledge related with its need.
4. Analyze various electric power plants operations and distinguish between properties.
5. Evaluate thermal, hydro, nuclear, gas power plant also able to Explain its fundamentals.
6. Design Economic Operation of Power Systems and also able to give solutions implementation of power plant on its basics.

Course Contents:

Unit 1: Introduction

Electric energy demand and growth in India, electric energy sources. Thermal Power Plant: Site selection, general layout and operation of plant, detailed description and use of different parts. Hydro Electric Plants: Classifications, location and site selection, detailed description of various components, general layout and operation of Plants, brief description of impulse, reaction, Kaplan and Francis turbines, advantages & disadvantages, hydro-potential in India

Unit 2: Nuclear Power Plant

Location, site selection, general layout and operation of plant. Brief description of different types of reactors Moderator material, fissile materials, control of nuclear reactors, disposal of nuclear waste material, shielding. Gas Turbine Plant: Operational principle of gas turbine plant & its efficiency, fuels, open and closed-cycle plants, regeneration, inter-cooling and reheating, role and applications. Diesel Plants: Diesel plant layout, components & their functions, its performance, role and applications

Unit 3: Sub-stations Layout

Types of substations, bus-bar arrangements, typical layout of substation. Power Plant Economics and Tariffs: Load curve, load duration curve, different factors related to plants and consumers, Cost of electrical energy, depreciation, generation cost, effect of Load factor on unit cost. Fixed and operating cost of different plants, role of load diversity in power system economy. Objectives and forms of Tariff; Causes and effects of low power factor, advantages of power factor improvement, different methods for power factor improvements.

Unit 4: Economic Operation of Power Systems

Characteristics of steam and hydro-plants, Constraints in operation, Economic load scheduling of thermal plants Neglecting and considering transmission Losses, Penalty factor, loss coefficients, Incremental transmission loss. Hydrothermal Scheduling

Unit 5: Non Conventional Energy Sources

Power Crisis, future energy demand, role of Private sectors in energy management, concepts & principals of MHD generation, Solar power plant, Wind Energy, Geothermal Energy, Tidal energy, Ocean Thermal Energy.

Text Books:

1. B.R. Gupta, "Generation of Electrical Energy", S. Chand Publication.
2. Soni, Gupta & Bhatnagar, "A text book on Power System Engg.", Dhanpat Rai & Co.
3. P.S.R. Murthy, "Operation and control of Power System" BS Publications, Hyderabad. Reference Books:
4. W. D. Stevenson, "Elements of Power System Analysis", McGraw Hill.
5. S. L. Uppal, "Electrical Power", Khanna Publishers

EE4T004	Electronics Devices and Circuits	3 Credit

COURSE OBJECTIVE

Students will learn:

1 To understand operation of semiconductor devices
2 To be exposed to the characteristics of basic electronic devices
3 To apply concepts for the design of Regulators and Amplifiers
4 To verify the theoretical concepts through laboratory and simulation experiments.
5 To implement mini projects based on concept of electronics circuit concepts.

COURSE OUTCOMES

Upon completion of this course, the students shall be able to:

1. Understand the characteristics of the p-n junction, the diode and some special function diodes and these diodes' application in electronic circuits
2. Familiarize the operation and applications of transistor like BJT
3. Develop design competence in power amplifiers using BJT.
4. Apply the knowledge of amplifier in order to Design various differential amplifier
5. Design Various Oscillator Circuits and Understand the concept of FETs as well as MOSFETs
6. Apply the knowledge of Digital Electronics in order to develop the truth tables for various logic Gates

Unit 1: Diode theory and Diode Circuits **[07 Hrs]**

Theory of PN-junction diodes, operation and characteristics, Zener diodes and voltage regulators, Half and Full Wave Rectifiers, Filters, Ripple factor, Voltage doublers.

Unit 2: Bipolar Junction Transistor **[07 Hrs]**

BJT, Theory of operation, characteristics, Biasing arrangements, Stability factor, Small signal analysis of CE, CB, CC amplifiers and their comparison, Power Transistors, Transistor as a switch

Unit 3: Power Amplifiers **[07 Hrs]**

Power amplifiers- classification as A,B, AB, C, Push pull amplifiers, Cross over distortion, Positive and Negative amplifiers- classification, feedback amplifiers, advantages and applications

Unit 4: Differential Amplifiers **[07 Hrs]**

Differential amplifier circuits and their stages, current source, biasing, level Shifting techniques, Common mode and differential mode gain, Impedance of different stages**.**

Unit 5: Oscillators **[07 Hrs]**

Oscillators- Barkhausen"s criterion, RC and Crystal oscillators. Field effect transistors and MOSFETs- Principle of operation and characteristics, biasing arrangements.

Unit 6: Digital Electronics **[07 Hrs]**

Boolean Identities, Binary, Gray, Octal, Hex & ASCII, Codes, Logic gates and their truth tables, De Morgan"s Laws, Concept of Sum of Products and Product of Sums.

Text Books:

1. Sanjeev Gupta, "Electronic Devices and Circuits" Dhanpat Rai Publication
2. P. Godse, U. A. Bakshi, "Electronic Devices and Circuits" Technical Publication

3. R P Jain, “Modern Digital Electronics” Tata McGraw-Hill Education

Reference Books:

1. Millman and Halkias;, “Electronic Devices and Circuits” McGraw Hill
2. Millman and Halkias, “Integrated Electronics”, McGraw Hill
3. H. Taub,“ Digital Integrated Electronics”, McGraw Hill
4. Wait, “Introduction to Operation Amplifiers”, Tata McGraw Hill

EE4T005	Power System-I	3 Credit

COURSE OBJECTIVE

Students will develop the ability

1 To calculate the basic parameters of transmission line of power systems.

2 To know the power flow through transmission lines under different circumstances.

3 To model and represent the system components used in power system

4 To represent and understand the transmission line

COURSE OUTCOMES

Upon completion of this course, the students shall be able to,

1. To define basic components of power system and remember the structure of power system.
2. To understand the working of transmission and distribution system and relate the different parameters of transmission and distribution system
3. To do Modeling and representation of the system component used in power system

4. To Analyze the per unit system of power system
5. To select the proper parameter of power system and determine the value of inductance, capacitance, voltage regulation and efficiency of transmission line and explain the effect of sag and corona on transmission line.
6. To create the structure of power system with suitable components and improve the efficiency of power system

COURSE CONTENTS

UNIT 1: General Structure of Electrical Power System [04 hrs]

Introduction to Power System, Generation, Transmission, Distribution and Utilization- Overview Single Line Diagram (SLD) Representation, Use of high voltage, idea about substation (indoor and outdoor), concept of real, reactive and complex power unit system, load and their characteristics, voltage and frequency dependence of loads, overhead v/s underground transmission

UNIT 2: Inductance [05 hrs]

Definition, Inductance due to internal flux of two wire single phase line of composite conductor line, Concept of GMD, Inductance of three phase line with equal & unequal spacing, vertical spacing.

Capacitance: Concept of electric field, Potential difference between two points in space, Effect of earth's surface on electric field, Computation of capacitance of single phase, three phase transmission lines with & without symmetrical spacing for solid & composite conductors.

UNIT 3: Representation of power system elements [05 hrs]

Representation of power system elements, models and parameters of generator, transformer and transmission lines, Transmission line parameters calculation (R,L,C), per unit system representation. Elementary distribution scheme: Feeders and distributors. Introduction to distribution automation.

UNIT 4: Transmission [06 hrs]

Transmission: Types of conductors, Choice of conductor materials, Stranded copper & ACSR conductor, Current and Voltage relation: Representation of short, medium & long transmission lines, voltage regulation and efficiency of power transmission lines using equivalent pi and T representation. Representation using circle diagram with generalized constants. Ferrant effect, Skin Effect, Proximity Effect.

Unit 5: Insulators and Cables Types [03 hrs]

Insulators and Cables Types: Classification of Insulators, Potential distribution over suspension insulator string, String efficiency, Numericals on string efficiency. CABLES: Construction, classification, insulation resistance, capacitance, Dielectric stress, economical size, Grading of cables, Numericals.

Unit 6:Mechanical Design of Transmission Line **[04 hrs]**

Mechanical Design of Transmission Line: Effect of wind & ice coating on transmission line, sag due to equal & unequal supports, with their derivation, Numericals. Corona: Phenomenon of corona, factors affecting the corona, Power loss & disadvantages of corona.

Textbook:

1. J. B. Gupta, “Power System Analysis”,(Katson Books)
2. Kothari Nagrath, “Electric Power System”, (Tata McGraw Hill Publications)
3. Wadhva C. L.,“Electric Power System”,(Tata McGraw Hill Publications)
4. Asfaque Hussain, “Power System Analysis” CBS

Reference:

1. W.D. Stevenson Jr., Elements of power system analysis, McGraw-Hill publications
2. John J Grainger, W.D. Stevenson, Power System Analysis, McGraw-Hill (India) Pub. , 2003

EE4T006	Electrical Machine II	3 Credit

COURSE OBJECTIVES

This course provides the fundamental knowledge to the students to

1. Understand the concept of MMFs and rotating magnetic fields in synchronous motor.
2. Understand basic principle, construction and operation of synchronous machines.
3. Understand transient and steady state analysis of synchronous machines.
4. Analyse performance characteristics of synchronous machines.

COURSE OUTCOMES

Upon completion of this course, the students shall be able to,

1. Define voltage regulation, load torque angle and MMF of windings.
2. Classify reactances under transient conditions and effects of variable excitation.
3. Apply the method of synchronous impedance and Potier triangle to find voltage regulation.

4. Develop phasor diagram of three phase synchronous machine.
5. Analyze the V curves and effects of excitation and load on motor operation.
6. Compare various methods of cooling in synchronous machine.

Unit 1: Synchronous Machines **[08hrs]**

Construction, types, armature reaction, introduction to armature winding and field windings MMF of armature and field windings induced EMF, circuit model of synchronous machine, power angle characteristics, two axis theory, synchronous motor operation, characteristic curves, synchronous condenser, dynamics, Single phase synchronous motors.

Unit 2: Steady State Operation of Three Phase Synchronous Machine **[06hrs]**

Phasor diagram, voltage regulation using synchronous impedance and Potier triangle method, steady state performance of three phase synchronous machines, circle diagrams

Unit 3: Synchronization **[08hrs]**

Parallel operation, experimental determination of parameters (positive sequence reactance, negative sequence reactance, Zero sequence reactance), short circuit ratio, losses and efficiency

Unit 4: Synchronous Machines On Infinite Bus **[06hrs]**

Phasor diagram, expression for torque, load torque angle, V curve and inverted V curve, effectsof variable excitation and power input on generator operation and effect of variable excitation and load on motor operation, asynchronous generator.

Unit 5: Transient Behaviour **[07hrs]**

Sudden 3, phase short circuit. Transient and sub- transient reactances and their measurement. Time constant and equivalent circuit diagram, hunting & damper windings.

Unit 6: Methods Of Cooling In Synchronous Machines **[07Hrs]**

Cooling system classification, Open ventilated, Air-to-water cooler, Air-to-air cooler, Radial flow ventilation system, Axial flow ventilation system, Circumferential Ventilation, Direct water cooling, Hydrogen cooling, their advantages and disadvantages.

Text Books:

1. Electrical Machine : Dr.P.K.Mukherjee and S. Chakravarti , DhanpatRai
2. Electrical Machinery : Nagrath and Kothari, 3rd , Tata Mcgraw Hill
3. Generalised Theory of Electrical Machinery: P.S. Bhimbra, Tata Mcgraw Hill

Reference Books:

1. Fitzgerald and Kingsley and Kusco , “Electrical Machinery” McGraw Hill
2. P. S. Bhimbra, “Electrical Machinary”

EE4L006	Electrical Machine II Lab	1 Credit

COURSE OBJECTIVES

This course provides the fundamental knowledge to the students

1. To study the performance characteristics of synchronous machine.
2. To study the predetermination of voltage regulation of synchronous generator.
3. To study the variation in reluctance in salient pole machine.
4. To predetermine the characteristics of three phase synchronous motors.

COURSE OUTCOMES

Upon completion of this course, the students shall be able to correlate the theory and practice of the study of

1. Performance characteristics of synchronous machines using direct and indirect methods
2. Regulation of three phase alternator using the predetermination methods
3. Saliency nature of synchronous machine
4. Starting and Speed control of ac machines
5. Synchronization of two three phase alternators
6. Measurement of impedances and short circuit ratio of alternator

List of Experiments

1. Predetermination of regulation of three phase alternator using emf, mmf and Potier triangle method
2. To determine Xd and Xq of the salient pole type synchronous machine
3. To plot V curves and inverted V curves for three phase synchronous machine.
4. Study of prime mover and damper windings in synchronous motor
5. To measure the synchronous reactance of a synchronous generator by measured values of open circuit voltage and short circuit current
7. To study and measure positive, negative and zero sequence impedance of alternator.
8. To measure short circuit ratio of synchronous generator
9. To perform synchronization of two three phase alternators by
   a) Synchroscope method
   b) Three dark lamp method

c) Two bright one dark lamp method

10. To perform OC test on synchronous generator and determine full load regulation of a three phase synchronous generator by synchronous impedance method
11. To study synchronization of the alternator with infinite bus bar

EE4T007	Universal Human Values	Audit

COURSE OBJECTIVES

1. Sensitization of student towards self, family (relationship), society and nature.

2. Understanding (or developing clarity) of nature, society and larger systems, on the basis of human relationships and resolved individuals.

3. Strengthening of self reflection.

4. Development of commitment and courage to act.

COURSE OUTCOMES

1. Students are expected to become more aware of their surroundings, society, social problems and their sustainable solutions, while keeping human relationships and human nature in mind.
2. They would have better critical ability.

3. They would also become sensitive to their commitment towards what they believe in (humane values. Humane relationships and humane society).
4. they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.

UNIT 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education [10 hrs]

Purpose and motivation for the course, recapitulation from Universal Human Values-I . Self-Exploration– what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration. Continuous Happiness and Prosperity- A look at basic Human Aspirations . Right understanding, Relationship and Physical Facility- the basic requirements for fulfillment of aspirations of every human being with their correct priority. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario. Method to fulfil the above human aspirations: understanding and living in harmony at various levels. Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking.

Unit 2: Understanding Harmony in the Human Being - Harmony in Myself! [12 hrs]

Understanding human being as a co-existence of the sentient 'I' and the material 'Body'. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer). Understanding the characteristics and activities of 'I' and harmony in 'I'. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail. Programs to ensureSanyam and Health. Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease

UNIT 3: Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship [12 hrs]

Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship. Understanding the meaning of Trust; Difference between intention and competence. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive

Human Goals. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family. Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives

Module 4: Understanding Harmony in the Nature and Existence - Whole existence as Coexistence

[10 hrs]

Understanding the harmony in the Nature. Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self- regulation in nature. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space.Holistic perception of harmony at all levels of existence.

Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

Module 5: Implications of the above Holistic Understanding of Harmony on Professional Ethics

[12 hrs]

Natural acceptance of human values. Definitiveness of Ethical Human Conduct. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people- friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems. Case studies of typical holistic technologies, management models and production systems. Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations.

Text Books:

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010

Reference Books :

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.

2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.

3. The Story of Stuff (Book).

4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi

5. Small is Beautiful - E. F Schumacher.

6. Slow is Beautiful - Cecile Andrews

7. Economy of Permanence - J C Kumarappa

8. Bharat Mein Angreji Raj - PanditSunderlal

9. Rediscovering India - by Dharampal

10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi

11. India Wins Freedom - Maulana Abdul Kalam Azad

12. Vivekananda - Romain Rolland (English)

13. Gandhi - Romain Rolland (English)

Recommendations for specialization B.Tech. with Honor (Major) and B. Tech. with Minor Engineering Degree

1. The concept of Honour and Minors at B. Tech. level is introduced, to enhance learning skills of students, acquisition of additional knowledge in domains and other than the discipline being pursued by the student through online mode, to make the students better employable with additional knowledge and encourage students to pursue cross-discipline research.

2. Eligibility Criteria and rules to award Honours

i) The Student should have Minimum CGPA of 7.5 up to 2nd Semester.

ii) Student willing to opt for honors has to register in 2nd year.

iii) The Student has to complete 6 to 7 additional advanced courses from the same discipline specified in the curriculum. Total credits of these courses should be between 18 to 20. The students should complete these credits before the end of last semester.

iv) Student to opt for the courses from NPTEL/SWAYAM platform as recommend by concern BOS.

v) If the credits of NPTEL/ SWAYAM courses do not match then proper scaling will be done).

Student complying with above criteria will be awarded B. Tech. with Honour Degree.

3. Eligibility Criteria and rules to award Minor Degree

i) The Student should have Minimum CGPA of 7.5 up to 2^{nd} Semester.

ii) Student willing to opt for honors has to register in 2^{nd} year.

iii) The Student has to complete 6-7 additional courses from other discipline of their interest, which are specified in the respective discipline. These courses are of total 18-20 credits.

iv) Student to opt for the courses from NPTEL/SWAYAM platform as recommended by concern BOS.

v) If the credits of NPTEL / SWAYAM courses do not match then proper scaling will be done).

Student complying with above criteria will be awarded B. Tech. with Minor Degree.

4. Availability of course from MOOC platform will be reviewed by the Major and Minor committee before beginning of semester.

Dr.S.R.Vaishnav
Chairman
Board of Studies, EE Dept

VISION	MISSION
"To develop competent and committed Electrical Engineers to serve the society"	1. To impart quality education in the field of Electrical Engineering. 2. To be excellent learning centre through research and industry interaction.

SYLLABUS of V Semester

EE5T001	Power Electronics	3 Credit

PRE REQUISITES: Electronic Devices And Circuits

COURSE OBJECTIVES:

1 .To review principle of construction, operation and characteristics of basic Semiconductor devices.
2. To understand and analyze performance of controlled and uncontrolled converters.
3. To understand and analyze performance of DC to DC converters. Dc to AC converters.
4 .To understand and analyze performance of AC voltage controllers.

COURSE OUTCOME:

CO1: To remember the principle of operation of various basic semiconductor devices
CO2: To understand the characteristics of various types of semiconductor device and its working as converters.
CO3: To make use of various semiconductor device for the converters operation under various load types.
CO4: Examine the performance of various types of converters.
CO5: Compare various types of converters based on performance parameter.
CO6:Todesign the converters based on real time industrial applications.

Unit I :Power semiconductor devices & their characteristics (6 Hrs)
SCR, triac, diac-construction, characteristics & applications, two transistor analogy for turning ON-OFF SCR, turn ON mechanism, different methods of turning ON-OFF SCR, turn OFF mechanism, series and parallel connections of SCRs, Protection of SCR gate circuit protection, over voltage and over current protection, snubber circuit design

Unit II : Turn on and Turn off circuits for power semiconductor devices (6Hrs)
Introduction to GTO, power transistor, power MOSFET & IGBT & their construction &characteristics.Uni-junction transistors, Triggering circuits and optocouplers and Pulse transformer
Introduction to types of power electronic circuits: diode rectifiers, AC-DC converters, AC-AC converters, DC-DC converters, DC-AC converters

Unit III:Diode Rectifiers and AC-DC converters (6Hrs)

Diode Rectifiers: Single phase half wave, full wave rectifiers with R and RL load, Threephase bridge rectifier with R and RL load, Effect of source inductance.

Controlled Rectifiers : Principle of phase controlled rectification, single phase semi andfull converter with R and RL load, power factor improvement in controlled rectifiers, threephase semi and full converter with R and RL load. (only descriptive approach)

Unit IV : DC-AC converters(6 Hrs)
Classification , series inverter, improved series inverter, parallel inverter, out put voltageand waveform control, principle of operation for three phase bridge inverter in 120 deg. and 180 deg. mode, single phase bridge inverter.

Unit V :DC-DC converters (6 Hrs)
Basic principles of chopper, time ratio control and current limit control techniques, voltage commutated chopper ckt., Jones chopper, step-up chopper, step-down chopper and AC chopper.

Unit VI : AC voltage controllers (AC-AC converters) (6 Hrs)
Principle of on-off control, principle of phase control in single phase and three phase circuits, Cycloconverters: single phase cycloconverter operation, three phase cycloconverter operation.

Text Books
1. Rashid M. H – Power Electronics circuits, devices and applications-(New Delhi Pearson Education).

Reference Books
1. Murthi.V. R- Power Electonics Devices, circuits and Industrial Applications.(Oxford).
2. Bimbhra.P. S- Power Electronics.(Khanna Publication).

EE5T002	**Control System-I**	**3 Credit**

PRE REQUISITES: Network Anlysis
COURSE OBJECTIVES:

1. To introduce about fundamental concepts of control system.
2. To understand the concept of stability analysis.

COURSE OUTCOME:
After completion of syllabus, students must be able:

CO1: To remember the basic concept of control system and methods of stability analysis.

CO2: To understand the basic concept of control system and its types

CO3: To apply knowledge of control system analysis to find stability of any system using various methods such as root locus, Bode plot, Nyquist plot etc.

CO4: To analyze any system to find its stability using various methods such as root locus, Bode plot, Nyquist plot etc.

CO5: To evaluate various parameters of system for its stability analysis.

CO6: To design the linear control system in time and frequency domains using various approaches.

EE5T002: CONTROL SYSTEM-I

Unit I: Introduction to Control System **[08 Hrs]**
Introduction to Control Problem : Industrial Control examples, Mathematical models of physical systems, Control hardware and their models, Transfer function models of linear time invariant systems, Feedback control, Open loop and closed loop systems, Benefits of feedback, Block dig and signal flow graph algebra

Unit II: Characteristics of Feedback Control Systems : **[08 Hrs]**
Effect of negative feedback compared to open loop system such as – sensitivity to parameter variation, speed of time response, bandwidth, disturbance rejection and linearizing effect, Effect of positive feedback

Unit III: Time domain analysis **[08 Hrs]**
Concept of transient response, Steady state response and time response, standard test signals, Time response of first order systems, Transfer function of second order system, Time response of second order system, Time response specifications of second order system, steady state error (ess) analysis, static error constants and system type, dominant poles, Relation between roots of characteristic equation, damping ratio and transient response, effect of proportional(P), Integral (I) and derivative (D) controllers on the time response concept of transportation lag.

Unit IV: Stability **[08 Hrs]**

Concept of stability, Effect of pole zero location on stability, Routh- Hurwitz criterian. Root Locus Techniques: Concept and use of root locus, Magnitude and angle criteria, Construction of root loci, effect of addition and poles and zeros on root loci

Unit V: Frequency domain analysis of control systems **[08 Hrs]**

Concept of frequency response and sinusoidal transfer function, resonant frequency, resonant peak, cut off frequency, bandwidth, correlation between time and frequency response.

Frequency Response Analysis: Relationship between time and frequency response, Polar plots, Bode plots. Nyquist stability criterion, Relative stability using Nyquist criterion gain and phase margin, Closed-loop frequency response.

Unit VI: State Space Approach **[08 Hrs]**

State Variable Analysis : Concept of state, state variables and state model, state model of linear systems, state model using physical variables, phase variables and canonical variables, state model from differential equations, block diagram and signal flow graph, transfer function from state model, stability of systems modeled in state variable form.

Text Book:

1. Benjamin C Kuo, "Automatic Control Systems", Prentice Hall of India.
2. M. Gopal, "Control Systems- Principle of Design", Fourth Edition, 2012, McGraw Hill.
3. I.J. Nagrath, "Control Systems Engineering" ,New Age International Ltd. , 2000

Reference Books:

1. D'AzzoHoupis, Logakusha, Huelsoman, "Linear System Analysis", McGraw Hill.
2. Richard C. Dorf and Robert H. Bishop, "Modern Control Systems", Pearson Education Inc.
3. Norman S Nise, "Control System Engineering", John Wiley & Sons.
4. Katsuhiko Ogata, "Modern Control Engineering", Prentice Hall of India

EE5T003	Power Systems-II	3 Credit

PRE REQUISITES: Power Systems-I

COURSE OBJECTIVES:

1. To understand the different parameters of power system operation.
2. To understand the different parameters of power system control.
3. To study different issues related to power systems.
4. After learning, students will be able to analyze different solution methods related to power system
5. Understand amongst the different analytical & numerical methods for power flow solutions
6. Understand different problems related to cost load flow, fault, reactive power and Stability constraints in the power systems

COURSE OUTCOMES:

After completion of syllabus, students must be able:
CO1. **Define** the different parameters of power system operation.
CO2. **Illustrate** the different parameters of power system operation and control.
CO3.To **identify** the different issues related to power systems
CO4. **Analyze** the different solution methods related to power system ..
CO5. **Choose** amongst the different analytical & numerical methods for power flow solutions.
CO6. **Solve** the different problems related to cost load flow, fault, reactive power and Stability constraints in the power systems

Unit I: Economic Operation of Power System (7 Hrs)
Introduction, Distribution of Load between Units & within the Plant.Optimum Generation Scheduling considering Transmission Losses, Representation of Transmission Loss Using Loss Formula Co-Efficient, Derivation of Loss Formula Co-Efficient.

Unit II: Load Flow Studies (6 Hrs)
Per Unit System, Ybus formation Simple example of a loadflowsolution ,Network model formulation, (Applications of iterative techniques like Gauss-Siedal method, and Newton-Raphson method, etc.).

Unit III: Reactive Power Control (6 Hrs)
System voltage and reactive power, Reactive power generation by synchronous machine, Excitation control, Automatic voltage regulator for alternator, Reactive power generation by turbo-generator, Synchronous compensators, Reactors, Capacitors, Static compensators. Introduction to power flow control, HVDC and FACTS.

Unit IV: Symmetrical and unsymmetrical fault analysis: (8 Hrs)

Unbalanced System Analysis using Sequence Components, Symmetrical Fault Analysis Without & With Pre-Fault Load Currents. Symmetrical Component Transformation, Three Phase Power in Unbalanced Circuit in Terms of Symmetrical Component Sequence Impedance of Generator Transformer & Transmission Line ,Unsymmetrical Fault Analysis: L-G, L-L-G-, L-L-L, LL-L-G, Open Conductors Fault Using Symmetrical Components.

Unit V: Stability of Power System : (7 Hrs)

Steady State Dynamic and Transient Stability Definition and Comparison Dynamics of Synchronous Machine Swing Equation Swing Equation for Single Machine Connected To Infinite Bus, Power Angle Equation. Steady State Stability Studies Transient Stability Studies: Swing Curve, Equal Area Criterion for Transient Stability Application of Equal Area Criterion for Different Disturbances. Solution of Swing Equation by Point by Point Method, Methods of Improving Transient Stability.

Unit VI: Load dispatch center functions (6 Hrs)

Contingency analysis, preventive, emergency and restorative Control. power quality def., causes, affects, slandered and mitigation methods

Text Books

1. Nagrath& Kothari – Modern Power System Analysis.(Tata Mcgraw Hill).
2. Prof A M Kulkarni IIT “Bombay Web Course on Power System Operation and Control”.

Reference Books

1. Stevension .W. D– Power System Analysis. (Tata Mcgraw Hill).
2. AshfaqHussian - Power System Analysis.(Tata Mcgraw Hill).
3. Hadi Sadat- Power System Analysis (Tata Mcgraw Hill).

EE5TE02(A) Elective I- Renewable Energy System 3 Credit

COURSE OBJECTIVES:

1. To give sufficient knowledge about the promising new and renewable sources of energy
2. Understanding basic characteristics of renewable sources of energy and technologies
3. To give review on utilization trends of renewable sources of energy

COURSE OUTCOMES:

CO1	To define basic properties of different renewable sources of energy and technologies for their utilization.
CO2	Describe main elements of technical systems designed for utilization of renewable sources of energy
CO3	Interpret advantages and disadvantages of different renewable sources of energy
CO4	Undertake simple analysis of energy potential of renewable sources of energy
CO5	Interpret the knowledge of fuel cells, wave power, tidal power and geothermal principles and applications.
CO6	Discuss the economics of harnessing energy from renewable energy sources.

UNIT I :(05 Hrs)

Overview of conventional &renewable energy sources, need , potential & development of renewable energy sources, types of renewable energy sources ,types of renewable energy system, future of energy use, Global and Indian Energy Scenario, Energy for sustainable development, Physical principle of conversion of solar radiation into heat, Global climate change, CO2 reduction potential of renewable energy.

UNIT II: (05 Hrs)

Solar Radiation & its Measurement: Solar constant, solar radiation on earth's surface, solar radiation geometry, solar radiation measurement, estimation of average solar radiation, solar radiation on tilted surface. Introduction to solar collectors.

Applications of Solar Energy: Solar water heating, Space cooling, Solar thermal heat conversion, Solar photovoltaic energy conversion, Solar pumping, Solar cooking , Online grid connected solar photovoltaic generation system.

UNIT III: (05 Hrs)

Wind Energy: Basic principles of wind energy conversion, Wind energy conversion system, Wind data& energy estimation, Site selection consideration, Basic component of wind energy conversion system (WECS), Classification of WEC system, Energy storage, Advantages and Disadvantages of (WECS), Application of wind energy.

UNIT IV:(04 Hrs)

Geothermal Energy: Geothermal fields, Estimates of geothermal power, Basic geothermal steam power plant, Binary fluid geothermal plant , Geothermal preheat hybrid power plant. Advantages and disadvantages of geothermal energy.Applications of geothermal energy in India.

UNIT V :(05 Hrs)
Energy from Oceans : Oceans thermal electric conversion (OTEC) , Claude & Anderson cycle, Evaporators,Bio-fueling,Hybrid cycle,Site selection, Component of OTEC for power generation.Energy from Tides: Introduction, Basic principles of Tidal power, Component of Tidal Power Plant, Operation methods of utilization of Tidal Energy,Estimation of Energy & Power in simple single basin Tidal system,Estimation of Energy & Power in double basin Tidal system , Advantages & limitations of Tidal Power Generation.

UNIT VI:(04 Hrs)
Other nonconventional Energy Sources: Brief intriduction to operating principles of small scale hydro electric power generation,Energy from Bio-Mass, Ethanol production, MHD power generation, Fuel cell, Energy from waste.

Text Books:

1. Non Conventional Energy Sources : G.D. Rai , Khanna publishers
2. Non Conventional Energy Resources : B. H. Khan, 2 nd , The McGraw Hill Companies
3. Energy Technology : Nonconventional, Renewable and Conventional : S. Rao& B. B. Parulekar, 1 st, Khanna Publisher
4. Solar Energy: Principles of thermal collection and storage : S. P. Sukhatme, 2 nd edition, Tata McGraw Hill Publishing Company Ltd.
5. Solar Photovoltaics : Fundamental, Technologies and Applications : Chetan Singh Solanki, PHI Learning Pvt. Ltd.

Reference Books:

1. A. N. Mathur: Non-Conventional Resources of Energy. 2010
2. V. V. N. Kishore: Renewable Energy Engineering and Technology, TERI. 2006

EE5TE01 (B)	**Elective I- Electromagnetic Field**	**3 Credit**

COURSE OBJECTIVES:

1. Static electric and magnetic fields.
2. Laws of electromagnetic & electrostatic fields.
3. The nature of dielectric materials like in parallel plate capacitance

COURSE OUTCOMES:

CO1	Remember, Understand Scalars & vector analysis, vector and scalars conversion for different coordinate system.
CO2	Apply Gauss law, Divergence theorem to electric field intensity.
CO3	Apply Faradays law of electromagnetic induction (as a component of Maxwell's equations) to solve and analyze problems of Performance and behavior of electromechanical devices such as Motors, Generators and Transformers.
CO4	Apply effective analysis tool like Poisson's and Laplace equations to current, current density, dielectrics and capacitances.
CO5	Analyze& Apply Biot-Savorts law.
CO6	Solve & Analyze problems of Capacitance of parallel plate capacitor, Capacitance of two wire line, Poissons.

Unit I: Review of Mathematics (05 Hrs)
Scalar and vector fields, calculus of scalar and vector fields (Vector Algebra, Vector addition, vector subtraction, Dot product, Scalar product) in Cartesian and curvilinear coordinates, conversion of variables from Cartesian to cylindrical of Cartesian to spherical.

Unit II: Electrostatics (06 Hrs)
Electric field, divergence & curl of electric field, Coulombs' law, the principle of superposition, point charges, field due to continuous volume charge distribution, field of line charge, field of sheet charges concept of flux density.

Unit III: Gauss's law, Energy and Potential of charge system (05 Hrs)
Gauss's law, Application of Gauss's law, divergence theorem, definition of potential difference and potential, potential of a point charges, potential field of system of charge, potential gradient, Energy density in Electrostatic field.

Unit IV: Conductors, Dielectric and Capacitance and Poisson's and Laplace's Equations (06 Hrs)
Current and current density, continuity of current, metallic conductors, conductor properties and Boundary conditions, Nature of Dielectric materials capacitance and capacitances, Capacitance of parallel plate capacitor, Capacitance of two wire line, Poissons and Laplace equations.

Unit V: Magneto Statics (08 Hrs)
Magnetic force between two small moving charges and the concept of magnetic field. Bio Savart's law, Magnetic flux density vector B and Magnetic flux .The law of conversation of

magnetic flux, Ampere’s law, magnetic scalar potential, application to various configurations. Magnetic fields of currents in presence of magnetic materials— current loop in a magnetic field (torque and behavior), elementary current loop and aggregates of current loops.Magnetization vector.Generalization of Ampere’s law. Magnetic fields intensity and its interpretation. Boundary conditions, effect of applied magnetic field on materials substances, magnetic characteristics of ferromagnetic materials, B-H curve of iron and hysteresis loops, magnetic circuit, magnetic field problems.

Unit VI: Maxwell Equations (06 Hrs)

The equation of continuity and displacement current, Maxwell’s equations in different forms and the constitutive relations consequence of Maxwell’s equations, plane electromagnetic waves in free space, boundary conditions with generalizations.

Text Books:

1. Matthew N. O. Sadiku, “Elements of Electromagnetics”, Oxford University publication, 6 th Edition, 2014.
2. A.Pramanik, ”Electromagnetism - Theory and applications”, PHI Learning Pvt. Ltd, New Delhi, 2nd Edition, 2009.
3. A.Pramanik,”Electromagnetism-Problems with solution”, Prentice Hall of India, Pvt. Ltd., 2nd Edition, 2012.

Reference Books:

1. G.W.Carter,”The electromagnetic field in its engineering aspects”, Longmans, 1st Edition, 1954.
2. W.J.Duffin,”Electricity and Magnetism”, McGraw Hill Publication, 3rd Edition (Rev), 1980.
3. W.J.Duffin,”Advanced Electricity and Magnetism”, McGraw Inc. US, 1968.
4. E.G.Cullwick,”The Fundamentals of Electromagnetism”, Cambridge University Press, 3rd Edition, 1966.
5. B.D.Popovic,”Introductory Engineering Electromagnetics”, Addison-Wesely, Educational Publishers Inc, International Edition, 1971.
6. WiilaimHayt, “ Engineering Electromagnetics”, Tata McGraw Hill Education Pvt. Ltd., 7th Edition, 2012.

E-notes:

- nptel.ac.in/downloads/

EE5TE01 (C)Elective I-Introduction to Special Machines 3 Credit

PRE REQUISITES: Electrical Machines -I

COURSE OBJECTIVES:

1. To develop a basic foundation of some special electrical machines.
2. Understand the basic principle, construction &operation, of special electrical machines.
3. Understand & evaluate the performance & operational characteristics of special electrical machines
4. Have the detailed knowledge regarding applications of special electrical machines in day today life.

COURSE OUTCOME:

CO1. **Remember** basic principles of some special electrical machines.
CO2. **Understand** the basics of construction & principle of operation of special electrical machines.
CO3. To **identify** the different operational characteristics related to the special electrical machines.
CO4. **Analyze** the performance indices of special electrical machines.
CO5. **Evaluate** the operation & characteristics of special electrical machines.
CO6. **Solve** the different problems related to operation, supply conversion & performance indices of special electrical machines.

UNIT-I: SPECIAL AC MACHINES (07 Hrs)
Inverted Induction Machine, Synchronous Induction motor, Linear induction Motors (LIM), High efficiency Induction motors, Repulsion motors, Schrage motors. (Only Elementary Aspects).

UNIT-II: FRACTIONAL KILOWATT MACHINES (07 Hrs)
Reluctance motors, AC tachometers, AC Series Motor-Universal Motor, Stepper Motor & its types, Hysteresis Motor, (Only Elementary Aspects).

UNIT-III: SPECIAL D.C. MACHINES (06 Hrs)
PMDC motors: Construction, Working, Characteristics & applications,
BLDC Motors: Construction, Working, Characteristics & applications.

UNIT-IV: PERMANENT MAGNET SYNCHRONOUS MOTORS (07 Hrs)
Introduction, Construction, Working, Ideal PMSM, EMF and Torque equations, Armature MMF, Phasor diagram, Torque/speed characteristics, Applications.

UNIT-V: SERVOMOTORS (07 Hrs)

DC servomotors: Construction, working, torque speed characteristics, applications.
AC servomotors: Construction, working, torque speed characteristics, applications, Comparison of servomotors with conventional motors.

UNIT-VI: SOFTWARE APPLICATIONS (03 Hrs)
NPTEL, (Swayam) courses, Software Applications in Electrical Machines.

Text Books

1. I.J Nagrath, D. P. Kothari,“Electric Machines”, Fourth Edition, Tata McGraw-Hill Publishing Company Ltd.
2. AshfaqHussain ,“Electric Machines”,SecondEdition,DhanpatRai& Co. Ltd.
3. P.S. Bhimbra, “Electrical Machinery”, Seventh Edition,1995,Khanna Publishers
4. Miller, T. J. E., Brushless Permanent Magnet and Reluctance Motor Drives, Oxford Science Publications, 1989.
5. Venkataratnam K., Special Electrical Machines, CRC Press, 2009.

Reference Books

1. Krishnan, R., “Permanent Magnet and BLDC Motor Drives”, CRC Press, 2009.
2. Chang-liang, X., "Permanent Magnet Brushless DC Motor Drives and Controls", Jun 2012.

EE5TE01 (D) Elective I-Electrical Power Utilization & Practice	3 Credit

COURSE OBJECTIVES:

1. Introduce various methods of effectively and efficiently utilizing Electrical Energy for different and desired applications.
2. Teach the various Electrical Lighting principles and their applications.
3. Impart knowledge on effective utilization of Electro Mechanical process.

COURSE OUTCOMES:

CO1: The students should be able to understand the process and application of different types of Electric Heating equipments.

CO2: The students should be able to understand the process and application of different types of Welding equipments.

CO3: Students should be able to understand basics of illumination and working principles of different light sources.

CO4: The students shall be able to apply the fundamentals of illumination systems for lighting design for indoor/ outdoor installations for residential/ commercial and industrial applications.

CO5: The students should be able to understand the working principles and applications for various electrolytic processes for industrial applications.

CO6: The students should be able to understand the Refrigeration cycle process and electrical circuit used in different cooling system.

Unit I: Electric Heating **(7 Hrs)**

Heating transfer methods, construction, working and applications Resistance heating,Induction heating; principle of core type and coreless induction furnace, Electric arc heating; direct and indirect arc heating, Dielectric heating, Infra-red heating and its applications, Microwave heating

Unit II: Electric Welding **(7 Hrs)**

Principles of resistance welding, types, Principle of arc production, electric arc welding, characteristics of arc; Power supply required. Advantages of using coated electrodes, comparison between AC and DC arc welding, welding control circuits, welding of aluminium and copper, Introduction to TIG, MIG Welding

Unit III: Illumination Fundamental **(7 Hrs)**

Nature of light, visibility spectrum curve of relative sensitivity of human eye andwave length of light, Basic terms in lighting systems ,laws of illumination, polar curves, construction & operation of light sources (Incandescent, Fluorescent Tube, Sodium Vapor Lamp, Mercury Vapor Lamp, Neon tube).

Unit IV: Design of Lightning System **(7 Hrs)**

Lux level requirements for various applications, classification of light fittings and luminaires, factors affecting the design of indoor lighting installations, total lumen method of calculation, Illumination schemes; indoor and outdoor. Illumination levels General ideas bout street lighting, flood lighting, monument lighting and decorativelighting, light characteristics etc.

Unit V: Electrolytic Processes (6 Hrs)

Need of electro-deposition, Laws of electrolysis, process of electro-deposition, Equipment and accessories for electroplating, Factors affecting electro-deposition, Principle of galvanizing, anodizing and its applications, Electroplating on non-conducting materials, Manufacture of chemicals by electrolytic process, Manufacturing of chemicals by electrolysis process.

Unit VI: Other Applications of Electrical Energy (6 Hrs)

Terminology, Refrigeration cycle, Vapor compression type, vapor absorption type, Electrical circuit of a Refrigerator, Room Air conditioner window type & split type.
Description of Electrical circuit used in
a) refrigerator,
b) air-conditioner, and
c) water cooler

Text Books

1. Art and Science of utilization of electrical energy by H. Partab, DhanpatRai and Sons, Delhi.
2. Uppal S.L, "Electric Power", Khanna Publishers, 1988
3. Open Shaw Taylor, "Utilization of Electrical Energy", Oriented Longmans Limited (Revised in SI Units), 1971.
4. Soni A. Chakrabarti, M.L.Soni, P.V.Gupta, U.S.Bhatnagar, “A text book on Power System Enggineering”, Khanna Publishers, 2000.
5. A.I.Starr, “Generation, Transmission and Utilization of Electric Power”, ELBS, 1978.

Reference Books

Guide book for National Certification Examination for Energy Managers and Energy Auditors, Bureau of Energy Efficiency.

EE5TE02(A) ElectiveII-Advance Renewable Energy System	4 Credit

PRE REQUISITES: Introduction to Non-Conventional energy sources

COURSE OBJECTIVES:

1. Study working principles of various renewable energy sources and their utilities.
2. Study economics of harnessing energy from renewable energy sources.
3. Study of various features of Ecosystem.

COURSE OUTCOME:

CO1: To Define the principle of energy conversion technique from biomass, geothermal and hybrid energy systems.
CO2: To Summarize the effects of air pollution and ecosystems Unit Contents Contact
CO3: To Identify the essential characteristics and technical requirements of photovoltaic and biomass energy systems.
CO4: To Analyze the need of various forms of non conventional energy sources, historical and latest developments
CO5 : Illustrate design of biogas, geothermal and hybrid power plant.
CO6 : Discuss about the environmental aspects of renewable energy resources.

Unit I: Biomass Energy (8 Hrs)
Introduction, Biomass conversion technologies, Biogas generation, classification of biogas plants and their Operating system.Biomass as a source of energy, methods of obtaining energy from biomass, thermal gasification of biomass, Applications.

Unit II: Geothermal Energy (6 Hrs)
Introduction, Geothermal sources , hydrothermal resources, Vapor dominated systems, Liquid dominated systems, hot water fields, Geo pressure resources, hot dry rocks, magma resources, volcanoes. Interconnection of geothermal fossil systems, geothermal energy conversion and applications.

Unit III: Hybrid energy systems (6 Hrs)
Need for hybrid systems, types of hybrid systems site specific examples; PV–Diesel and battery systems, PV– Gas Hybrid system, Biomass gasifier based thermal back up for Solar systems, natural convection solar driers in combination with biomass back up heater. Biogas and solar energy hybrid system, typical applications.

Unit IV: Air pollution (6 Hrs)

Primary, secondary, chemical and photochemical reactions, effects of CO, NO, CH and particulates, acid rain, global warming and Ozone depletion; monitoring and control of pollutants; noise pollution-sources and control measures; thermal-, heavy metals- and nuclear pollutions; industrial pollution from paper, pharmacy, distillery, tannery, fertilizer, food processing and small scale industries.

Unit V: Environment and Social Structure (6 Hrs)
Environment impact assessment policies and auditing, conflicting world views and environmentally sustainable economic growth, introduction to Design For Environment (DFE), product lifecycle assessment for environment and ISO 14000; triple bottom line of economic, environment and social performance.

Unit VI :Ecosystem(7 Hrs)
Ecosystem definition, concepts, structure, realm of ecology, lithosphere, hydrosphere, biosphere, atmosphere-troposphere-stratosphere; Nonrandom high quality solar energy flow/ balance to earth, greenhouse effect, matter and nutrient recycling in ecosystems; nitrogen, oxygen, carbon and water cycles, food producers, consumers and decomposers, food chains; biodiversity, threat and conservation of biodiversity

Text Books/Reference Books

1. Non-conventional energy sources by G.D. Rai, Khanna Publishers
2. Solar Energy: Principles of Thermal Collection and Storage by S,P Sukhatme, Tata McGraw Hill

EE5TE02 (B)	**ElectiveII- Analog Digital Electronics**	**3 Credit**

COURSE OBJECTIVES:

1. Understand the diode Circuits
2. Understand the MOSFET Circuits
3. Understand the sequential Circuits

COURSE OUTCOMES:

CO1 Understand the operation and analyze the characteristics of semiconductor diodes, MOSFET, and BJT

CO2 Examine and design electronic circuits containing non-linear elements such as diodes, MOSFET, & BJT using the concepts of biasing, load lines, operating point and incremental analysis

CO3 Apply feedback techniques in amplifier and examine its effect on parameters of amplifiers (ex. Gain, bandwidth, i/p and o/p impedance, etc) and the stability of amplifier

CO4 Design different combinational circuits for various applications

CO5 Design various sequential circuits for different applications

CO6 Design and verify digital systems using combinational and sequential circuits

Unit I: Diode Circuits: (7 Hrs)

P-N junction diode, V-I characteristics of a diode; half-wave and full-wave rectifiers, Zener diodes, clamping and clipping circuit.

Unit II: BJT Circuits (7 Hrs)

Structure and V-I characteristics of a BJT; BJT as a switch. BJT as an amplifier: small-signal model, biasing circuits; common-emitter, common-base and common-collector amplifiers; Small signal equivalent circuit, high-frequency equivalent circuits.

Unit III: MOSFET Circuits: (7 Hrs)

MOSFET structure and V-I characteristics.MOSFET as a switch. MOSFET as an amplifier: small-signal model and biasing circuits, common-source, common-gate and common-drain amplifiers; small signal equivalent circuit - gain, input and output impedances, trans-conductance, high frequency equivalent circuit

Unit IV:Number Systems(7 Hrs)

Logic Simplification Binary/Hexa/octal/BCD Number system, Binary Arithmetic, Boolean Algebra and De Morgan's Theorem, Logic Gates, SOP & POS forms, Logic Optimization

Technique, Karnaugh maps. Introduction to logic families, TTL and CMOS logic, Tri-state logic, Memory- classification, organization, operation and interfacing.

Unit V: Combinational logic Design: (6 Hrs)
Comparators, Multiplexers, Demultiplexer, Encoder, Decoder, Arithmetic Circuit Design, Barrel Shifter, ALU.

Unit VI: Sequential logic Design: (6 Hrs)
Sequential Logic Design Latches, Flip flop – S-R, J-K, D, T and Master-Slave JK FF, counters, Shift registers.

Text books:-

1. Digital Electronic Principles, By Malvino PHI, 3 Edition.
2. Modern Digital Electronics, R. P. Jain, McGraw Hill Education, 2009.
3. Sergio Franco,"Design with Operational Amplifiers and Analog Integrated Circuits," Fourth Edition, McGraw-Hill Education, 2014.

Reference books: -

1. Digital logic and Computer design, M. M. Mano, Pearson Education India, 2016.
2. Fundamentals of Digital Circuits, A. Kumar, Prentice Hall India, 2016.
3.DonaldNeamen, "Electronic Circuits: Analysis and Design," Third Edition, McGraw-Hill Publication, 2006.
4. Donald Neamen, "Semiconductor Physics and Devices: Basic Principles," Fourth edition, McGraw-Hill, 2011.
5. Jacob Millman, Christos Halkias, Chetan Parikh, "Millman's Integrated Electronics," Second edition, McGraw Hill Education, 2017.
6. J. V. Wait, L.P. Huelsman and G. A. Korn, Introduction to Operational Amplifier theory and applications, 2nd Edition, McGraw Hill, New York, 1992.
7. P. R. Gray, R. G. Meyer and S. Lewis, "Analysis and Design of Analog Integrated Circuits", John Wiley & Sons, 2001.

EE5TE02 (C)ElectiveII-Electrical Machine Design	**3 Credit**

COURSE OBJECTIVES:

1. To study mmf calculation and thermal rating of various types of electrical machines.
2. To design armature and field systems for D.C. machines.
3. To design core, yoke, windings and cooling systems of transformers.
4. To design stator and rotor of induction machines.

COURSE OUTCOMES:

CO1. **Remember** appropriate ratings, material, heating and cooling time constants.
CO2. **Understand** magnetic, electric materials, windings and transformers.
CO3. **Apply** concepts in design of electrical apparatus, devices and computer aided designing of transformer.
CO4. **Analyze** different materials, windings and modes of heat generation and heat dissipation in electrical machines.
CO5. **Evaluate** fault parameters in windings, voltage regulation and efficiency in transformer.
CO6. **Design** different types of transformers, heating coils and field coils.

Unit I: Review of material used in construction of electrical machines(7 Hrs)
Classification of magnetic, electric and insulating materials, Design of Electrical machines along with their parts and special features, rating, Specifications, Standards, Performance and other criteria to be considered

Unit II: Design of Induction Motor (7 Hrs)
Construction, Output equation of Induction motor, Main dimensions, choice of specific loadings,Design of squirrel cage rotor and wound rotor,Operating characteristics, Magnetizing current,Short circuit current, Circle diagram

Unit III: Design of synchronous machines (7 Hrs)
Output equations, choice of specific loadings, Design of salient pole machines, Short circuit ratio, Armature design, Estimation of air gap length, Design of rotor,Design of damper winding, Determination of full load field mmf, Design of field winding, Design of turboalternators

Unit IV: Design of transformer (7 Hrs)
Design of distribution and power transformers, Types,Classification and specifications, Design and main dimensions of core, yoke, winding,tank (with or without cooling tubes) and cooling tubes, Estimation of leakage reactance,resistance of winding, No load current, Losses, Voltage regulation and efficiency,Mechanical force developed during short circuits, Their estimation and measures tocounteract them, Testing of transformers as per I.S.S., Numerical examples.

Unit V: Heating, Cooling and Ventilation (6 Hrs)

Study of different modes of heat generation,Temperature rise and heat dissipation, Heating and Cooling cycles, heating and coolingtime constants, their estimation, dependence and applications, Methods of cooling /ventilation of electrical apparatus, Thermal resistance, radiated heat quantity of cooling medium (Coolant) Numerical.

Unit VI: Computer aided Design of Electrical machine(6 Hrs)

Introduction, advantages various approaches of Computer Aided Designing, Computer Aided Designing of transformer, Winding of rotating Electrical Machines. Optimization of Design.

Text Books

1. Sawhney, A.K., 'A Course in Electrical Machine Design', DhanpatRai& Sons, New Delhi, Fifth Edition, 1984.
2. M V Deshpande 'Design and Testing of Electrical Machines' PHI learning Pvt Ltd, 2011
3. Sen, S.K., 'Principles of Electrical Machine Designs with Computer Programmes', Oxford andIBH Publishing Co. Pvt. Ltd., New Delhi, Second Edition, 2009.

Reference Books

1. J Pyrhonen,T. Jokinen and V.Hrabovcova, " Design of Rotating Electrical Machines" , Wiley,2009.
2. K.M.Vishnumurthy 'Computer aided design of electrical machines' B S Publications,2008

EE5TE02(D) Electrical Installation & Design		**3 Credit**

PRE REQUISITES: Electrical Installation & Design

COURSE OBJECTIVES:

1. To explain how the Regulations and Codes are intended to be applied in practice, with the emphasis on design and specification of electrical installation.
2. Acquire knowledge of standard clearances, design and estimation methods of service connections and its safety aspects.

COURSE OUTCOME:

CO1: To Define various terms related to electrical installation system.
CO2: To Illustrate methods of installation, testing and commissioning of electrical apparatus and conductors.
CO3: To Apply knowledge to design the distribution system for residential, commercial, industrial applications and utility distribution networks and illumination design.
CO4: To Examine fault level at various locations in radial networks and be able to find rating and location of series reactors.
CO5 : Design single line diagrams with specifications for distribution networks, motor and power control centers for industrial installations and design reactive power compensation.
CO6 : Understand the fundamental principles for the design and installation of associated protective systems relating to electrical installations and understand the fundamental transformer testing and recognizes the limits of acceptance of each test.

Unit 1: **(7 Hrs)**
Electrical load assessment:
Concept of electrical load, categories of load, types of loads, connected load, demand factor, Maximum demand, diversity factor, load factor, power factor, TOD Tariff, Industrial Electric Bills.
Cables, conductors & bus-bars:
Construction, selection, installation, testing of LT/ HT cables, overload & short circuit ratings, rating factors; Overhead line conductors, copper and aluminiumbusbars.

Unit 2:
Switching & protection devices: **(7 Hrs)**
Types, specifications; selections of isolators, switches, switch fuse units, MCB, ELCB, MCCB,ACB, VCB, SF6 breakers, dropout/ horn gap fuses, AB switches, contactors for voltages upto 33 kV.
Symmetrical Short Circuit Calculations: **(7 Hrs)**

Determining symmetrical short circuit currents at various locations for selecting proper circuit breaker rating & determining value of series reactors for limiting short circuit current.

Unit 3:

Electric supply to Induction Motors in industries:**(7 Hrs)**

Types of motors, SLD and working of DOL/ Star-Delta/ Autotransformer starters; types, specifications, selection of power contactors, Overload relays, short circuit protective devices.

Reactive power management in industries:

Reactive power compensation in industries using static capacitors, use of Power Triangle, Calculating payback period for capacitor investment due to reduced system currents.

Unit 4

Transformers: **(6 Hrs)**

Specifications, ratings, selection, installation, testing & commissioning of transformers, protective device for transformers.

Substations: Types of Substation, Substation scheme and components, 11kV & 33 kV, indoor/ outdoor substations, plan/ elevations, Earthing Arrangements.

Unit 5:Earthing: (7 Hrs)

Necessity of earthing, concept of system & equipment earthing, Dimension & drawings of typical earth electrodes 1) Pipe Earthing 2) Plate Earthing , Earth tester & measurement of earth resistance , Megger. Definition of various terms – Referene earth, earth electrode, earth grid, earth electrode resistance, earth leakage current, earthing conductor, earth mat.

Unit 6: (6 Hrs)

General awareness of IS codes (IS 3043,IS 732,IS 2675, IS 5216,IS 2309), The India Electricity act 1910, The Indian Electricity supply Act 1948, Indian Electricity rule 1956, The electricity regulation commission act 1998, Electricity act 2003, National Electric Code (NEC), scope and safety aspects applicable to residential, commercial & Industrial installation.

Text Books

1. Electric Power Distribution system by A.S.Pabla, Tata Mcgraw Hill.
2. Electrical Engineering Handbook, C. L. Wadhwa.
3. Design of Electrical Installations, V.K.Jain,Amitab Bajaj, Laxmi Publications Pvt Limited, 01-Jan-1993.

EE5TO01	OpenElective-I	Electrical Safety & Management	4 Credit

COURSE OUTCOMES
CO1: Explain the objectives and precautions of Electrical Safety, effects of Shocks and their Prevention.
CO2: Summarize the Safety aspects during Installation of Plant and Equipment.
CO3: Describe the electrical safety in residential, commercial and agricultural installations.
CO4: Describe the various Electrical Safety in Hazardous Areas, Equipment Earthing and System Neutral Earthing.
CO5: State the electrical systems safety management and IE rules.

UNIT-I (7Hr)
INTRODUCTION TO ELECTRICAL SAFETY, SHOCKS AND THEIR PREVENTION:
Terms and definitions, objectives of safety and security measures, Hazards associated with electric current, and voltage, who is exposed, principles of electrical safety, Approaches to prevent Accidents, scope of subject electrical safety. Primary and secondary electrical shocks, possibilities of getting electrical shock and its severity, medical analysis of electric shocks and its effects, shocks due to flash/ Spark over's, prevention of shocks, safety precautions against contact shocks, flash shocks, burns, residential buildings and shops.

UNIT-II (7Hr)
SAFETY DURING INSTALLATION OF PLANT AND EQUIPMENT:
Introduction, preliminary preparations, preconditions for start of installation work, during, risks during installation of electrical plant and equipment, safety aspects during installation, field quality and safety during erection, personal protective equipment for erection personnel, installation of a large oil immersed power transformer, installation of outdoor switchyard equipment, safety during installation of electrical rotating machines, drying out and insulation resistance measurement of rotating machines.

UNIT-III (7Hr)
ELECTRICAL SAFETY IN RESIDENTIAL, COMMERCIAL AND AGRICULTURAL INSTALLATIONS:
Wiring and fitting – Domestic appliances – water tap giving shock – shock from wet wall – fan firing shock – multi-storied building – Temporary installations – Agricultural pump installation – Do's and Don'ts for safety in the use of domestic electrical appliances.

UNIT-IV (7Hr)
ELECTRICAL SAFETY IN HAZARDOUS AREAS:
Hazardous zones – class 0,1 and 2 – spark, flashovers and corona discharge and functional requirements – Specifications of electrical plants, equipments for hazardous locations – Classification of equipment enclosure for

various hazardous gases and vapours – classification of equipment/enclosure for hazardous locations. SF6 Breaker, Vaccum Circuit Breaker, AB Switches, HRC Fuses,etc.

UNIT – V

EQUIPMENT EARTHING AND SYSTEM NEUTRAL EARTHING: (7Hr)

Introduction, Distinction between system grounding and Equipment Grounding, Equipment Earthing, Functional Requirement of earthing system, description of a earthing system, , neutral grounding(System Grounding), Types of Grounding, Methods of Earthing Generators Neutrals.

UNIT-VI

SAFETY MANAGEMENT OF ELECTRICAL SYSTEMS: (5Hr)

Principles of Safety Management, Management Safety Policy, Safety organization, safety auditing, Motivation to managers, supervisors, employees.Review of IE rules and acts and their significance:

Objective and scope – ground clearances and section clearances – standards on electrical safety - safe limits of current, voltage –Rules regarding first aid and fire fighting facility. The Electricity Act, 2003, (Part1, 2, 3,4& 5)

Text books:

1. S. Rao, Prof. H.L.Saluja, "Electrical safety, fire safety Engineering and safety management", Khanna Publishers. New Delhi, 1988.(units-I to V)
2. www.apeasternpower.com/downloads/elecact2003.pdf (Part of unit-V)

Reference Books:

1. PradeepChaturvedi, "Energy management policy, planning and utilization", Concept Publishing company, New Delhi, 1997.

EE5L001	**Power Electronics Lab**	**1 Credit**

List of Practical:-

SrNo	Title of Experiment
1	To study Gate drive circuit
2	To study Reverse recovery time of diode
3	To study Single phase half wave controlled converter
4	To study Characteristics of junction gate fet
5	To study Unsymmetrical half wave bridge rectifier
6	To study SCR parallel inverter
7	To study Lamp dimmer using DIAC and TRIAC
8	To study Simulation of 3 phase full wave controlled rectifier
9	To study Simulation of 3 phase inverter
10	To study Simulation of buck converter

EE5L002	**Control Systems Lab**	**1 Credit**

List of Practical:-

Sr No	Title of Experiment
1	Potentiometer error detector
2	Time response of second order systems
3	Characteristics of synchros
4	A.C. position control system
5	D.C. position control system
6	Determination of step & impulse response for a first order unity feedback system
7	Lag and lead compensation - magnitude and phase plot
8	Stability analysis (Bode, Root locus, Nyquist) of linear time invariant system using MATLAB
9	State space model for classical transfer function using MATLAB
10	Study the effect of addition of poles to the forward path transfer function of a closed loop system
11	Effect of P, PD, PI, PID controller on second order systems

EE5L003	Power Systems-II Lab	1 Credit

List of Practical:-

Expt No	Title of Expt
1	Formation of Bus Admittance Matrix Y-BUS
2	Load flow study using Newton Raphsonmethod .
3	Load flow study using Gauss Seidal Iteration Method .
4	Study of AC network analyzer
5	Measurement of sequence reactance of salient pole synchronous machine
6	Measurement of sub transient reactance of salient pole synchronous machine
7	Steady state stability of synchronous motor
8	Steady sate power limit of transmission line
9	Fault study on AC network analyzer
10	Load flow study on AC network analyzer

EE5P003	Mini Project (Phase I)	**2 Credit**

Mini project should consist of Circuit design, PCB fabrication, & software testing of small digital or analog application circuit. Mini Project work should be carried out by a group of maximum three students. Student should use standard software available for drawing circuit schematic, simulating the design and PCB (single/double sided) layout of circuit.

SYLLABUS of VI Semester

EE6T001	Microprocessor and microcontroller	3 Credit

COURSE OBJECTIVES:

1.To know the architecture of 8085 and 8051.
2.To understand interfacing and interrupt features of 8085 and 8051.
3.To develop program for basic applications.

COURSE OUTCOMES:
CO1: To remember the architecture of 8085 and 8051.
CO2: To understand interfacing and interrupt features of 8085 and 8051.
CO3: To develop program for basic applications
CO4: To distinguish and analyze the properties of Microprocessors & Microcontrollers
CO5:To explain programming logic and concepts of 8085 microprocessors and 8051 micro-controller.
CO6:To build strong foundation for designing real world applications using microprocessors and microcontrollers.

Unit 1 : 8085architecture:(6 Hrs)
Architecture, register structure, addressing modes, instruction set of 8085, timing diagrams,Assembly Language Programming of 8085

Unit 2 : Interfacing: (7 Hrs)
Memory Interfacing: Interface requirements, Address space partitioning,Buffering of Buses, timing constraints, Memory control signals, Read and write cycles,interfacing SRAM, EPROM and DRAM sections. I/O Interfacing: Memory mapped I/OScheme, I/O mapped I/O scheme, Input and Output cycles, Simple I/O ports,Programmable peripheral interface (8255). Data transfer schemes: Programmable datatransfer, DMA data transfer, Synchronous, Asynchronous and interrupt driven datatransfer schemes, Interfacing, Simple keyboards and LED displays.

Unit 3 : Interrupts and DMA:(6 Hrs)
Interrupt feature, Need for interrupts, Characteristics of Interrupts,Types of Interrupts, Interrupt structure, Methods of servicing interrupts, Developmentof Interrupt service subroutines, Multiple interrupt request and their handling, need fordirect memory access, Devices for Handling DMA, Programmable DMA controller8237.

Unit 4 : Applications: (7 Hrs)

Interfacing of A/D converters (ADC 0800/ADC 0808/ADC 0809),Interfacing of D/A converters (DAC 0800), Waveform generators, Multiplexed seven segment LED display systems, Measurement of frequency, phase angle and powerfactor-Traffic light controller, Stepper motor control

Unit 5 : Introduction to microcontroller:(6 Hrs)
8051 architectures, 8051 Internal resources, pin diagram, I/O pins, ports and their internal logic circuits, counters, serial ports, interrupt structure, SFRs and their addressing, watch-dog timer, internal code memory, data memory, stack pointer, flags, bit addressable memory, study of instruction set of 8051.

Unit 6 : 8051 Peripheral Functions :(6 Hrs)
8051 interrupt structures, Timer and serial functions, parallelport features : Modes of operation, Power control, features, Interfacing of 8051, Typicalapplications, MCS 51 family features

Text Books

1. Goankar, R.S., "Microprocessor Architecture Programming and Applications with the 8085/8080A", 3rd Edition, Penram International Publishing House, 1997.
2. Singh. I.P., "Microprocessor Systems", Module 9: Microcontrollers and their Applications", IMPACT Learning Material Series IIT, New Delhi, 1997.

Reference Books

1. Douglas, V.Hall. "Microprocessor and Interfacing Programming and Hardware", 2ndEdition, McGraw Hill Inc., 1992.
2. Kenneth, L.Short., "Microprocessors and Programmed Logic", Prentice Hall of India, 2nd Edition, 1987

EE6T001	**Advanced Control Systems**	**3 Credit**

PRE REQUISITES: Control System-I
COURSE OBJECTIVES:

1. To introduce students about state variable approach and feedback design problems and also to introduce concept of Optimal Control theory, digital control system, Non Linear Control System
2. To Impart the knowledge of stability analysisforOptimal Control theory, digital control system, Non Linear Control System

COURSE OUTCOME:
After completion of syllabus, students must be able:

CO1: To remember the basic concepts of compensation, State variable analysis, Non linear Control System, Digital Control system.

CO2: To understand the basic concepts of compensation, State variable analysis, Nonlinear Control System, Digital Control system.

CO3: To apply different concepts to find controllability, observability and stability of non-linear control system, sampled data control system.

CO4: To analyze continuous time system using state space technique and investigate Controllability and Observability of the system, digital systems using the Z-transformation, and nonlinear system using the describing function technique and phase plane analysis

CO5: To evaluate various parameters of continuous time system, digital systems using the Z-transformation, and nonlinear system using various methods.

CO6: To design controllers to achieve desired specification

UNIT I: COMPENSATION [07 Hrs]

Need for compensation. Performance Analysis of Lead, Lag and Lag-lead Compensators in time & frequency domain, Bode Plots of Lead, Lag and Lag-lead Compensators.

UNIT II: DESIGN BY STATE VARIABLE FEEDBACK [07 Hrs]

Review of state variable representation. Eigen Values, Eigen Vectors, State Transition Matrix (STM), Model Matrix, Solution of state equation.Controllability and Observability. Design of SVF

UNIT III: OPTIMAL CONTROL SYSTEM [07 Hrs]

Performance Index (PI), Desirability of single P.I., Integral square error.Parameter Optimization with & without constraints. Optimal control problem with T.F. approach for continuous time system only.

UNIT IV: CONTROLLER TUNING [07 Hrs]

Review of analog PID controller, PID tuning methods in process control (Ziegler-Nichols tuning method), digital PID controllers.

UNIT V: NON LINEAR CONTROL SYSTEM (NLCS) [07 Hrs]

Non Linear Control System: Types of non-linearities, characteristics of NLCS. Inherent & intentional non- linearities. Describing function method for Analysis Describing functions of some common non-linearities. Stability analysis. Limit cycles & stability of limit cycles. Phase - Plane Method: Singular points stability from nature of singular points Construction of trajectory by Isocline and Delta Method Computation oftime.

UNIT VI: DIGITAL CONTROL SYSTEM [07 Hrs]

Representation of SDCS.Sample & Hold Circuit. Z – Transform. Inverse Z- Transform & solution of difference equation.Z & S domain relationship.Stability by bilinear transformation & Jury's test.Comparison of time response of continuous and digital control system, Effect of sampling period on transient response characteristic Discretization of continuous time state equation.Solution of Discrete time state equations. Controllability &Observability of Discrete time systems.

Text Book:

4. Benjamin C Kuo, “Automatic Control Systems”, Prentice Hall of India.
5. M. Gopal, “Control Systems- Principle of Design”, Fourth Edition, 2012, McGraw Hill.
6. I.J. Nagrath, “Control Systems Engineering” ,New Age International Ltd. , 2000

Reference Books:

5. D’AzzoHoupis, Logakusha, Huelsoman, “Linear System Analysis”, McGraw Hill.
6. Richard C. Dorf and Robert H. Bishop, “Modern Control Systems”, Pearson Education Inc.
7. Norman S Nise, “Control System Engineering”, John Wiley & Sons.
8. Katsuhiko Ogata, “Modern Control Engineering”, Prentice Hall of India

EE6TE03(A)	Elective III- Electrical Energy Conservation &Audit	4 Credit

COURSE OBJECTIVES:

To understand the need of energy audit and the mechanism through which it should be carry out and also to manage the electric and thermal energy.

COURSE OUTCOME:

CO1: Know Present energy scenario with need of energy audit and energy conservation.
CO2: Classify and Manage electric and thermal energy in the industry.
CO3: Identify various aspects of energy audit such as planning, monitoring and implementation
CO4: Analyze the energy flow diagram of an industry and identify the energy wasted or a waste stream.
CO5: Evaluate the techno economic feasibility of the energy conservation technique adopted.
CO6 : Choose appropriate energy conservation method to reduce the wastage of energy

Unit 1: Basics of Energy Management and Conservation (10 Hrs)

Global and Indian energy scenario. Global environmental concerns, Climate Change, Concept of energy management, energy demand and supply, economic analysis; Carbon Trading & Carbon foot prints. Energy Conservation: Basic concepts, Energy conservation in household, transportation, agricultural, service and industrial sectors; Lighting & HVAC systems in buildings.

Unit 2: Energy Audit (8 Hrs)

Definition, need, and types of energy audit; Energy management (audit) approach: Understanding energy costs, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements; Fuel & energy substitution; Energy audit instruments; Energy Conservation Act; Duties and responsibilities of energy managers and auditors.

Unit 3: Material & Energy balance and Waste Heat Recovery (8 Hrs)

Facility as an energy system; Methods for preparing process flow; material and energy balance diagrams. Cogeneration and waste heat recovery;

Unit 4: Energy Action Planning, Monitoring and Targeting: (8 Hrs)

Energy Action Planning : Key elements; Force field analysis; Energy policy purpose, perspective, contents, formulation, ratification; Organizing the management: location of energy

management, top management support, managerial function, roles and responsibilities of energy manager, accountability; Motivation of employees: Information system-designing barriers, strategies; Marketing and communicating: Training and planning.
Monitoring and Targeting : Defining monitoring & targeting; Elements of monitoring & targeting; Data and information analysis; Techniques: energy consumption, production, cumulative sum of differences (CUSUM); Energy Service Companies; Energy management information systems; SCADA systems.

Unit 5: Electrical Energy Management: (8 Hrs)
Supply side: Methods to minimize supply-demand gap, renovation and modernization of power plants, reactive power management, Demand side management: conservation in motors, pumps and fan systems; energy efficient motors.

Unit 6: Thermal energy Management : (8 Hrs)
Energy conservation in boilers, steam turbines and Furnaces; Application of FBC, Heat exchangers and heat pumps.

Text Books/Reference books :

1) Principles of Energy Conservation, Archie, W Culp, Published by McGraw Hill, 1991.
2) Energy Management, P. O'Callaghan, McGraw - Hill Book Company, 1993.
3) Energy Management Handbook, Wayne C. Turner, Wiley Inter Science Publication

EE6TE04 (B)	Linear Electronic Circuits	3 Credit

COURSE OBJECTIVES:

CO1 To understand characteristics of IC and Op-Amp and identify the internal structure.
CO2 To introduce various manufacturing techniques.
CO3 To study various op-amp parameters and their significance for Op-Amp.
CO4 To learn frequency response, transient response and frequency compensation techniques for Op-Amp.
CO5 To analyze and identify linear and nonlinear applications of Op-Amp.
CO6 To understand functionalities of PLL.

COURSE OUTCOME:

On completion of the course, students will be able to:

CO1 Understand the characteristics of IC and Op-Amp and identify the internal structure.
CO2 Derive and determine various performances based parameters and their significance for Op-Amp.
CO3 Comply and verify parameters after exciting IC by any stated method.
CO4 Analyze and identify the closed loop stability considerations and I/O limitations.
CO5 Analyze and identify linear and nonlinear applications of Op-Amp.
CO6 Understand and verify results (levels of V & I) with hardware implementation
CO7 Implement hardwired circuit to test performance and application for what it is being designed.
CO8 Understand and apply the functionalities of PLL.

Unit I: OP-AMP Basics(7 Hrs)

Block diagram of OP-AMP, Differential Amplifier configurations, Differential amplifieranalysis for dual-input balanced-output configurations, Need and types of level shifter,current mirror circuits. Feedback topologies: Voltage series and voltage shunt feedbackamplifier and its effect on Ri, Ro, bandwidth and voltage gain.

Unit II: Linear Applications of OP-AMP(7 Hrs)

Inverting and non-inverting amplifier configurations, voltage follower, summing, averagingscaling amplifier, difference amplifier, integrator, differentiator, and instrumentationamplifiers.

Unit III: Non-linear Applications of OP-AMP(7 Hrs)
Introduction to comparator, characteristics and applications of comparator, Schmitt trigger,clippers and clampers, voltage limiters, square wave generator, triangular wave generator,Need of precision rectifiers, Half wave and Full wave precision rectifiers.

Unit IV: Converters using OP-AMP(7 Hrs)
V-F, I-V and V-I converter, Digital-to-analog converters (DAC): Weighted resistor, R-2Rladder, resistor string etc. Analog-to-digital converters (ADC): Single slope, dual slope,Successive approximation, flash type.

Unit V: Oscillators(6 Hrs)
Principle of Oscillators, Barkhausen criterion, Oscillator types: RC oscillators (design ofphase shift, Wien bridge etc.), LC oscillators (design of Hartley, Colpitts, Clapp etc.), nonsinusoidaloscillators, and voltage controlled oscillators.

Unit VI: Active filters and PLL(6 Hrs)
Design guidelines of Active filters: Low pass, high pass, band pass and band stop filters, block diagram of PLL and its function.

Text Books

1. Ramakant A. Gaikwad, “Op Amps and Linear Integrated Circuits”, Pearson Education 2000.
2. Salivahanan and KanchanaBhaskaran, “Linear Integrated Circuits”, Tata McGraw Hill, India 2008.
3. George Clayton and Steve Winder, “Operational Amplifiers”, 5th Edition Newnes.
4. Sergio Franco, “Design with Operational Amplifiers and Analog Integrated Circuits”, Tata McGraw Hill.

Reference Book

1. Bali, “Linear Integrated Circuits”, McGraw Hill 2008.
2. Gray, Hurst, Lewise, Meyer, “Analysis & Design of Analog Integrated Circuits”, Wiley Publications on Education.

EE6TE03(C)	Elective III- Introduction to AC and DC Drive	3 Credit

COURSE OBJECTIVES:

1. Understanding the operation of various drives
2. Learning about selection and control of motors.
3. Idea about AC/DC Contactors/Relays, Traction system and PLC programming & its application in electrical drives.

COURSE OUTCOMES

Students are able to

1. Examine factors governing selection of Electric Motors like speed torque characteristics under starting, running, and braking for particular application in a common electric drive system.
2. Select motor rating, Flywheel of common drive motors for continuous and intermittent periodic duties.
3. Analyze control circuit of ac/dc contactors and relays for automatic starting and braking of ac/dc motors.
4. Analyze the performance and suitability of motors used in ac/dc traction, their performance characteristic, and control and braking.
5. Apply digital control of electric motor, plc programming in electrical drives.

Unit I: Introduction to Drives (6 Hrs)

Basics of electrical drives and control ,Factors Governing Selection of Electric Motors, Types of Drives and Types of Load, Starting of electric motors, Speed control of Electric motors. Definition classification and speed torque characteristics of common drive motors and their characteristics under starting, running, Electric Braking. Types of enclosures.

Unit II: Rating (6 Hrs)

Rating & Service Capacity: Selection of Motor, Insulating materials, its classification, Temperature rise in Electrical machines, Power Capacity for Continuous and Intermittent Periodic Duties, Load Equalization: Flywheel Effect, Speed-Time Relations. Brief idea about drives commonly used in industries.

Unit III:AC and DC contactors and relays **(6 Hrs)**

Control devices for industrial motors, AC and DC contactors and relays: Lock out contactors, magnetic structure, operation, arc interruption, contactor rating, and H.V. contactors. Control circuits for automatic starting and braking of DC motor and three phase induction motor. Control panel design for MCC.

Unit IV: Electrical Traction **(6 Hrs)**

Electrical Traction: Electric Traction system, Speed time curve. Mechanics of Train movement. Traction motor: Motor Used in AC/DC Traction, Their Performance and Desirable Characteristics, Requirements and Suitability of Motor for Traction Duty. Control of D.C. Traction Motor, Series Parallel Control Starting and Braking of Traction Motor

Unit V:Traction motor control **(6 Hrs)**

Traction motor control – Starting and speed control traction motors. Series parallel control with numerical. Starting and speed control of 3-phase induction motors. Braking of traction motor.

Unit VI: **(6 Hrs)**

PLC, its programming and its applications in electrical drives.Digital control of Electric motor, Block diagram arrangement, comparison with other methods of control.

Text Books

1. G. K. Dubey, "Fundamentals of electrical drives", Second edition, (sixth reprint), Narosa Publishing house, 2001.
2. G.K Dubey, "Electrical Drives", Second Edition, 2002, PHI.
3. M.L. Soni, P.V. Gupta, U.S.Bhatnagar, "A course in Electrical Power", 1999, DhanpatRai& Sons.

Reference Books

1. VedamSubrahamanyam, "Electric Drives –Concepts & Applications", 1997, Tata McGraw-Hill.
2. H.Partab, "Art & Science of Utilization of Electrical Energy", 1999, DhanpatRai& Sons.
3. H.Partab, "Modern Electrical Traction", 1973, PritamSurat& Brothers.

EE6TE03 (D)	Elective III-Electrical Power Distribution System	Credit 3

COURSE OBJECTIVES:

1.To calculate different distribution factors

2.Understand classification of load, types of load curves.

3.Control of voltage and reactive power in distribution system

4.Understanddistribution automation

COURSE OUTCOME:

CO1. **Remember** basic principles of distribution systems and reliability indices.
CO2. **Understand** the principle of operation of feeder, substation and data acquisition system.
CO3. To **identify** the different factors related to distribution systems.
CO4. **Analyze** the effect of various equipments on voltage control and substation protection requirements.
CO5. **Evaluate** voltage drop, power loss and line drop in distribution system
CO6. **Solve** different problems related to radial networks, reactive power requirements and substation protection

UNIT-1: Distribution systems (6 hrs)
Introduction to Distribution systems, Explanation of basic terms like demand factor, utilization factor, load factor, plant factor, diversity factor, coincidence factor, contribution factor and loss factor, Relationship between the load factor and loss factor, Classification of loads , Changes in load curve due to loads, use of captive generation & cogeneration in distribution network, Electricity Act 2003, Energy conservation act-2001, electricity rules-2005

UNIT-2: **Feeders** **(6 hrs)**
Radial and loop types, engineering considerations for voltage levels and loading, causes of unbalance and unequal drops.

System analysis : Voltage drop and power loss calculations, manual methods of solution of radial networks, three-phase & non-three-phase primary lines load flow and symmetrical component applications.

UNIT-3 :**Distribution System Reliability** **(6 hrs)**
Basic definition, appropriate levels of distribution reliability, Series & Parallel System, Markov Processes, Distribution reliability Indices, System and customer based indices, load and energy based indices, usage of reliability indices.

UNIT-4: **Voltage control** **(6 hrs)**
Equipment for voltage control, effect of series capacitors, effect of AVB/AVR, line drop calculations and compensations, Reactive power requirements, economic consideration & best location.

UNIT-5: DistributionAutomation(6 hrs)
Introduction to Distribution Automation, Data acquisition system and decentralized control, data acquisition and protection considerations of control panel, circuit breakers, fuses, relays, earthing.

UNIT-6: Substation **(6 hrs)**
Substation layout, selection criteria, voltage and spacing load, space and location, distribution substation protection needs, distribution substation construction methods, trends in distribution substation, insulation coordination, voltage regulation, theoretical consideration for fault calculations.

Text Books
1. A. S. Pabla,“Electric Power Distribution”, Fourth Edition, 1997, Tata McGraw-Hill Publishing Company.

2. Kamaraju ,“Electrical Power Distribution System”,Tata-McGraw Hill Publications.

3. TuranGonen, “Electric Power Distribution SystemEngineering”, 2^{nd}Edition,2008,CRC Press

Reference Books
1.M. K. Khedkar& G. M. Dhole., “Electric Power Distribution Automation”, University Science Press.

EE6TE04(A)	Elective IV- Solar Photovoltaic Devices	3 Credit

COURSE OBJECTIVES:

1. To make the student aware about potential of solar photovoltaic energy source,
2. Introduce modeling of PV cell,
3. Understand the maximum PV power harnessing
4. familiarize with PV power conversion devices.

COURSE OUTCOME:

CO1: Calculate and analyse solar insolation on a collecting surface by locating the sun position at anygiven location and time, interpret sun path diagrams.
CO2. Interpret I-V curves from the circuit model of a PV cell, understand the impact of temperature andsolar insolation on I-V curves.
CO3. Evaluate the algorithms used for the maximum power point tracking of PV array.
CO4. Understand the principle of DC-AC power conversion in Grid connected PV system
CO5. Design standalone PV system by estimating the load, sizing and selecting the batteries, sizing and
selecting the PV modules and other components
CO6. Understand the various issues in PV systems.

Unit I:Introduction : (6 Hrs)

Fossil fuel energy usage and global warming; role of renewable energy in sustainable development; renewable energy sources; global potential for solar electrical energy systems.

Unit II Solar Radiation :(6 Hrs)

Extra-terrestrial and terrestrial solar spectrum; clear sky direct-beam radiation; total clear sky Insolation on a collecting surface; radiation on the collector in tracking systems; calculation of average monthly insolation from measured data.

Unit III: PV Cells and Modules :(6 Hrs)

Photovoltaic cell and its simple model; i-v and p-v characteristics; PV modules and arrays ; effect of shading, use of bypass and blocking diodes; influence of temperature; types of solar cells and their performance; Charge controller, Introduction of maximum power point tracking algorithms

Unit IV: PV Inverters: (7 Hrs)

Principle of DC-AC conversion, Working of Grid-connected PV inverter, schemes and basic control; Introduction to Grid Interfacing standards.

Unit V: PV Systems with Battery Energy Storage: (7 Hrs)

Power processing schemes and control for stand-alone applications; batteries for energy storage – types, charging, battery sizing and turn-around efficiency; other types of energy storage for PV systems; grid connected schemes with standby energy storage.

Unit VI :System Level Issues: (6 Hrs)

Design related issues; grounding, dc arcing and other safety related issues; islanding; harmonics; electro-magnetic interference; energy yield and economics of a PV installation.

Text Books

1. Solar Photovoltaic: Fundamentals, Technologies and Applications: Solanki, PHI Learning Pvt Ltd, 2009

Reference Books

1. Photovoltaic Systems Engineering: Roger A. Messenger & Jerry Ventre, CRC Press, 2004, 2nd edition.
2. Renewable and Efficient Electric Power Systems: Gilbert M. Masters, John Wiley & Sons, 2004

EE6TE04(B)	High Power Semiconductor Devices	3 Credit

COURSE OBJECTIVES:

1. To review principle of construction, operation and characteristics of Power switching devices
2. To understand and analyse performance of Power switching devices.
3.To understand various types of Firing and Protecting Circuits.
4. To understand various types of Thermal Protection.

COURSE OUTCOME:

CO1: To remember the principle of operation of various Power switching devices
CO2: To Understand the characteristics of various types of Power switching devices
CO3: To make use of steady state and dynamic models of Power switching devices
CO4: To analyse various types of Thermal Protection required for protection of Power switching devices
CO5: To compare various Thermal Protections and firing protection Circuits of Power switching devices
CO6: To design the Firing and Protecting Circuits for various Power switching devices.

Unit I: Power switching devices overview(6 Hrs)
Attributes of an ideal switch, application requirements, circuit symbols; Power handling capability – (SOA); Device selection strategy – On-state and switching losses – EMI due to switching - Power diodes - Types, forward and reverse characteristics, switching characteristics – rating.

Unit II :Current Controlled Devices: (6 Hrs)
BJT's – Construction, static characteristics, switchingcharacteristics; Negative temperature co-efficient and secondary breakdown; Power darlington –Thyristors – Physical and electrical principle underlying operating mode, Two transistor analogy– concept of latching; Gate and switching characteristics; converter grade and inverter grade andother types; series and parallel

operation; comparison of BJT and Thyristor – steady state and dynamic models of BJT &Thyristor.

Unit III: Voltage Controlled Devices: **(6 Hrs)**
Power MOSFETs and IGBTs – Principle of voltage controlled devices, construction, types, static and switching characteristics, steady state and dynamic models of MOSFET and IGBTs - Basics of GTO, MCT, FCT, RCT and GATT.

Unit IV: Firing and Protecting Circuits: **(6 Hrs)**
Necessity of isolation, pulse transformer, optocopler – Gate drives circuit: SCR, MOSFET, IGBTs and base driving for power BJT. - Over voltage, over current and gate protections; Design of snubbers.

Unit V: Thermal Protection: **(6 Hrs)**
Heat transfer – conduction, convection and radiation; Cooling – liquid cooling, vapour – phase cooling; Guidance for hear sink selection – Thermal resistance and impedance -Electrical analogy of thermal components, heat sink types and design – Mounting types

Unit VI: Phase Controlled Converters: **(6 Hrs)**
Performance measures of single and three-phase converters with discontinuous load current for R, RL and RLE loads. Effect of source inductance for single and three-phase converters.

Text Books:
1. Rashid M. H., "Power Electronics Circuits, Devices and Applications”, Prentice Hall India,Third Edition, New Delhi.
Reference Books:
1. B.W. Williams ‘Power Electronics: Devices, Drivers, Applications and Passive Components, Tata McGraw Hill.
2. M. D. Singh and K. B. Khanchandani, “Power Electronics”, Tata McGraw Hill.
3. Mohan, Undeland and Robins, “Power Electronics – Concepts, applications and Design, John Wiley and Sons, Singapore.

EE6TE04(C)	Elective IV -Power Semiconductor Based Drive	3 Credit

COURSE OBJECTIVES:

1.To study the converter and Chopper control of DC drives.
2.To study the semiconductor based control of Induction and Synchronous motors.
3.To learn the basics of Switched reluctance motor and Brushless DC motor.
4.To study the non conventional and renewable energy based drives.

COURSE OUTCOMES:

CO1. **Remember** fundamental principles of power electronics and electric drives.
CO2. **Understand** the basics of construction & principle of operation ofvarious electric drives.
CO3. **Apply** suitable control methods to different motor drives.
CO4. **Analyze** the output of conventional drives and semiconductor based drives.
CO5. **Evaluate** the power factor, harmonics and ripple in motor current.
CO6. **Solve** the problems related starting, braking and speed control of motor drives.

Unit I:Dynamics of Electric Drives (7 Hrs)
Fundamentals of torque equations, speed torque convention and multiquadrant operation, components of load torques, classification of load torques, steady state stability, load equation. Speed control and drive classification, close loop control of drives.

Unit II:D.C. motor drives(7 Hrs)
Controlled rectifier fed d.c. drives, single phase and three phase rectifier control of d.c. separately excited motor. Dual converter control of D.C separately excited motor. Power factor, supply harmonics and ripple in motor current. Chopper controlled dc drives of separately excited dc motor, chopper control of series motor, source current harmonics.

Unit III:Induction motor drives(7 Hrs)
Stator voltage control, variable frequency control usingvoltage source invertors, and current sources invertors. Concept of scalar control of 3-ph Induction Motor, Basic philosophy of vector control of 3-ph I.M. their advantages and list of applications.Basic idea of energy conservation in fan and pump type loads using scalar controlled induction motordrives.(Numericals excluded)

Unit IV:Synchronous Motor Drives(7 Hrs)
Starting Braking of synchronous motor, variable frequency control selfcontrolled synchronous motor drive employing load commutated thyristor inverter or cycloconverter, starting oflarge synchronous motors.

Unit V:Advanced Motor Drives(7 Hrs)
Brushless DC motor, stepper motor drives, Introduction tosolar and battery powered drives.Energy conservation in electric drives.

Unit VI:Traction drives: (7 Hrs)
Conventional dc and ac traction drives, semiconductors converter controlled Drives, 25KV AC traction using semiconductor converter controlled dc motor. DC traction using semiconductor, chopper controlled dc motors, polyphase AC motors for traction drives.

Text Books

1.M. H. Rashid, "Power Electronics Circuits Devices and Applications", Prentice Hall India

2.G. K. Dubey, "Fundamentals of Electric drives", CRC Press

3.HPartab, "Modern Electric Traction", PritamSurat, 1973.

4.Venkataratnam K., Special Electrical Machines, CRC Press, 2009.

Reference Books

1.Ned Mohan, "Power Electronics", John Wiley and Sons, 3rd Edition

2. VedamSubramanhyam, "Electrical drives concepts and applications ", McGraw Hill 1996

EE6TE04(D)	Elective 4-High Voltage DC transmission(HVDC)	4 Credit

PRE REQUISITES: Electrical Power Systems I & II

COURSE OBJECTIVES:

1. To expose the students to the state of the art HVDC technology.
2. Methods to carry out modelling and analysis of HVDC system for inter-area power flow regulation

COURSE OUTCOME:

CO1. **Remember** basic principles of some HVDC Systems.
CO2. **Understand** the basics of HVDC Systems and their implementation.
CO3. To **identify** the different operational characteristics related to HVDC Systems.
CO4. **Analyze** the performance of HVDC Systems.
CO5. **Evaluate** the operation & characteristics of HVDC Systems.
CO6. **Solve** the different problems related to operation of HVDC Systems.

UNIT-I: DC POWER TRANSMISSION FUNDAMENTALS (07 Hrs)
Introduction, Economics of Dc Power transmission, comparison with AC system, Types of DC links, major components of converter station, planning of HVDC system.

UNIT-II: HVDC CONVERTERS (07 Hrs)
Choice of converter configuration, analysis of Gratz circuit with and without overlap, working of converter as rectifier and inverter, equivalent circuit for HVDC link.

UNIT-III: HVDC SYSTEM CONTROL (06 Hrs)
HVDC System Control: Principles of DC link control, converter control characteristics, firing angle control, current and extinction angle control, Starting and stopping of HVDC link.

UNIT-IV: CONVERTER FAULTS AND PROTECTION (07 Hrs)
Converter Faults and Protection: Types of faults-commutation failure, Arc through, Misfire, short circuit in bridge, Over current and over voltage protection, Detection of line faults, Principle of DC circuit interruption, DC breakers, Types and characteristics of DC breakers, effects of proximity of AC and DC transmission lines.

UNIT-V: Multi -Terminal DC (MTDC) Systems (05 Hrs)
Introduction to MTDC Systems, Importance of Multi-Terminal HVDC Systems, Control of MTDC Systems, Interaction between AC-DC Power Systems.

UNIT-VI: Modelling& Representation of HVDC systems (05 Hrs)
Modeling Of HVDC Systems, Per Unit System, Representation for Power Flow Solution, and Representation for Stability Studies.

Text Books

1. J. Arrillaga,“High Voltage Direct Transmission”, Peter Peregrinus Ltd. London, 1983.
2. K. R. Padiyar, “HVDC Power Transmission Systems”, Wiley Eastern Ltd., 1990.

Reference Books

1. E. W. Kimbark, “Direct Current Transmission”, Vol.I, Wiley Interscience, 1971.
2. Erich Uhlmann, “Power Transmission by Direct Current”, B.S. Publications, 2004.

EE6TO01	OpenElective I-Industrial Instrumentation	**4 Credit**

COURSE OBJECTIVES:

The objective of the course is to prepare the students:
1. To equip the students with relevant knowledge to suit the industrial requirements.
2. To provide the knowledge about various techniques used for the measurement of industrial parameters.
3. To have an adequate knowledge about electrical and mechanical transducers for measurements of various physical quantities.

COURSE OUTCOME:
At the completion of this course, students will be able to:
1. Select the instruments for measurement of various physical quantities,
2. Select a transducer based on its operating characteristics for the required application.
3. Check various available techniques and select appropriate to obtain satisfactory task for the parameter to be measured.
4. Know advantages and limitations of selected techniques.

Unit I: Introduction to Industrial Instrumentation: (6 Hrs)
Definitions, Dynamic Characteristics of Instruments, Zero-Order Instrument, First-Order Instrument, Second-Order System.
Pressure Measurement: Introduction, Basic terms, Pressure formulas, Pressure measuring instruments, Application considerations.

Unit II: Temperature and Heat Measurement: (6 Hrs)
Introduction, basic terms, Temperature and heat formulas, Temperature measuring devices, Application considerations.

Unit III: Level Measurement &Flow Measurement: **(6 Hrs)**

Introduction, basic terms, Level formulas, Level sensing devices, Application considerations. Flow formulas, Flow measuring instruments, Application considerations.

Unit IV: Position and motion sensing: **(6 Hrs)**

Basic definitions, measuring devices, application considerations.
Force, Torque and Load cell: Basic definitions, measuring devices, application considerations

Unit V: Transducers:

Introduction to instrumentation system, static and dynamic characteristics of an instrumentation system, Principles and classification of transducers, Electrical transducers, basic requirements of transducers.

Unit VI: Digital Data Acquisition systems & control:

Use of signal conditioners, scanners, signal converters, recorders, display devices, A/D & D/A circuits in digital data acquisition.Instrumentation systems.Types of Instrumentation systems.Components of an analog Instrumentation Data –Acquisition system.Multiplexing systems.Uses of Data Acquisition systems.Use of Recorders in Digital systems.Digital Recording systems.Modern Digital Data Acquisition system. Analog Multiplexed operation, operation of sample Hold circuits.

Text Books

1. Industrial Instrumentation: K Krushnaswamy, New Age International
2. E.O. Doebelin, 'Measurement Systems – Application and Design', Tata McGraw Hill publishing company, 2003.
3. R.K. Jain, 'Mechanical and Industrial Measurements', Khanna Publishers, New Delhi, 1999.

Reference Books

1. Fundamentals of Industrial Instrumentation and Process Control:
   William C. Dunn, TMH Publication, 2nd edition.
2. D. Patranabis, 'Principles of Industrial Instrumentation', Tata McGraw Hill Publishing Company Ltd, 1996.
3. A.K. Sawhney and P. Sawhney, 'A Course on Mechanical Measurements, Instrumentation and Control', DhanpathRai and Co, 2004.
4. B.C. Nakra&K.K.Chaudary, 'Instrumentation Measurement & Analysis', Tata McGraw Hill Publishing Ltd, 2004
5. S.K. Singh, 'Industrial Instrumentation and Control', Tata McGraw Hill, 2003.
6. D.P. Eckman', Industrial Instrumentation', Wiley Eastern Ltd.,

EE6L001	Microprocessor and microcontroller **Lab**	**1 Credit**

List of Practical:-

Sr.No	Title of Experiment
1	Study of architecture of 8085
2	Assembly language programmes for determination of smaller and larger no
3	Assembly language programmes for ascending and descending order
4	Multiplication/division of numbers
5	Assembly language programmes for led flashing (Interfacing of 8051 Microcontroller with various display devices.
6	Programming for speed and direction control of dc motor(Interfacing of 8051 Microcontroller with DC motor.
7	Programming for speed and direction of stepper motor
8	Study of hexadecimal, modulo-9, BCD counter

9	Write a program to move a block of data using 8085 & verify
10	Write a program using 8085 & verify for :A. Addition of Two 8-Bit Numbers,B. Addition of Two 16-Bit Numbers (With Carry).
11	Write a Program Using 8085 & Verify for :a. Subtraction of Two 8-Bit Numbers. (Display Of Borrow),b Subtraction of Two 16-Bit Numbers. (Display Of Borrow)

EE6L003	CAD **Lab**	**1 Credit**

List of Practical:-

Sr.No	Title of Experiment
1	**Introduction to CAD**
2	Study of AutoCAD software basics - GUI, limits and units, drawing tools, editing tools, annotations etc.
3	Study of Coordinate systems- Cartesian and Polar (absolute and relative system of measurement) and practice drawing by using following tools: Grid, span, O-snap, Lines, Erase, Zoom.
4	Create a 2D drawing of a given diagram by using drawing tools: circle, arc, rectangle, polygon, ellipse, and Editing tools: trim, move, copy, rotate, and practice of drawing using these commands.
5	Study and create drawing by using Geometry modifying tools: fillet, chamfer, scale, stretch.
6	Study and create drawing by using copying tools like array, mirror, block and offset.

7	Draw regular solids: Cube, Prism, Pyramid, Cylinder, Cones
8	Study and draw 3D drawing of the given object by using AutoCAD commands and tools.
9	Study and draw 3D drawing of the given object by using AutoCAD commands and tools.
10	Study and draw 3D drawing of the given object by using AutoCAD commands and tools.

EE6P004	**Mini Project (Phase II)**	**2 Credit**

Hardware Mini project should consist of Circuit design, PCB fabrication, & hardware designing of small digital or analog application circuit. Mini Project work should be carried out by a group of maximum three students. Student should use standard software available for drawing circuit schematic, simulating the design and PCB (single/double sided) layout of circuit. Project report should consist of details of work carried out including layouts, circuits, datasheets, list of components, cost .

EE6T003	**Research Methodology**	**2 Credit**

Course Objectives:

Student will be able to

1.Understand the basics of research and the research process.

2.Understand the conducting research work and formulating research synopsis andreport.

Know how to develop data analytics skills and meaningfulinterpretation to the data sets so as to solve the business/Research problem.

Course Outcomes

Student should be able to:

CO1. Remember the basic framework of research process.

CO2. Demonstrate various sources of information for research.

CO3. Develop an understanding of various research design and techniques.

CO4. Compare various sources of information for literature review and data collection.

CO5. Interpret the fundamental functions and working of analytical instruments used in research.

CO6.Discuss different methodologies and techniques used in research work.

Unit-I:

Introduction to Research Methodology Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, and Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Importance of Knowing How Research is Done, Research Process and Criteria of Good Research. Defining the Research Problem: Selecting the Problem, Necessity of Defining the Problem and Technique Involved in Defining a Problem

Unit-II:

Research Design Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs: Exploratory research, Descriptive research, diagnostic research, Basic principles of experimental Design and Important Experimental Designs.

Unit-III:

Sampling Design, Measurement and Scaling Techniques Census and Sample Survey, Implications of a Sample Design, Steps in Sampling Design, Criteria of Selecting a Sampling Procedure, Characteristics of a Good Sample Design, Different Types of Sample Designs, How to Select a Random Sample, Random Sample from an Infinite Universe, Complex Random Sampling Designs. Measurement in Research, Measurement Scales, Sources of Error in Measurement, Tests of Sound Measurement, Technique of Developing Measurement Tools, Scaling, Meaning of Scaling, Scale Classification Bases, Important Scaling Techniques

Unit-IV:

Methods of Data Collection Collection of Primary Data, Observation Method, Interview Method, Collection of Data through Questionnaires, Collection of Data through Schedules, Difference between Questionnaires and Schedules, Some Other Methods of Data Collection, Collection of Secondary Data, Selection of Appropriate Method for Data Collection and Case Study Method.

Unit-V:

Simulation in Research

Meaning of Simulation, Need of Simulation, Appropriateness of Simulation, Advantages and Disadvantages of Simulation, Areas of Application, Study of any one tool relevant to electrical engineering area is compulsory

Text Books/References:

1. C. R. Kothari, Research Methodology: Methods and Techniques, Second Revised Edition, New Age International Publication, 2004.
2. J. Banks, J. C. Carson II, B. L. Nelson, D. M. Nicol, Discrete Event System Simulation, Fourth Edition, Prentice Hall of India Publication, 2006.
3. K. N. Krishanaswamy, Appa Iyer Sivakumar, M. Mathiranjan, Management Research Methodology: Integration of Principles, Methods and Techniques, Pearson Education, New Delhi, 2006.

Dr.S.R.Vaishnav
Chairman
Board of Studies, EE Dept

Dr. Babasaheb Ambedkar Technological University, Lonere.

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COURSE STRUCTURE AND SYLLABUS

For

Final Year B. Tech. Electrical Engineering / Electrical Engineering (Electronics and Power)/ Electrical & Electronics Engg / Electrical & Power Engineering

With effect from the Academic Year 2020-2021(Final Year)

Dr. Babasaheb Ambedkar Technological University, Lonere.

B.Tech (Electrical Engineering / Electrical Engineering (Electronics and Power)/ Electrical & Electronics Engg / Electrical & Power Engineering)

Curriculum for Semester VII [Final Year]

Sr. No.	Course Code	Type of Course	Course Title	Hours per week			Evaluation Scheme			Total Marks	Credits
				L	T	P	MSE	CA	ESE		
1	BTEEC701	PCC1	Power System Operation & Control	3	0	0	20	20	60	100	3
2	BTEEC702	PCC2	High Voltage Engineering	3	0	0	20	20	60	100	3
3	BTEEC703	PCC3	Electrical Drives	3	0	0	20	20	60	100	3
4	BTEEE704	PEC1	Elective-IX	3	0	0	20	20	60	100	3
5	BTEEE705	PEC2	Elective-X	3	0	0	20	20	60	100	3
6	BTEEL706	Lab	Power System Operation & Control Lab	0	0	2	--	30	20	50	1
7	BTEEL707	Lab	High Voltage Engineering Lab	0	0	2	--	30	20	50	1
8	BTEEL708	Lab	Electrical Drives Lab	0	0	2	--	30	20	50	1
9	BTEES709	Seminar	Seminar	0	0	2	--	30	20	50	1
10	BTEEP710	Project	Project Part-I	0	0	6	--	30	20	50	3
11	BTEEF711	--	Field Training /Internship/Industrial Training III	--	--	--	--	--	50	50	1
			Total	**15**	**0**	**14**	**100**	**250**	**450**	**800**	**23**

Elective-IX	Elective-X
A) Special Purpose Electrical Machines	A) Digital Signal Processing
B) Electrical Traction and Utilization	B) Energy Audit and Conservation
C) Engineering System Design and Optimization	C) Electrical Power Quality
D) Financial Management	D) HVDC Transmission and FACTS

Dr. Babasaheb Ambedkar Technological University, Lonere.

B.Tech (Electrical Engineering / Electrical Engineering (Electronics and Power)/ Electrical & Electronics Engg / Electrical & Power Engineering)

Curriculum for Semester VIII [Final Year]

Sr. No.	Course Code	Course Title	Hours per week			Evaluation Scheme			Total Marks	Credits
			L	T	P	MSE	CA	ESE		
	1.Power Management Integrated Circuits 2.DC Power Transmission Systems 3.High Power Multilevel Converters 4.Fuzzy Sets, Logic and Systems & Applications 5.The Joy of Computing using Python 6.Introduction to Industry 4.0 and Industrial Internet of Things 7.Entrepreneurship Essentials **# Student to opt any two subjects from above list**		3	0	0	20*	20*	60*	100	3
			3	0	0	20*	20*	60*	100	3
6	BTEEP803	Project - II	0	0	30	--	100	150	250	15
		Total	**6**	**0**	**30**	**40**	**240**	**270**	**450**	**21**

** Six months of Internship in the industry*

**Students doing project at institute will have to appear for CA/MSE/ESE*

** Student doing project at Industry will give NPTEL examination / Examination conducted byuniversity i.e. CA/MSE/ESE*

 # These subjects are to be studied on self –study mode using SWAYAM/NPTEL/Any other source

 # Teacher who work as a facilitator for the course should be allotted 3 hrs/week load.

 # Project Load: 2hrs/week/project.

Mapping of Courses with MOOCs Platform SWYAM / NPTEL

S.N.	Course Name	Duration	Name of Professor	Institute offering Course
1	Power Management Integrated Circuits	12 Weeks	Prof. Qadeer Ahmad Khan	IITM
2	DC Power Transmission Systems	12 Weeks	Prof. Krishna S	IITM
3	High Power Multilevel Converters	12 Weeks	Prof. Anandarup Das	IITD
4	Fuzzy Sets, Logic and Systems & Applications	12 Weeks	Prof. Nishchal Kumar Verma	IITK
5	The Joy of Computing using Python	12 Weeks	Prof. Sudarshan Iyengar Prof. Yayati Gupta	IIT Ropar
6	Introduction to Industry 4.0 and Industrial Internet of Things	12 Weeks	Prof. Sudip Misra	IIT KGP
7	Entrepreneurship Essentials	12 Weeks	Prof. Manoj Kumar Mondal	IIT KGP

BTEEC701: POWER SYSTEM OPERATION AND CONTROL	
Teaching Scheme:	Examination Scheme:
Theory: 3hr	Mid-term Test: 20 Marks
Tutorial: 0	Internal Assessment: 20 Marks
Total Credits: 3	End Term Exam: 60 Marks

Prerequisite:

1. Power System-II

Course Objectives:

1. To understand the fundamental concepts of power system.
2. To obtain mathematical model of Synchronous machine, excitation and speed governing system.
3. To analyze the transient stability of power system.
4. To understand the economic operation of power system.
5. To explain various techniques of reactive power and voltage Control

Course Outcome:

1. Explain the fundamental concept of power system.
2. Design the mathematical model of synchronous machine.
3. Design the mathematical model Excitation system and speed governing system.
4. Analyze the transient stability of power system using swing equation and equal area criteria.
5. Analyze the economic operation of power system.
6. Explain the methods of Voltage control.

UNIT I. FUNDAMENTALS OF POWER SYSTEM: (6hr)

Concepts of real and reactive powers, complex power, per-unit representation of power system, Transmission capacity, load characteristics, real power balance and its effect on system frequency, load frequency mechanism, reactive power, balance and its effect, on-load tap changing transformer and regulating transformer

UNIT II. SYNCHRONOUS MACHINE MODELLING (8hr)

Schematic diagram, Physical description: armature and field structure, machines with multiple pole pairs, MMF waveforms, direct and quadrature axes, Mathematical Description of a Synchronous Machine: Basic equations of a synchronous machine: stator circuit equations, stator self, stator mutual and stator to rotor mutual inductances, dq0 Transformation: flux linkage and voltage equations for stator and rotor in dq0 coordinates, electrical power and torque, physical interpretation of dq0 transformation

UNIT III. MODELLING OF EXCITATION AND SPEED GOVERNING SYSTEM (8hr)

Elements of an Excitation System; Types of Excitation System; Control and protective functions; Functional Block Diagram of Power Generation and Control, Schematic of a hydroelectric plant, classical transfer function of a hydraulic turbine, special characteristic of hydraulic turbine, electrical analogue of hydraulic turbine, Governor for Hydraulic Turbine: Requirement for a transient droop, Block diagram of governor with transient droop compensation, Steam turbine modelling: Single reheat tandem compounded type and cross compound type.

UNIT IV. TRANSIENT STABILITY: (6hr)

Solution of Swing equation using classical model, application of equal area creation on point by point solution

UNIT V. ECONOMIC OPERATION OF POWER SYSTEM: **(6hr)**

Distribution of load between units within a plant, transmission loss as function of plant generation, calculation of loss-coefficient, distribution of loads between plants with special reference to steam and hydro plants, automatic load dispatching, Unit commitment, constraints on unit commitment – spinning reserve, thermal and hydro constraints, methods of unit commitment – priority list and dynamic programming.

UNIT VI. REACTIVE POWER AND VOLTAGE CONTROL: (6hr)

Production and absorption of reactive power- Methods of Voltage Control – Shunt reactors – Shunt Capacitors – Series Capacitors – Synchronous condensers – Static Var systems – Principles of Transmission system compensation – Modeling of reactive compensating devices

Reference Books:

1. P. Kundur, “Power System Stability and Control”, McGraw-Hill, 1993.
2. Gross C. A., ‘Power System Analysis’ McGraw Hill
3. Arrilaga J., ‘Computerised Power system Analysis’ McGraw Hill
4. Foud Anderson, ‘Power system control dynamics’ McGraw Hill
5. Kaushik, ‘Computerised Power system Analysis’ McGraw Hill
6. Padiyar K. R., ‘Power system dynamics, ‘ New Age International

BTEEC702: HIGH VOLTAGE ENGINEERING	
Teaching Scheme:	Examination Scheme:
Theory: 3hr	Mid-term Test: 20 Marks
Tutorial: 0	Internal Assessment: 20 Marks
Total Credits: 3	End Term Exam: 60 Marks

Pre-requisite: Electrical Engineering Materials,Power systems I, Power Systems II

Course Objectives:

1. To study conduction and breakdown in gases, liquids and solids.
2. To understand the methods and measurement of high voltage generation and measurement
3. To explain the lightening phenomenon and insulation co-ordination.
4. To know different non-destructive testing and standards in HV.

Course Outcomes:

1. Illustrate the concept of electric field stresses, applications of insulating materials and methods for Non-destructive testing of equipment like transformers, insulators, isolators, bushings, lightning arrestors, cables, circuit breakers and surge diverters.
2. Explain the breakdown process in solid, liquid, and gaseous materials
3. Analyze methods for generation and measurement of High Voltages and Currents (both ac and dc)
4. Describe the phenomenon of over-voltage and choose appropriate insulation co-ordination levels based on IS & IEC Standards.

UNIT I: INTRODUCTION TO HIGH VOLTAGE ENGINEERING (2hr)

Electric Field Stresses,Poisson's equation, Estimation and Control of Electric Stress, Surge Voltages, their distribution and control.

UNIT II:CONDUCTION & BREAKDOWN IN GASES: (6hr)

Gases as insulation media, ionization processes, Townsend's current growth equation, current growth in presence of secondary processes, Townsend's criterion for breakdown in electronegative gases, time lags for breakdown, Streamers theory, Paschen's law, breakdown in non-uniform fields and corona discharge, corona under positive & negative polarities, glow & arc discharge, considerations in using gases for insulation purpose.

UNIT III: BREAKDOWN IN DIELECTRIC MATERIALS: (8hr)

Conduction & breakdown in liquid dielectrics: Pure and commercial liquids, breakdown in pure and commercial liquids, theories of breakdown in liquids. Breakdown in solid dielectrics: Intrinsic, electromechanical& thermal breakdown, chemical, electrochemical deterioration, treeing, tracking, internal discharges, breakdown in composite insulation, properties of solid insulators & other materials used in practice. Insulating materials: In power transformers, rotating machines, circuit breakers, cables, power capacitors & other equipment.

UNIT IV: OVER VOLTAGE DUE TO LIGHTENING PHENOMENON: (8hr)

Natural causes for over voltages – Lightning phenomenon, Overvoltage due to switching surges, system faults and other abnormal conditions, propagation of lightning voltage & current waves on transmission lines, reflection & transmission of traveling wave at junction, system control of over voltage due to switching protection of transmission lines against over voltage. Insulation co-ordination, surge diverters, equipment insulation level & co-ordination of substations.

UNIT V:GENERATION & MEASUREMENT OF HIGH VOLTAGES & CURRENTS: (10hr)

Generation of a) high d. c voltage b) power frequency high alternating voltage c) high frequency a. c. d) impulse voltages Standard impulse waves shapes and it's equation, multistage impulse generator, matrix circuit, generation of switching surges, tripping & control of impulse generators, generation of impulse currents.

Measurement of High Direct Current voltages, Abraham Voltmeter Measurement of High Voltages alternating and impulse, Measurement of High Currents-direct, alternating and Impulse, Oscilloscope for impulse voltage and current measurements

UNIT VI:NON DESTRUCTIVE TESTING: (6hr)

I.E.C. & IS codes for high voltage tests on electrical appliances & power apparatus &electrical motors, non- destructive testing, testing of insulators, bushings, isolators, circuit breakers, cables, transformers, surge diverter, layout of high voltage laboratories & test facilities.

Reference Books:

1) High Voltage Engineering: Fundamentals by E.Kuffel, W.S.Zaengl, J.Kuffel by Elsevier, 2nd Edition
2) High Voltage Insulation Engineering by Ravindra Arora, Wolfgang Mosch, New Age International (P) Limited, 1995.
3) High Voltage Engineering, Theory and Practice by Mazen Abdel Salam, Hussein Anis, Ahdan El-Morshedy, RoshdyRadwan, Marcel Dekker

Text Books:

1. Kamaraju V. & Naidu M. S., 'High Voltage Engineering', Tata-McGraw Hill

2. C. L. Wadhwa, "High Voltage Engineering", New Age International Pvt. Ltd

BTEEC703: ELECTRICAL DRIVES	
Teaching Scheme:	Examination Scheme:
Theory: 3hr	Mid-term Test: 20 Marks
Tutorial: 0	Internal Assessment: 20 Marks
Total Credits: 3	End Term Exam: 60 Marks

Pre requisite : Electrical machine-II, Power Electronics

Course objective :

Students will be able to understand the dynamics of drive system.
Students will be able to use various methods of speed control of AC and DC Drive.
Students will be have the ability to analyze the drive system
Students will be able to select proficiently and the proper drive system for particular application.
Students will be able to have basic knowledge of recent advancement in Electric Drive.

Course outcomes:

Analyze the dynamics of Electrical Drives system.
Use various control techniques for controlling the speed of AC and DC motors.
Analyze the AC and DC drives.
To Select/recommend the appropriate Drive according to the particular applications.
State the recent technology of AC and DC drive

UNIT I: . INTRODUCTION (8hr)

Advantages of Electrical Drives, Parts of Electrical drive, Choice of Electric drives Dynamics of Electrical drives: fundamental torque equations, multiquadrant operation, nature and classification of load torques, steady state stability, concept of load equalization in drives

UNIT II. .CONTROL OF ELECTRICAL DRIVES (6hr)

Modes of operation: Steady state, Acceleration, Deceleration, Drive classification. Closed loop control of drives : Current limit control, torque control, speed control, position control, Control of multi motor drives, speed sensing, current sensing, Classes of motor duty & criteria for selection of motor.

UNIT III. DC MOTOR DRIVES (7hr)

Review of basic characteristics of DC motors, Single phase drives : Single phase half wave converter drives, semi converter drives, Full converter drives, Dual converter drives. Three phase drives : Three phase half wave drives, semi-converter drives, full converter drives, dual-converter drives, DC-DC converter drives: Principle of Rheostatic and regenerative braking control, combined control, two and four quadrant DC-DC converter fed drives. Introduction to closed loop control of DC drives.

UNIT IV: INDUCTION MOTOR DRIVES (7hr)

Review of starting, braking and speed control of three phase induction motors, Stator voltage control, Rotor voltage control, frequency control, Voltage and frequency control, Current control, Closed loop control of Induction motors, Principle of Scalar and Vector control of Induction motor, Multiquadrant operation of induction motor drives fed from Voltage Source Inverters. Static rotor resistance control method, static slip power recovery control-Static Scherbius drive and StaticKramer drive.

UNIT V: SYNCHRONOUS MOTOR DRIVES (6hr)

Review of starting, pull in and braking of Synchronous motor,Static variable frequency control for Synchronous motors,Load commutated inverter fed Synchronous motor drive, Introduction to closed loop control of Load commutated inverter fed Synchronous motor drive.

UNIT VI: DRIVES FOR SPECIFIC APPLICATIONS (6hr)

Textile Mill: various stages and drive requirements control of ac motors for controlling torque. Steel Rolling Mill : reversing and continuous hot and cold rolling mills, Drive requirements, motors for mill drive. Cement mill : Stages in cement production, requirements of mill motors, Kiln drives, crusher drives, fan/blower drives, compressor drive. Sugar Mill : Requirements for various drive motors, selection of motors for various processes

Ref Books:

1. Dubey G. K., “Fundamentals of Electrical Drives”, Narosa Publishing house
2. De N. K., Sen P. K., “Electric Drives”, Prentice Hall of India
3. VedamSubramanyam, “Electrical Drives and Control”, TMH Publications

BTEEE704A: SPECIAL PURPOSE ELECTRICAL MACHINES	
Teaching Scheme:	Examination Scheme:
Theory: 3hr	Mid-term Test: 20 Marks
Tutorial: 0	Internal Assessment: 20 Marks
Total Credits: 3	End Term Exam: 60 Marks

Prerequisite:

AC Machines and DC Machines

Course Objectives:

To impart knowledge on Construction, principle of operation and performance of synchronous reluctance motors, stepping motors, switched reluctance motors, Permanent magnet brushless D.C. motors , Permanent magnet synchronous motors.

Course Outcome:

After Completion of this Course, student will be able

1. Demonstrate construction, working principle, and application of various types of special purpose electrical machines
2. Select a special Machine for a particular application
3. Demonstrate behaviour of induction generator and induction machine.

UNIT I. SYNCHRONOUS RELUCTANCE MOTORS (6hr)

Constructional features , Types – Axial and radial air gap motors – Operating principle – Reluctance – Phasor diagram - Characteristics – Vernier motor.

UNIT II. STEPPING MOTORS (6hr)

Constructional features – Principle of operation – Variable reluctance motor – Hybrid motor – Single and multi stack configurations – Theory of torque predictions – Linear and non-linear analysis – Characteristics – Drive circuits.

UNIT III. SWITCHED RELUCTANCE MOTORS (6hr)

Constructional features – Principle of operation – Torque prediction – Power controllers – Non-linear analysis – Microprocessor based control - Characteristics – Computer control.

UNIT IV. PERMANENT MAGNET BRUSHLESS D.C. MOTORS (8hr)

Principle of operation – Types – Magnetic circuit analysis – EMF and torque equations – Power controllers – Motor characteristics and control.

UNIT V. PERMANENT MAGNET SYNCHRONOUS MOTORS (8hr)

Principle of operation – EMF and torque equations – Reactance – Phasor diagram – Power controllers - Converter - Volt-ampere requirements – Torque speed characteristics - Microprocessor based control.

UNIT VI. INDUCTION MACHINES (6hr)

Induction generator–self excitation requirement – voltage regulation – different methods of voltage control –doubly fed induction machine – generation operating mode– linear Induction Motor

Text Books:

1. K.Venkataratnam, Special Electrical Machines, Universities Press (India) Private Limited, 2008.
2. T. Kenjo, Stepping Motors and Their Microprocessor Controls, Clarendon Press London, 1984
3. E.G. Janardanan, Special electrical machines, PHI learning Private Limited, Delhi, 2014.

References:

1. R.Krishnan, Switched Reluctance Motor Drives – Modeling, Simulation, Analysis, Design and Application, CRC Press, New York, 2001.
2. T. Kenjo and S. Nagamori, Permanent Magnet and Brushless DC Motors, Clarendon Press, London, 1988.
3. T.J.E.Miller,Brushless Permanent-Magnet and Reluctance Motor Drives, Oxford University Press, 1989.
4. R.Srinivasan, Special Electrical Machines, Lakshmi Publications, 2013.

BTEEE704B: ELECTRIC TRACTION & UTILIZATION	
Teaching Scheme:	Examination Scheme:
Theory: 3hr	Mid-term Test: 20 Marks
Tutorial:	Internal Assessment: 20 Marks
Total Credits:3	End Term Exam: 60 Marks

Prerequisite:

- Basics of Electrical Engineering and Electrical Machine-II.

Course Objectives:

1. To possess knowledge of advanced and emerging topics in traction mechanism and illumination engineering and their applications in the field.
2. An ability to design a traction system, a component, to meet desired needs of locomotive industry within realistic constraints and confirms manufacturability, and sustainability.
3. To mold students professionally to possess in-depth and advanced knowledge by course contents along with emerging topics.

Course Outcomes:

After Completion of this Course, student will be able to

1. Identify types of Traction System.
2. Interprete Various Power supply in Electric Traction.
3. Analyze Various Traction Motors.
4. Define methods of Traction motor Control.
5. Elobrate Train movement & Breaking in Traction system.
6. Classify the indoor and outdoor Illumination system.

UNIT I: ELECTRIC TRACTION SYSTEM: (8hr)

Electrical transmission: Electrical transmission system employing D.C. generator D.C. series motor, Electrical transmission system employing 3 phase alternator supplying D.C. traction motors, electrical transmission employing 3 phase alternator supplying induction motors, Choice of traction system-battery drive, hybrid drive, flywheel drive, tramways, trolley bus. Track electrification: D.C. System, single phase low frequency A.C. system, single phase high frequency A.C. system, 3 phase A.C. system and composite system.

UNIT II: POWER SUPPLY FOR ELECTRIC TRACTION: (6hr)

Current collection system, current collectors for Over Head Systems, Overhead construction for Tramways and trolley buses and railways, Sag and Tension calculation for a trolley wire, Traction substations, location of substations, feeding and distributing system, substation equipment's. Block Diagram of AC Electric locomotive, Signaling interference in tele-communication circuits.

UNIT III: TRACTION MOTORS: (6hr)

Characteristics of traction motors, straight D.C. series motor, suitability of series motor for traction duty, constructional details of D.C. Traction Motors, Series motor using undulating D.C, suitability of shunt motor for traction duty, single phase series motors, Repulsion motor, compensated repulsion motor, Induction motor with variable frequency with SCR, Linear Induction motor.

UNIT IV: TRACTION CONTROL: (6hr)

Traction control: Duty cycle, Methods of traction motor control, series-Parallel and other types of controllers, use of interlocks, run back prevented, multiple unit control, Master controllers, Reverses, Dead man's handle, use of Metaldyne and Megavolt.

UNIT V: TRAIN MOVEMENT AND BRAKING: (8hr)

Speed time curve, its analysis and construction, schedule speed and factors affecting it, train resistance and its components. Tractive effort calculations, average acceleration and speed, energy output and consumption.

Braking: Mechanical versus electric breaking, rheostatic braking, Regenerative braking, method and energy saved in the process, Magnetic track brakes.

UNIT VI: ILLUMINATION: (6hr)

Requirement of good lighting, Classification of light fitting & luminaries, factors to be considered for design of indoor & outdoor lighting scheme, Design Procedure for factory lighting, street lighting.

Reference Books:

1) Utilization of Electrical Power and Electic Traction by J.B. Gupta. (Katson Book publisher)
2) H. Partab: Modern Electric Traction, Dhanpat Rai & sons.
3) Upadhayay J. & Mahindra S.N., Electric Traction, Allied Publishers Ltd., 1st Ed.
4) Rao P.S., Principle of 25 KV Overhead Equipments. R. (Nasik) Printpack Pvt Ltd,, 1st Ed.
5) Electric Traction for Railway Trains, by Edward P. Burch. McGraw Hill Book Co. Inc.
6) C.L.Wadhwa, "Generation, Distribution and Utilization of Electrical Energy", New Age International Publishers.

BTEEE704C: ENGINEERING SYSTEM DESIGN OPTIMIZATION	
Teaching Scheme:	Examination Scheme:
Theory: 3hr	Mid-term Test: 20 Marks
Tutorial:	Internal Assessment: 20 Marks
Total Credits: 3	End Term Exam: 60 Marks

Pre requisite: Linear Algebra, Non-linear Problems

Course Outcome:

1. To understand different level optimization problem formulation.
2. To study novel methods in optimization.
3. To understand and develop genetic algorithm for engineering problems.

UNIT I: INTRODUCTION (8hr)

Introduction to Optimization problem formulation, optimization algorithms, applications and examples, different optimization methods available

UNIT II: SINGLE VARIABLE OPTIMIZATION (6hr)

Optimization criteria, bracketing methods– Exhaustive search method, bound phase method, Region Elimination methods– Fibonacci search method, Golden search method, Gradient based methods– Newton Raphson method, Bisection method, Root finding using optimization technique

UNIT III: MULTI OBJECTIVE OPTIMIZATION (6hr)

Optimization criteria, Different search methods, Unidirectional search, Direct search method – Evolutionary optimization method, Powell's conjugate direction method, Gradient based methods– Newton's method and Variable metric method.

UNIT IV: SPECIALIZED METHODS (6hr)

Integer programming, Geometric programming, simulated annealing, Global optimization using - steep descent method, simulated annealing.

UNIT V: GENETIC ALGORITHMS AND EVOLUTIONARY APPROACHES (6hr)

Differences and similarities between genetic algorithms and traditional techniques, operators of GA's, Computer program for simulated annealing, Newton Raphson method, Evolutionary optimization method.

References

1. Kalyanmoy Deb, "Optimization for Engineering design", Prentice Hall,India, 2005.
2. Kalyanmoy Deb, "Multi objective optimization using Evolutionaryalgorithms", John Wiley,2001

BTEEE704D: FINANCIAL MANAGEMENT	
Teaching Scheme:	Examination Scheme:
Theory: 3hr	Mid-term Test: 20 Marks
Tutorial:	Internal Assessment: 20 Marks
Total Credits:3	End Term Exam: 60 Marks

Course Objectives:

• To help the students to develop cognizance of the importance of Financial Management in corporate valuation

• To enable students to describe how people analyze the corporate leverage under different conditions and understand why people valuate different corporates in different manner.

• To provide the students to analyze specific characteristics of Supply Chain Industry and their future action for cash flow

• To enable students to synthesize related information and evaluate options for most logical and optimal solution such that they would be able to predict and control Debt Equity incurrence and improve results.

Course Outcomes: At the end of this course students will demonstrate the ability to

1. The students would be able to understand and define basic terminology used in finance and accounts
2. The students would be able to prepare& appraise Financial Statements and evaluate a company in the light of different measurement systems.
3. The students would be able to analyze the risk and return of alternative sources of financing.
4. Estimate cash flows from a project, including operating, net working capital, and capital spending.
5. To estimate the required return on projects of differing risk ,to estimate the cash flows from an investment project, calculate the appropriate discount rate, determine the value added from the project, and make a recommendation to accept or reject the project
6. To describe and illustrate the important elements in project finance Using financial calculator and Excel in a variety of problems.

UNIT I: INTRODUCTION

Introduction to Financial Accounting, Book keeping & Recording: Meaning, Scope and importance of Financial Accounting. Financial Accounting - concepts and conventions, classification of accounts, Rules and principles governing Double Entry Book-keeping system, Meaning, Preparation of Journal, Ledger , Cash book & Trial balance.

UNIT II: FINANCIAL STATEMENT PREPARATION, ANALYSIS & INTERPRETATION

Preparation of financial statement and Profit & Loss Account, Balance Sheet. , Ratio Analysis - classification of various ratios.

UNIT III: INTRODUCTION TO FINANCIAL MANAGEMENT

Concept of business finance, Goals & objectives of financial management, Sources of financing, Long Term financing- shares, debentures, term loans, lease & hire purchase, retained earnings, public deposits, bonds (Types, features & utility). Short Term Financing- bank finance, commercial paper, trade credit

UNIT IV: WORKING CAPITAL MANAGEMENT

Concept of working Capital, significance, types. Adequacy of working capital, Factors affecting working capital needs, financing approaches for working capital, Methods of forecasting working capital requirements, Methods of Forecasting.

UNIT V: TIME VALUE OF MONEY & CAPITAL BUDGETING

Concept of time value of money, Compounding & discounting; Future value of single amount & annuity, present value of single amount & annuity; Practical application of time value technique. Capital budgeting - Nature and significance, techniques of capital budgeting –Pay Back Method, Accounting rate of return, Internal Rate of Return, DCF, Net Present Value and profitability index.

UNIT VI: PROJECT FINANCING

Details of the company, its promoters and project finances required, profitability etc., Loan documentation-Appraisal of terms loans by financial institutions. Basic components of project finance.

TEXT & REFERENCE BOOKS:

1. Financial Management by Khan & Jain, Text, Problem & Cases, Tata McGraw Hill Publication 5th Edition.
2. Tulsian Financial Management by Dr. P.C.Tulsian, S Chand Publication 5th Edition.
3. Taxman's Financial Management by Ravi M. Kishore, Taxmann 2017 Edition.
4. A Textbook of Financial , Cost & Management Accounting by Dr.P.Pariasamy, Himalaya Publishing House
5. Fundamentals of financial Management by Bhabhtosh Banerjee, PHI publication, 2nd Edition.

BTEEE705A: DIGITAL SIGNAL PROCESSING	
Teaching Scheme:	Examination Scheme:
Theory: 3hr	Mid-term Test: 20 Marks
Tutorial:	Internal Assessment: 20 Marks
Total Credits:3	End Term Exam: 60 Marks

Prerequisite:

Digital Systems, Interfacing, Z-Transform, Fourier Transform

Course Objectives:

To understand the design and implementation of digital Signal processing systems

Course Outcomes:

After Completion of this Course, student will be able to

1. Represent signals, systems and digital processing of analog signals.
2. Represent discrete time signals, systems and analysis of Discrete-Time Linear Time-Invariant Systems.
3. Apply digital signal processing techniques to analyze discrete time signals in time domain.
4. Apply digital signal processing techniques to analyze discrete time signals in frequency domain.
5. Design different filter structure
6. Validate system functionality and evaluate results.

UNIT I: INTRODUCTION TO DIGITAL SIGNAL PROCESSING (8 hr)

Signals, Systems and Signal Processing: Basic Elements of a Digital Signal Processing System, Advantages of Digital over Analog Signal Processing.

Classification of Signals: Multichannel and Multidimensional Signals, Continuous-Time versus Discrete-Time Signals, Continuous-Valued Versus Discrete-Valued Signals, Deterministic Versus Random Signals.

The Concept of Frequency in Continuous-Time and Discrete-Time Signals: Continuous-Time Sinusoidal Signals, Discrete-Time Sinusoidal Signals, Harmonically Related Complex Exponentials.

Analog-to-Digital and Digital-to-Analog Conversion: Sampling of Analog Signals, the Sampling Theorem, Quantization of Continuous-Amplitude Signals, Quantization of Sinusoidal Signals, Coding of Quantized Samples, Digital-to-Analog Conversion, Analysis of Digital Signals and Systems versus Discrete-Time Signals and Systems.

UNIT II: DISCRETE-TIME SIGNALS AND SYSTEMS (8 hr)

Discrete-Time Signals: Some Elementary Discrete-Time Signals, Classification of Discrete-Time Signals, Simple Manipulations of Discrete-Time Signals.

Discrete-Time Systems: Input-Output Description of Systems, Block Diagram Representation of Discrete-Time Systems, Classification of Discrete-Time Systems, Interconnection of Discrete-Time Systems.

Analysis of Discrete-Time Linear Time-Invariant Systems: Techniques for the Analysis of Linear Systems, Resolution of a Discrete-Time Signal into Impulses, Response of LTI Systems to Arbitrary Inputs: The Convolution Sum, Properties of Convolution and the Interconnection of LTI Systems, Causal Linear Time-Invariant Systems, Stability of Linear Time-Invariant Systems, Systems with Finite-Duration and infinite-Duration Impulse Response.

Discrete-Time Systems Described by Difference Equations: Recursive and Nonrecursive Discrete-Time Systems, Linear Time-Invariant Systems Characterized by Constant-Coefficient Difference Equations, Solution of Linear Constant-Coefficient Difference Equations, The Impulse Response of a Linear Time-Invariant Recursive System

UNIT III: Z-TRANSFORM AND ITS APPLICATION TO THE ANALYSIS OF LTI SYSTEMS (6 hr)

Z-Transform: Direct z-Transform, Inverse z-Transform. Properties of z-transform. Rational z-Transforms: Poles and Zeros. Pole Location and Time-Domain Behavior for Causal Signals, System Function of a Linear Time-Invariant System. Inversion of the z-Transform: Inverse z-Transform by Contour Integration, Inverse z-Transform by Power Series Expansion, Inverse z-Transform by Partial-Fraction Expansion, Decomposition of Rational z-Transforms, One-sided z-Transform: Definition and Properties, Solution of Difference Equations.

UNIT IV: FREQUENCY ANALYSIS OF SIGNALS AND SYSTEMS (4 hr)

Properties of the Fourier Transform for Discrete-Time Signals: Symmetry Properties of the Fourier Transform, Fourier Transform Theorems and Properties.

UNITV:DISCRETE FOURIER TRANSFORM: PROPERTIES AND APPLICATIONS (8 hr)

Frequency Domain Sampling: The Discrete Fourier Transform: Frequency-Domain Sampling and Reconstruction of Discrete-Time Signals, Discrete Fourier Transform (DFT), DFT as a Linear Transformation, Relationship of the DFT to Other Transforms. Properties of the DlT: Periodicity. Linearity and Symmetry Properties, Multiplication of Two DFTs and Circular Convolution, Additional DFT Properties.

UNIT VI: IMPLEMENTATION OF DISCRETE- TIME SYSTEMS (6 hr)

Structures for the Realization of Discrete-Time Systems. Structures for FIR Systems: Direct-Form Structure, Cascade-Form Structures, Frequency-Sampling Structures, Lattice Structure.

Structures for IIR Systems: Direct-Form Structures, Signal Flow Graphs and Transposed Structures, Cascade-Form Structures, Parallel-Form Structures, Latticc and Lattice-Ladder Structures for IIR Systems.

Reference Book:

1) John G. Proakis, Dimitris G.Manolakis, “Digital Signal Processing”.
2) Shalivahanan, Vallavaraj and Gnanapriya, “Digital Signal Processing”

Text Book:

1) N.G.Palan, “Digital Signal Processing”
2) Ramesh Babu, “Digital Signal Processing”
3) Alon V. Oppenhelm, “Digitsl Signal Processing”, PHI Pub.
4) S.K.Mitra, “Digital Signal Processing”, TMH Pub.

BTEEE705B: ENERGY AUDIT AND CONSERVATION	
Teaching Scheme:	Examination Scheme:
Theory: 3hr	Mid-term Test: 20 Marks
Tutorial:	Internal Assessment: 20 Marks
Total Credits:3	End Term Exam: 60 Marks

Pre Requisite:

Basics of Electrical Machines, Power Plant Engineering

Course Objectives:

1. To understand the basic process involved in the energy audit and the terminologies associated in the process.
2. To be able to develop audit reports of any firm including large and small scale industries, residential and commercial establishments.
3. To select and comment on the appropriate method for the planning and monitoring of any energy conservation project.

Course Outcomes:

After Completion of this Course, student will be able

1. To recognize Global Environmental Issues and Role of Renewable & non-conventional energy sources
2. To estimate Energy efficiency opportunities in Thermal- Mechanical Systems and Electrical System.
3. To analyze Energy Conservation Proposals economically and prepare audit reports.

UNIT I: SOURCES OF ENERGY: (6hr)

Energy resources, Stored & running resources, Environmental Concerns – Global Warning , Depletion of Ozone layer, Kyoto Protocol, UNFCCC, CDM, Carbon Emissions, Role of Renewable Energy Sources

UNIT II: (7hr)

Energy Conservation Act 2001, Designated Consumers, Energy Policy, BEE and its role in Energy Conservation, Energy Audit – Need, Types , Methodology, Steps involved in Energy Audit, Energy Costs and Benchmarking , Measurements for Energy Audit, Energy Management Duties and Responsibilities.

UNIT III: THERMAL MECHANICAL SYSTEMS (8hr)

Boiler Efficiency by direct and indirect methods, Energy efficiency opportunities in boilers, HVAC, and refrigeration systems, compressed air systems, pumps, cooling towers, fans and blowers, Cogeneration – Need and Principle , Prime movers for cogeneration, Waste heat recovery systems – Recuperators, economizer heat recovery boilers.

UNIT IV: ELECTRICAL SYSTEMS **(7hr)**

Utilities: Energy conservation in generation, transmission,distribution & utilization, Electrical billing , load management ,maximum demand control, APFC Panel , PF improvement and benefits , Energy Efficient motors and starter, lightning systems, Electronic Ballast

UNIT V: **(6hr)**

Planning, Implementation & monitoring of energy conservation project, Time Value of money, Financial Investment – Simple payback period, ROI (Return on Investment), Net Present value, Internal rate of return, profitability index. All calculations and numerical interpretation.

UNIT VI: **(6hr)**

Case studies on various industrial sectors like Steel Plant, Thermal Plant, Industries Building and Commercial Establishments and preparing audit reports

Text Books:

1. "Industrial Energy Conservation" Charles M Gottschalk ,John Willey and Sons
2. "Energy Management" Paul O Callagham, Tata Mc Grawhill
3. "Energy Technology" – S Rao and B Parulekar , Khanna Publisher

References:

1. "Energy Management Handbook" – Wayne C Turner

BTEEE705C: ELECTRICAL POWER QUALITY	
Teaching Scheme:	Examination Scheme:
Theory: 3hr	Mid-term Test: 20 Marks
Tutorial:	Internal Assessment: 20 Marks
Total Credits:3	End Term Exam: 60 Marks

Prerequisite:

1. Basic Electrical concepts
2. Power Electronics concepts
3. Power system concepts

Course Objectives:

1. To study the various power quality issues, their production, monitoring and mitigation.
2. To study the various power quality standards.
3. To study various power quality monitoring methods.
4. To apply appropriate solution techniques for power quality Problems.

Course Outcome:

After Completion of this Course….

1. Student will be able to get the in-depth understanding of power quality issues & standards.
2. Students will be able to understand working of power quality improving Equipment's.

UNIT I: INTRODUCTION (7hr)

Understanding Power quality, definitions, growing concerns to Power Quality, Evaluation Procedure,General Classes of Power Qualitydisturbances, causes and effects of Power Quality disturbances

UNIT II: TRANSIENT OVER VOLTAGES (7hr)

Sources, causes and effects, Principle of Overvoltage protection and solutions. VoltageSag and Interruptions: causes and effects, estimation of voltage sag performance, principle ofprotection and solutions.

UNIT III: LONG-DURATION VOLTAGE VARIATIONS (7hr)

Long Duration Voltage variations, principles of regulating voltage Devices for voltage regulation, flickers, flicker sources and mitigation, quantifying flicker.

UNIT IV: FUNDAMENTALS OF HARMONICS **(7hr)**

Harmonic distortion, sources of harmonics, effects of harmonic distortion, Voltage Vs Current Harmonics,Active, Reactive, Volt-Amp power under non sinusoidal conditions, Harmonic Indices (THD and TDD),principles of harmonic control, mitigating devices, interharmonics, IEEE standard 519.

UNIT V: WIRING AND GROUNDING **(4hr)**

Reasons for Grounding, wiring and grounding problems and solutions

UNIT VI: POWER QUALITY MONITORING **(7hr)**

Monitoring Considerations, site survey, Monitoring Quality, monitoring location, PQ measuringinstruments, assessment of power quality measurement data, IEEE 1159 Standard. Impact of poor power quality on Reliability Indices.

References/Books:

1.Chattopadhyay, Surajit, Mitra, Electric Power Quality, Springer.
2.Haytt G. T., ―Electric Power Quality‖, Stars In Circle Publication.
3. NPTEL courses
   a) NOC:Power Quality Improvement Technique, IIT Roorkee by Avik Bhattacharyya.
   b) Power Quality in Power Distribution Systems, IIT Madras by Dr. Mahesh Kumar.

BTEEE705D: HVDC TRANSMISSION AND FACTS	
Teaching Scheme:	Examination Scheme:
Theory: 3hr	Mid-term Test: 20 Marks
Tutorial:	Internal Assessment: 20 Marks
Total Credits: 3	End Term Exam: 60 Marks

Pre requisite: Power System-II, Power Electronics

Course Outcome:

1. To understand importance, configuration and types of HVDC transmission.
2. To analyst the operation of HVDC converter, system control and protection.
3. To understand the concept of FACTS, their role, type and functionality.
4. To analyze the operation of static series and shunt compensator.

UNIT I: DC POWER TRANSMISSION FUNDAMENTALS (8hr)

Introduction, Economics of Dc Power transmission, comparison with AC system, Types of DC links, major components of converter station, planning of HVDC system.

UNIT II: HVDC CONVERTER (6hr)

Choice of converter configuration, analysis of Gratz circuit with and without overlap, working of converter as rectifier and inverter, equivalent circuit for HVDC link

UNIT III: HVDC SYSTEM CONTROL (6hr)

HVDC System Control: Principles of DC link control, converter control characteristics, firing angle control, current and extinction angle control, Starting and stopping of HVDC link

UNIT IV: CONVERTER FAULTS AND PROTECTION (6hr)

Converter Faults and Protection: Types of faults-commutation failure, Arc through, Misfire, short circuit in bridge, Over current and over voltage protection, Detection of line faults, Principle of DC circuit interruption, DC breakers, Types and characteristics of DC breakers, effects of proximity of AC and DC transmission lines.

UNIT V: FACTS CONCEPT AND GENERAL SYSTEM CONSIDERATIONS (6hr)

Transmission Interconnections, Flow of Power in an AC System, Loading Capability limits, Power Flow and Dynamic Stability Considerations of a Transmission Interconnection, Relative Importance of Controllable Parameters, Basic types of FACTS Controllers, Description and Definitions of FACTS Controllers, Benefits from FACTS Technology, Comparison between HVDC & FACTS.

UNIT VI: STATIC SHUNT COMPENSATORS (6hr)

Static Shunt Compensators: Objective of shunt compensation, Methods of Controllable VAR Generation, Static VAR Compensators: SVC and STATCOM, Comparison of SVC and

STATCOM, Static VAR Systems (SVS)Static Series Compensation: Objective of series compensation, Variable Impedance Type Series Compensators, Switching Converter Type Series Compensators

References

1. Padiyar K. R., “HVDC Power Transmission Systems”, New Age International.
2. Kimbark, “ HVDC Transmission”, John Willey AndSons.
3. Hingorani N. G., “ Understanding FACTS”, IEEE Press2001
4. Yong Hua Song, ‘ Flexible AC transmission systems(FACTS)’IEEE

BTEEL706: POWER SYSTEM OPERATION AND CONTROL LAB	
Teaching Scheme:	Examination Scheme:
Practical: 2hr	Continuous Assessment: 30 Marks
Total Credits: 1	End Term Exam: 20 Marks

Sr. No.	List of the Experiment
1	Write a program for economic dispatch in power systems using
2	Simulation of Automatic voltage regulator using MATLAB.
3	Write a program to compute the voltage and power factor for a given system using MATLAB.
4	Write a program to solve Swing Equation by Classical Method.
5	Write a program to plot power angle curve of synchronous machine using MATLAB.
6	Write a program to solve the given Equal Area Criteria problem using MATLAB.
7	To demonstrate the Excitation System for Synchronous machine using MATLAB
8	Simulation of single area load frequency control using MATLAB.

BTEEL707: HIGH VOLTAGE ENGINEERING LAB	
Teaching Scheme:	Examination Scheme:
Practical: 2hr	Continuous Assessment: 30 Marks
Total Credits: 1	End Term Exam: 20 Marks

Sr. No.	List of Experiment
1	Study of Faraday Cage for HV labs.
2	Study of Standard HV Laboratory layouts.
3	One min. (1-min.) DC high voltage withstand test on Equipment. (Max. up to 10 KV).
4	Effect of gap length on liquid insulating material.
5	Breakdown Strength of composite dielectric material.
6	Study of impulse generator.
7	High voltage withstand test on cables/safety gloves/shoes, as per IS. (Max. 2.25 KV DC)
8	Horn gap arrangement as surge diverter.
9	Measurement audible and visible corona inception and extinction voltage
10	Development of tracks and trees on polymeric insulation.
11	Study of Effect of EHV field on Human, Animals & Plants.

BTEEL708: ELECTRICAL DRIVES LAB	
Teaching Scheme:	Examination Scheme:
Practical: 2hr	Continuous Assessment: 30 Marks
Total Credits: 1	End Term Exam: 20 Marks

Pre requisite	Basic electronics engineering, basic electronics engineering Course
Course Outcome	• Efficiently use various AC and DC drive. • Simulate various drive system
Sr.No	List of Experiments
1	Study the ramp comparator firing circuit.
2	Study of single phase half wave converter and semi converter DC Drive .
3	Study of single phase full controlled converter (Bridge converter) DC Drive.
4	Speed control of DC motor using chopper.
5	Simulation of single phase half wave and semiconductor controlled DC drive.
6	Simulation of chopper fed DC Drive .
7	Study of AC Drive .
8	Study of V/f control of AC drive
9	Study the inverter fed induction motor drive.
10	Simulation of AC drive .

BTEES709: SEMINAR	
Teaching Scheme:	Examination Scheme:
Practical: 2hr	Continuous Assessment: 30 Marks
Total Credits: 1	End Term Exam: 20 Marks

Student shall choose a topic of his/her interest in consultation with faculty in the department. The topic for seminar may be related to Recent Developments in Instrumentation Engineering area and/or interdisciplinary area. Student shall attempt to collect necessary information and present a summary indicating comprehension of the topic and acquired depth of knowledge. A brief report on topic of seminar shall be submitted. Evaluation shall be based on report and power point presentation.

BTEEP710: PROJECT PART-I	
Teaching Scheme:	Examination Scheme:
Practical: 6hr	Continuous Assessment: 30 Marks
Total Credits: 3	End Term Exam: 20 Marks

Term work shall consist of detailed report for chosen topic and output of final working proposed. Report shall summarize the literature survey, spell out the scope of work, methodology and results. Viva-voce Examination shall be based on work carried out by the student. In case of students opting for Internship in the eighth semester, the Project may be industry-based.

BTEEF711: FIELD TRAINING/INTERNSHIP/INDUSTRIAL TRAINING III	
Teaching Scheme:	Examination Scheme:
Practical: --	Continuous Assessment: --
Total Credits: 1	End Term Exam: 50 Marks

Students are expected to undergo industrial training for at least four weeks at factory / design offices or in combination of these after VI semester. Training session shall be guided and certified by qualified engineer / industry expert. A neat detailed report on activities carried out during training is expected. Students should undergo training in Summer Vacation after Semester VI and appear at examination in Semester VII. A brief report of industrial training shall be submitted. Evaluation shall be based on report and power point presentation.

POWER MANAGEMENT INTEGRATED CIRCUITS	
Teaching Scheme:	Examination Scheme:
Theory: 3hr	Mid-term Test: 20* Marks
Total Credits: 3	Internal Assessment: 20* Marks
	End Term Exam: 60* Marks

Prof. Qadeer Ahmad Khan | IIT Madras
Course Duration: 12 weeks

CourseOutline:

This course is intended to develop understanding of why power management circuits are needed in a VLSI system, what are the different components of a power management system with focus on voltage regulators. By the end of this course, students should be able to understand the concept behind power management circuits and design a linear (LDO) and switching regulator (dc-dc converter) for a given specifications using behavioral and circuit level simulators.

Course Plan:

Week 1 : Introduction to Power Management - Application, Need, Discrete vs. Integrated PMIC; DC-DC Converters, Types of DC-DC Converters, Linear versus Switching Regulator, Choosing between Linear and Switching Regulators, Choosing the Type of Regulator in a Multi-Chip System; Performance Parameters - Efficiency, Accuracy, Line and Load Regulation, Line and Load Transient, PSRR; Remote versus Local Feedback, Point-of-Load Regulator, Kelvin Sensing, Droop Compensation; Current Regulators and their Applications; Bandgap Voltage Reference - Designing a Bandgap Reference using PTAT and CTAT Voltage References, Brokaw Bandgap Circuit.

Week 2: Sub-1-volt Bandgap Reference; Introduction to Linear Regulator, Applications of Linear Regulator; Review of Feedback Systems and Bode Plots, Loop Gain AC Analysis, Stability Criterion and Phase Margin, Review of First-Order and Second-Order Systems, Relationship between Damping Factor and Phase Margin; Parasitic Capacitances in a MOS transistor, Finding the Poles of the Error Amplifier; Stabilising a Linear Regulator - Frequency Compensation Techniques, Dominant Pole Compensation.

Week 3 : Miller Compensation, R.H.P. zero due to Miller Compensation, Intuitive Methods of Determining Poles and Zeros after Miller Compensation, Pole Splitting due to Miller Compensation, Reducing the Effect of R.H.P. zero; LDO with NMOS Pass Element; Load Regulation and Output Impedance of LDO; Line Regulation and PSRR of LDO; Sources of Error in a Regulator, Static Offset Correction, Dynamic Offset Cancellation.

Week 4 : Digital LDO, Avoidance of Limit-Cycle Oscillations in a Digital LDO, Hybrid LDO; Short-Circuit Protection and Foldback Current Limit in an LDO; Basic Concept of a Switching Regulator, Inductor volt-second Balance, Power Stage of a Buck Converter and Calculation of Duty Cycle; Transformer Model of a Buck Converter, Resistive Losses, Efficiency of a Switching Regulator, Efficiency considering only Conduction Losses; Synchronous and Non-Synchronous Switching Converters; PWM Control Techniques (Voltage-Mode and Current-

Mode Control); Losses in Switching DC-DC Converter- Conduction Loss, Gate-Driver Switching Loss, Segmented Power FETs, Dead-Time Switching Loss.

Week 5 : Hard Switching Loss, Magnetic Loss, Relative Significance of Losses as a Function of the Load Current; Inductor Current Ripple and Output Voltage Ripple in a DC-DC Converter, Ripple Voltage versus Duty Cycle, Ripple Voltage versus Input Supply Voltage; Choosing the Inductor and Capacitor of a Buck Converter; Continuous and Discontinuous Conduction Modes - Boundary Condition, Voltage Conversion Ratio in DCM; Concept of Pulse Frequency Modulation (PFM); Classification of Pulse Width Modulators -- Trailing, Leading and Dual-Edge PW Modulators; Control Techniques for DC-DC Converters; Voltage Mode Control, Small-Signal Modeling of a DC-DC Converter, Loop Gain and Stability Analysis using Continuous-Time Model.

Week 6 : Compensating a Voltage-Mode-Controlled Buck Converter; Designing Type-I (Integral), Type-II (PI) and Type-III (PID) Compensators; Implementation of Compensators using Op Amp-RC and Gm-C Architectures, Finding Compensation Parameters; Design Examples with Simulation Demonstrations.

Week 7 : Designing Type-III Compensator using Gm-C Architecture and Design Example; Ramp Generator with Feed-Forward Line Compensation, Loop Gain Compensation via Gm-modulation; Designing a Buck Converter - Power Loss Budgeting, Sizing of Power FETs, Estimation of Switching Losses and Choice of Switching Frequency, Choosing the External Passive Components (L and C); Choice of C in Relation to Factors that Limit the Load Transient Response; Inductor and Capacitor Characteristics, Reducing the Effect of Capacitor ESL.

Week 8 : Designing the Gate-Driver (Gate Buffer and Non-Overlap Clock Generator), Designing the Ramp Generator in a Pulse-Width Modulator, Design Considerations of the Error Amplifier; Delays Associated with Pulse-Width Modulators; PFM/PSM for Light Load, Using PSM in CCM to Avoid Duty Cycle Saturation; DCM Operation using an NFET; Designing a Zero-Cross Detector/Comparator; Introduction to Current Mode Control; Peak, Valley and Average CMC; Sub-Harmonic Oscillations, Avoiding Current Loop Instability via Slope Compensation in a Current-Mode-Controlled Buck Converter.

Week 9 : Non-Linear Control Techniques for DC-DC Converters; Hysteretic Control - Stability Issues due to Phase Shift between Inductor Current and Capacitor Voltage; Voltage-Mode versus Current-Mode Hysteretic Control, Stabilising a Voltage-Mode-Controlled Hysteretic Converter using R_esr, Relation between Hysteresis Window and Switching Frequency, Using R-C Circuit as Ripple Generator in a Current-Mode-Controlled Hysteretic Converter, Hybrid Voltage-Mode and Current-Mode Hysteretic Control, Fixed-Frequency Hysteretic Control, Effect of Loop Delay, Frequency-Regulation and Voltage-Regulation Loops in a Fixed-Frequency Hysteretic Converter; Constant ON/OFF-Time Control; Basic Concept of a Boost Converter, RHP zero in a Boost Converter.

Week 10 : Introduction to the Buck-Boost Converter, Tri-Mode Buck-Boost Converter, Boundary Conditions for Mode Transition in a Tri-Mode Buck-Boost Converter, Generation of Buck and Boost Duty Cycles; Introduction to Switched-Capacitor DC-DC Converters, Applications of SC DC-DC Converters in Open-Loop, Output Regulation in SC DC-DC Converters using Feedback Control, H-Bridge SC DC-DC Converter, Multiple Gain Settings in SC DC-DC Converters; Current-Sensing Techniques in DC-DC converters.

Week 11 : Selecting the Process Node for a PMIC, Chip-Level Layout and Placement Guidelines, Board-Level Layout Guidelines, EMI Considerations; Introduction to Advanced Topics in Power Management --- Digitally-Controlled DC-DC Converters, Adaptive Compensation Techniques, Limitations of Analogue and Digital Controllers, Time-Based Control Techniques and their Drawbacks, Multi-Phase DC-DC Converters; Dynamic Voltage and Frequency Scaling (DVFS); Single-Inductor Multiple-Output (SIMO) DC-DC Converters.

Week 12 : Introduction to Advanced Topics in Power Management (continued) - DC-DC Converters for LED Lighting, LCD/AMOLED Display Drivers, LED Drivers for Camera Flash, Lithium-ion Battery and its Charging Phases, Battery Charger ICs.

DC POWER TRANSMISSION SYSTEM	
Teaching Scheme:	Examination Scheme:
Theory: 03	Mid-term Test: 20* Marks
Tutorial: 00	Internal Assessment: 20* Marks
Total Credits: 3	End Term Exam: 60* Marks

Prof. Krishna S, IIT Madras

Course Duration: 12 weeks

CourseOutline:

This course gives an introduction to the DC power transmission system using the conventional line commutated converters. The topics covered include a detailed analysis of the 6 pulse line commutated converter (LCC), 12 pulse LCC, capacitor commutated converter, DC link control, and design of single tuned filter.

Course Plan:

Week 1: Introduction, choice of converter configuration

Week 2: Converter configuration for pulse number equal to 6, analysis of 6 pulse LCC neglecting overlap

Week 3: Fourier series, analysis of 6 pulse LCC neglecting overlap

Week 4: 2 and 3 valve conduction mode of 6 pulse LCC

Week 5: Extinction angle, 3 and 4 valve conduction mode and 3 valve conduction mode of 6 pulse LCC

Week 6: Commutation margin angle, normalization, characteristics of 6 pulse LCC, steady state analysis of a general LCC

Week 7: 6 pulse LCC with other circuits on the AC and DC sides

Week 8: Capacitor commutated converter, 12 pulse LCC

Week 9: Mode of operation of 12 pulse LCC, purposes of transformer, applications of DC transmission, types of DC link, DC link control

Week 10: Converter control characteristics, MTDC systems, non-characteristic harmonics

Week 11: Design of single tuned filter

Week 12: Double tuned and damped filters, reactive power requirement, comparison of AC and DC transmission

HIGH POWER MULTILEVEL CONVERTERS	
Teaching Scheme:	Examination Scheme:
Theory: 3hr	Mid-term Test: 20* Marks
Tutorial:	Internal Assessment: 20* Marks
Total Credits: 3	End Term Exam: 60* Marks

Prof. Anandarup Das, IIT Delhi
Course Duration: 12 weeks

CourseOutline:

The course covers different types of high power converters used in the industry for applications in HVDC, FACTS, Motor Drives, Power quality improvement. Traditional converters like NPC and emerging converters like modular multilevel converters will be covered. Operational issues and design considerations for these medium/high voltage high power converters will be covered. The course will discuss many practical issues faced in the industry while designing and operation of these converters.

Course Plan:

Week 1 : (a) Half bridge, Full bridge and three phase converters, sinusoidal PWM

Week 2 : (a) 3rd harmonic addition, space vector PWM

Week 3 : (a) Different types of multilevel converters
(b) Cascaded H-Bridge converter – Basic operation

Week 4 : (a)PWM Techniques for CHB converter
(b) Fault tolerant operation of CHB converter

Week 5 : (a) Modular Multilevel converter- Topology, operation and PWM

Week 6 : (a) Capacitor voltage balancing in MMC
(b) Design of components of MMC

Week 7 : (a) NPC converter – Basic operation
(b) NPC (3 level) Space vector diagram

Week 8 : NPC - PWM technique and midpoint balancing

Week 9 : (a) Case study of High Power converters for Motor drive and HVDC application

Week 10 : (a) Multi –pulse transformers

Week 11 : (a) Gate Drive circuit designing, protection and condition monitoring in high power converters

Week 12 : (a) Other topologies : conclusion

FUZZY SETS, LOGIC AND SYSTEMS & APPLICATIONS	
Teaching Scheme:	**Examination Scheme:**
Theory: 3hr	Mid-term Test: 20* Marks
Tutorial:	Internal Assessment: 20* Marks
Total Credits: 3	End Term Exam: 60* Marks

Prof. Nishchal Kumar Verma, IIT Kanpur

Course Duration: 12 weeks

CourseOutline:

The course is designed to give a solid grounding of fundamental concepts of fuzzy logic and its applications. The level of the course is chosen to be such that all students aspiring to be a part of computational intelligence directly or indirectly in near future should get these concepts.

Course Plan:

Week 1 : Introduction and Fuzzy Sets Theory

Week 2: Membership Functions

Week 3: Set Theoretic Operations

Week 4: Fuzzy Arithmetic

Week 5: Fuzzy Relations

Week 6: Fuzzy Inference Systems I

Week 7: Fuzzy Inference Systems II

Week 8: Wang and Mendel Model

Week 9: TSK Model

Week 10: Fuzzifiers and Defuzzifiers

Week 11: ANFIS Architecture

Week 12: Fuzzy Systems and Machine Learning

THE JOY OF COMPUTING USING PYTHON	
Teaching Scheme:	Examination Scheme:
Theory: 3hr	Mid-term Test: 20* Marks
Tutorial: 1hr	Internal Assessment: 20* Marks
Total Credits: 3	End Term Exam: 60* Marks

Prof.Sudarshan Iyengar, Department of Computer Science and Engineering, IIT Ropar
Course Duration: 12 weeks

CourseOutline:

ThisisamostfundamentalDigitalCircuitDesigncourseforpursingamajorinVLSI. We do not deal with any Verilog coding during this course and instead discuss transistor level circuit design concepts in greatdetail.

Learning objectives of this course are:

- Characterize the key delay quantities of a standardcell
- Evaluate power dissipated in a circuit (dynamic andleakage)
- Design a circuit to perform a certain functionality with specifiedspeed
- Identify the critical path of a combinationalcircuit
- Convert the combinational block to pipelinedcircuit
- Calculate the maximum (worst case) operating frequency of the designedcircuit

Course Plan:

Motivation for Computing
Variables and Expressions: Design your own calculator
Loops and Conditionals: Hopscotch once again
Lists, Tuples and Conditionals: Let’s go on a trip
Abstraction Everywhere: Apps in your phone
Counting Candies: Crowd to the rescue
Birthday Paradox: Find your twin
Google Translate: Speak in any Language
Currency Converter: Count your foreign trip expenses
Monte Hall: 3 doors and a twist
Sorting: Arrange the books
Searching: Find in seconds
Substitution Cipher: What’s the secret !!
Sentiment Analysis: Analyse your Facebook data
20 questions game: I can read your mind
Permutations: Jumbled Words
Spot the similarities: Dobble game
Count the words: Hundreds, Thousands or Millions.
Rock, Paper and Scissor: Cheating not allowed !!
Lie detector: No lies, only TRUTH

Calculation of the Area: Don’t measure.
Six degrees of separation: Meet your favourites
Image Processing: Fun with images
Tic tac toe: Let’s play
Snakes and Ladders: Down the memory lane.
Recursion: Tower of Hanoi
Page Rank: How Google Works !!

INTRODUCTION TO INDUSTRY 4.0 AND INDUSTRIAL INTERNET OF THINGS	
Teaching Scheme:	**Examination Scheme:**
Theory: 3hr	Mid-term Test: 20* Marks
Tutorial:	Internal Assessment: 20* Marks
Total Credits: 3	End Term Exam: 60* Marks

Prof. SudipMisra, IIT Kharagpur

Course Duration: 12 weeks

CourseOutline:

Industry 4.0 concerns the transformation of industrial processes through the integration of modern technologies such as sensors, communication, and computational processing. Technologies such as Cyber Physical Systems (CPS), Internet of Things (IoT), Cloud Computing, Machine Learning, and Data Analytics are considered to be the different drivers necessary for the transformation. Industrial Internet of Things (IIoT) is an application of IoT in industries to modify the various existing industrial systems. IIoT links the automation system with enterprise, planning and product lifecycle.

Course Plan:

Week 1 : Introduction: Sensing & actuation, Communication-Part I, Part II, Networking-Part I, Part II

Week 2 : Industry 4.0: Globalization and Emerging Issues, The Fourth Revolution, LEAN Production Systems, Smart and Connected Business Perspective, Smart Factories

Week 3 : Industry 4.0: Cyber Physical Systems and Next Generation Sensors, Collaborative Platform and Product Lifecycle Management, Augmented Reality and Virtual Reality, Artifical Intelligence, Big Data and Advanced Analysis

Week 4 : Cybersecurity in Industry 4.0, Basics of Industrial IoT: Industrial Processes-Part I, Part II, Industrial Sensing & Actuation, Industrial Internet Systems.

Week 5 :IIoT-Introduction, Industrial IoT: Business Model and RefereceArchiterture: IIoT-Business Models-Part I, Part II, IIoT Reference Architecture-Part I, Part II.

Week 6 : Industrial IoT- Layers: IIoT Sensing-Part I, Part II, IIoT Processing-Part I, Part II, IIoT Communication-Part I.

Week 7 : Industrial IoT- Layers: IIoT Communication-Part II, Part III, IIoT Networking-Part I, Part II, Part III.

Week 8 : Industrial IoT: Big Data Analytics and Software Defined Networks: IIoT Analytics - Introduction, Machine Learning and Data Science - Part I, Part II, R and Julia Programming, Data Management with Hadoop.

Week 9 : Industrial IoT: Big Data Analytics and Software Defined Networks: SDN in IIoT-Part I, Part II, Data Center Networks, Industrial IoT: Security and Fog Computing: Cloud Computing in IIoT-Part I, Part II.

Week 10 : Industrial IoT: Security and Fog Computing - Fog Computing in IIoT, Security in IIoT-Part I, Part II, Industrial IoT- Application Domains: Factories and Assembly Line, Food Industry.

Week 11 : Industrial IoT- Application Domains: Healthcare, Power Plants, Inventory

Management & Quality Control, Plant Safety and Security (Including AR and VR safety applications), Facility Management.

Week 12 : Industrial IoT- Application Domains: Oil, chemical and pharmaceutical industry, Applications of UAVs in Industries, Real case studies :

Case study - I : Milk Processing and Packaging Industries
Case study - II: Manufacturing Industries - Part I
Case study - III : Manufacturing Industries - Part II
Case study - IV : Student Projects - Part I
Case study - V : Student Projects - Part II
Case study - VI : Virtual Reality Lab
Case study - VII : Steel Technology Lab

ENTREPRENEURSHIP ESSENTIALS	
Teaching Scheme:	Examination Scheme:
Theory: 3hr	Mid-term Test: 20* Marks
	Internal Assessment: 20* Marks
Total Credits: 3	End Term Exam: 60* Marks

Prof. Manoj Kumar Mondal, IITKharagpur

Course Duration: 12 weeks

CourseOutline:

The course provides foundational knowledge on various aspects of entrepreneurial venture creation and management during its life-cycle. It has been designed to address multidisciplinary audiences. The objective of the course is to teach key issues faced by entrepreneurs and managers at different stages of the life-cycle of an enterprise and is relevant both for aspiring entrepreneurs and for decision makers in established enterprises. Topics can be classified in some major themes such as : Making a choice to create an entrepreneurial venture, current trend of technology entrepreneurship, how to start a start-up, identifying opportunities, factors driving competitive advantages, organizational structure, basic knowledge of financial statements and project report,introductory knowledge on marketing management, human resource management, & strategic management, risk analysis, legal aspect of business, how to raise fund during life-cycle of a new ventures.

Course Plan:

Week 1 : Introduction
DhirubhaiAmbani& Sofia
Myths & Realities about entrepreneurship
entrepreneurial qualities
Why start-ups fail?

Week 2: Mission, vision, entrepreneurial qualities – I
Mission, vision, entrepreneurial qualities – II
Value proposition
Business Model canvas
Business model generation

Week 3: Competitive advantage
Lean start-up – 1
Lean start-up – 2
Team and early recruit
Legal forms of business

Week 4: Marketing management 1
Marketing management 2
Market research –I
Market research –II
Market research –Example

Week 5: Introduction to financial statements
Profit & Loss statement
Balance sheet

Cash flow
Example – 1
Example – 2
Cost-volume-profit & Bread-Even analysis
Capital budgeting

Week 6: Business plan-I
Business plan-II
Pitching
Go-to-market strategies
Does & Don'ts

Week 7: How to innovate
Design Thinking
Design-Driven Innovation, Systems thinking
Open innovation, TRIZ
How to start a start-up?

Week 8: Government incentives for entrepreneurship (1 lecture)
Incubation, acceleration
Funding new ventures – bootstrapping, crowd sourcing, angel investors, VCs, debt financing (3), due diligence
Legal aspects of business (IPR, GST, Labour law)

Week 9: Cost, volume, profit and break-even analysis
Margin of safety and degree of operating leverage
Capital budgeting for comparing projects or opportunities
Product costing
Product pricing

Week 10: Funding new ventures – bootstrapping, crowd sourcing, Angel investors, VCs, debt financing (3), and due diligence
Incubation and acceleration
Government incentives for entrepreneurship
Project cost and Financial Closure

Week 11: Dos &Donts in entrepreneurship
Growth Hacking
Growth Strategy
Legal aspects of business (IPR, GST, Labor law)
Negotiation skill

Week 12: Human Resource management in startups
Pivoting
Entrepreneurial cases
Risk assessment and analysis
Strategy management for entrepreneurial ventures
Factors driving success and failure of ventures
Concluding remarks

BTEEP803: PROJECT-II	
Teaching Scheme:	Examination Scheme:
Practical: 30hr	Continuous Assessment: 100 Marks
Total Credits: 15	End Term Exam: 150 Marks

Since Project Stage II is in continuation to Project Stage I, the students are expected to complete the total project by the end of semester VIII. After completion of project work, they are expected to submit the consolidated report including the work done in stage I and stage II.

The report shall be comprehensive and presented typed on A4 size sheets and bound. The number of copies to be submitted is number of students plus two. The assessment would be carried out by the panel of examiners for both, term work and oral examinations.

JAIDEV EDUCATION SOCIETY'S

J D COLLEGE OF ENGINEERING AND MANAGEMENT

KATOL ROAD, NAGPUR

An Autonomous Institute, with NAAC "A" Grade

Department Of Electrical Engineering

"Igniting minds to illuminate the world"

2021-22 (Odd Sem)

VISION	MISSION
"To develop competent and committed Electrical Engineers to serve the society"	1. To impart quality education in the field of Electrical Engineering. 2. To be excellent learning centre through research and industry interaction.

AUTONOMOUS SYLLABUS SCHEME

V Semester

Sr. No.	Subject Category	Subject Code	Course Title	Teaching Scheme			Evaluation Scheme				Credits
				L	T	P	CA	MSE	ESE	TOTAL	
1	PCC-EE	EE5T001	Power Electronics	3	0	0	20	20	60	100	3
2	PCC-EE	EE5T002	Control System I	2	1	0	20	20	60	100	3
3	PCC-EE	EE5T003	Power System II	3	0	0	20	20	60	100	3
4	PEC-EE	EE5TE01	**Elective I**	3	0	0	20	20	60	100	3
5	PEC-EE	EE5TE02	**Elective II**	3	0	0	20	20	60	100	3
6	OEC-EE	EE5TO01	**Open Elective I**	4	0	0	20	20	60	100	4
7	PCC-EE	EE5L001	Power Electronics Lab	0	0	2	60	0	40	100	1
8	PCC-EE	EE5L002	Control System I Lab	0	0	2	60	0	40	100	1
9	PCC-EE	EE5L003	Power System II Lab	0	0	2	60	0	40	100	1
10	PROJ-EE	EE5P003	Mini Project (Phase I)	0	0	2	0	0	50	50	2
11	MC	EE5T004	Consumer Affairs	2	0	0	10	15	25	50	Audit
				20	**1**	**8**	**310**	**135**	**555**	**1000**	
							Total Credits				**24**

VI Semester

Sr. No.	Subject Category	Subject Code	Course Title	Teaching Scheme			Evaluation Scheme				Credits
				L	T	P	CA	MSE	ESE	TOTAL	
1	PCC-EE	EE6T001	Microprocessor and microcontroller	3	0	0	20	20	60	100	3
2	PCC-EE	EE6T002	Advance Control System	3	0	0	20	20	60	100	3
3	PEC-EE	EE6TE03	**Elective III**	3	0	0	20	20	60	100	3
4	PEC-EE	EE6TE04	**Elective IV**	3	0	0	20	20	60	100	3
5	OEC-EE	EE6TO01	**Open Elective II**	4	0	0	20	20	60	100	4
6	PCC-EE	EE6L001	Microprocessor and microcontroller Lab	0	0	2	60	0	40	100	1
7	PCC-EE	EE6L003	Cad Lab	0	0	2	60	0	40	100	1
8	PROJ-EE	EE6P004	Mini Project phase II	0	0	2	0	0	50	50	2
9	MC	EE6T003	Research Methodology	2	0	0	10	15	25	50	Audit
				15	**0**	**6**	**210**	**95**	**395**	**700**	
								Total Credits			**20**

SYLLABUS of V Semester

EE5T001	**Power Electronics**	**3 Credit**

PRE REQUISITES: Electronic Devices And Circuits

COURSE OBJECTIVES:

1 .To review principle of construction, operation and characteristics of basic Semiconductor devices.
2. To understand and analyze performance of controlled and uncontrolled converters.
3. To understand and analyze performance of DC to DC converters. Dc to AC converters.
4 .To understand and analyze performance of AC voltage controllers.

COURSE OUTCOME:

CO1: To remember the principle of operation of various basic semiconductor devices
CO2: To understand the characteristics of various types of semiconductor device and its working as converters.
CO3: To make use of various semiconductor device for the converters operation under various load types.
CO4: Examine the performance of various types of converters.
CO5: Compare various types of converters based on performance parameter.
CO6:Todesign the converters based on real time industrial applications.

Unit I :Power semiconductor devices & their characteristics (6 Hrs)
SCR, triac, diac-construction, characteristics & applications, two transistor analogy for turning ON-OFF SCR, turn ON mechanism, different methods of turning ON-OFF SCR, turn OFF mechanism, series and parallel connections of SCRs, Protection of SCR gate circuit protection, over voltage and over current protection, snubber circuit design

Unit II : Turn on and Turn off circuits for power semiconductor devices (6Hrs)
Introduction to GTO, power transistor, power MOSFET & IGBT & their construction &characteristics.Uni-junction transistors, Triggering circuits and optocouplers and Pulse transformer
Introduction to types of power electronic circuits: diode rectifiers, AC-DC converters, AC-AC converters, DC-DC converters, DC-AC converters

Unit III:Diode Rectifiers and AC-DC converters (6Hrs)

Diode Rectifiers: Single phase half wave, full wave rectifiers with R and RL load, Threephase bridge rectifier with R and RL load, Effect of source inductance.
Controlled Rectifiers : Principle of phase controlled rectification, single phase semi andfull converter with R and RL load, power factor improvement in controlled rectifiers, threephase semi and full converter with R and RL load. (only descriptive approach)

Unit IV : DC-AC converters(6 Hrs)
Classification , series inverter, improved series inverter, parallel inverter, out put voltageand waveform control, principle of operation for three phase bridge inverter in 120 deg. and 180 deg. mode, single phase bridge inverter.

Unit V :DC-DC converters (6 Hrs)

Basic principles of chopper, time ratio control and current limit control techniques, voltage commutated chopper ckt., Jones chopper, step-up chopper, step-down chopper and AC chopper.

Unit VI : AC voltage controllers (AC-AC converters) (6 Hrs)

Principle of on-off control, principle of phase control in single phase and three phase circuits, Cycloconverters: single phase cycloconverter operation, three phase cycloconverter operation.

Text Books

1. Rashid M. H – Power Electronics circuits, devices and applications-(New Delhi Pearson Education).

Reference Books

1. Murthi.V. R- Power Electonics Devices, circuits and Industrial Applications.(Oxford).
2. Bimbhra.P. S- Power Electronics.(Khanna Publication).

EE5T002	**Control System-I**	**3 Credit**

PRE REQUISITES: Network Anlysis
COURSE OBJECTIVES:

1. To introduce about fundamental concepts of control system.
2. To understand the concept of stability analysis.

COURSE OUTCOME:
After completion of syllabus, students must be able:

CO1: To remember the basic concept of control system and methods of stability analysis.
CO2: To understand the basic concept of control system and its types
CO3: To apply knowledge of control system analysis to find stability of any system using various methods such as root locus, Bode plot, Nyquist plot etc.
CO4: To analyze any system to find its stability using various methods such as root locus, Bode plot, Nyquist plot etc.
CO5: To evaluate various parameters of system for its stability analysis.
CO6: To design the linear control system in time and frequency domains using various approaches.

EE5T002: CONTROL SYSTEM-I

Unit I: Introduction to Control System **[08 Hrs]**
Introduction to Control Problem : Industrial Control examples, Mathematical models of physical systems, Control hardware and their models, Transfer function models of linear time invariant systems, Feedback control, Open loop and closed loop systems, Benefits of feedback, Block dig and signal flow graph algebra

Unit II: Characteristics of Feedback Control Systems : **[08 Hrs]**
Effect of negative feedback compared to open loop system such as – sensitivity to parameter variation, speed of time response, bandwidth, disturbance rejection and linearizing effect, Effect of positive feedback

Unit III: Time domain analysis **[08 Hrs]**
Concept of transient response, Steady state response and time response, standard test signals, Time response of first order systems, Transfer function of second order system, Time response of second order system, Time response specifications of second order system, steady state error (ess) analysis, static error constants and system type, dominant poles, Relation between roots of characteristic equation, damping ratio and transient response, effect of proportional(P), Integral (I) and derivative (D) controllers on the time response concept of transportation lag.

Unit IV: Stability **[08 Hrs]**
Concept of stability, Effect of pole zero location on stability, Routh- Hurwitz criterian. Root Locus Techniques: Concept and use of root locus, Magnitude and angle criteria, Construction of root loci, effect of addition and poles and zeros on root loci

Unit V: Frequency domain analysis of control systems **[08 Hrs]**
Concept of frequency response and sinusoidal transfer function, resonant frequency, resonant peak, cut off frequency, bandwidth, correlation between time and frequency response.
Frequency Response Analysis: Relationship between time and frequency response, Polar plots, Bode plots. Nyquist stability criterion, Relative stability using Nyquist criterion gain and phase margin, Closed-loop frequency response.

Unit VI: State Space Approach **[08 Hrs]**

State Variable Analysis : Concept of state, state variables and state model, state model of linear systems, state model using physical variables, phase variables and canonical variables, state model from differential equations, block diagram and signal flow graph, transfer function from state model, stability of systems modeled in state variable form.

Text Book:

1. Benjamin C Kuo, "Automatic Control Systems", Prentice Hall of India.
2. M. Gopal, "Control Systems- Principle of Design", Fourth Edition, 2012, McGraw Hill.
3. I.J. Nagrath, "Control Systems Engineering" ,New Age International Ltd. , 2000

Reference Books:

1. D'AzzoHoupis, Logakusha, Huelsoman, "Linear System Analysis", McGraw Hill.
2. Richard C. Dorf and Robert H. Bishop, "Modern Control Systems", Pearson Education Inc.
3. Norman S Nise, "Control System Engineering", John Wiley & Sons.
4. Katsuhiko Ogata, "Modern Control Engineering", Prentice Hall of India

EE5T003	**Power Systems-II**	**3 Credit**

PRE REQUISITES: Power Systems-I

COURSE OBJECTIVES:

1. To understand the different parameters of power system operation.
2. To understand the different parameters of power system control.
3. To study different issues related to power systems.
4. After learning, students will be able to analyze different solution methods related to power system
5. Understand amongst the different analytical & numerical methods for power flow solutions
6. Understand different problems related to cost load flow, fault, reactive power and Stability constraints in the power systems

COURSE OUTCOMES:

After completion of syllabus, students must be able:
CO1. **Define** the different parameters of power system operation.
CO2. **Illustrate** the different parameters of power system operation and control.
CO3.To **identify** the different issues related to power systems
CO4. **Analyze** the different solution methods related to power system ..
CO5. **Choose** amongst the different analytical & numerical methods for power flow solutions.
CO6. **Solve** the different problems related to cost load flow, fault, reactive power and Stability constraints in the power systems

Unit I: Economic Operation of Power System (7 Hrs)
Introduction, Distribution of Load between Units & within the Plant.Optimum Generation Scheduling considering Transmission Losses, Representation of Transmission Loss Using Loss Formula Co-Efficient, Derivation of Loss Formula Co-Efficient.

Unit II: Load Flow Studies (6 Hrs)
Per Unit System, Ybus formation Simple example of a loadflowsolution ,Network model formulation, (Applications of iterative techniques like Gauss-Siedal method, and Newton-Raphson method, etc.).

Unit III: Reactive Power Control (6 Hrs)
System voltage and reactive power, Reactive power generation by synchronous machine, Excitation control, Automatic voltage regulator for alternator, Reactive power generation by turbo-generator, Synchronous compensators, Reactors, Capacitors, Static compensators. Introduction to power flow control, HVDC and FACTS.

Unit IV: Symmetrical and unsymmetrical fault analysis: (8 Hrs)
Unbalanced System Analysis using Sequence Components, Symmetrical Fault Analysis Without & With Pre-Fault Load Currents. Symmetrical Component Transformation, Three Phase Power in Unbalanced Circuit in Terms of Symmetrical Component Sequence Impedance of Generator Transformer & Transmission Line ,Unsymmetrical Fault Analysis: L-G, L-L-G-, L-L-L, LL-L-G, Open Conductors Fault Using Symmetrical Components.
Unit V: Stability of Power System : (7 Hrs)
Steady State Dynamic and Transient Stability Definition and Comparison Dynamics of Synchronous Machine Swing Equation Swing Equation for Single Machine Connected To Infinite Bus, Power Angle Equation. Steady State Stability Studies Transient Stability Studies: Swing Curve, Equal Area Criterion for Transient Stability Application of Equal Area Criterion for Different Disturbances. Solution of Swing Equation by Point by Point Method, Methods of Improving Transient Stability.

Unit VI: Load dispatch center functions **(6 Hrs)**
Contingency analysis, preventive, emergency and restorative Control. power quality def., causes, affects, slandered and mitigation methods

Text Books
1. Nagrath& Kothari – Modern Power System Analysis.(Tata Mcgraw Hill).
2. Prof A M Kulkarni IIT "Bombay Web Course on Power System Operation and Control".

Reference Books
1. Stevension .W. D– Power System Analysis. (Tata Mcgraw Hill).
2. AshfaqHussian - Power System Analysis.(Tata Mcgraw Hill).
3. Hadi Sadat- Power System Analysis (Tata Mcgraw Hill).

EE5TE02(A) Elective I- Renewable Energy System 3 Credit

COURSE OBJECTIVES:

1. To give sufficient knowledge about the promising new and renewable sources of energy
2. Understanding basic characteristics of renewable sources of energy and technologies
3. To give review on utilization trends of renewable sources of energy

COURSE OUTCOMES:

CO1	To define basic properties of different renewable sources of energy and technologies for their utilization.
CO2	Describe main elements of technical systems designed for utilization of renewable sources of energy
CO3	Interpret advantages and disadvantages of different renewable sources of energy
CO4	Undertake simple analysis of energy potential of renewable sources of energy
CO5	Interpret the knowledge of fuel cells, wave power, tidal power and geothermal principles and applications.
CO6	Discuss the economics of harnessing energy from renewable energy sources.

UNIT I :(05 Hrs)

Overview of conventional &renewable energy sources, need , potential & development of renewable energy sources, types of renewable energy sources ,types of renewable energy system, future of energy use, Global and Indian Energy Scenario, Energy for sustainable development, Physical principle of conversion of solar radiation into heat, Global climate change, CO_2 reduction potential of renewable energy.

UNIT II: (05 Hrs)

Solar Radiation & its Measurement: Solar constant, solar radiation on earth's surface, solar radiation geometry, solar radiation measurement, estimation of average solar radiation, solar radiation on tilted surface. Introduction to solar collectors.

Applications of Solar Energy: Solar water heating, Space cooling, Solar thermal heat conversion, Solar photovoltaic energy conversion, Solar pumping, Solar cooking , Online grid connected solar photovoltaic generation system.

UNIT III: (05 Hrs)

Wind Energy: Basic principles of wind energy conversion, Wind energy conversion system, Wind data& energy estimation, Site selection consideration, Basic component of wind energy conversion system (WECS), Classification of WEC system, Energy storage, Advantages and Disadvantages of (WECS), Application of wind energy.

UNIT IV:(04 Hrs)

Geothermal Energy: Geothermal fields, Estimates of geothermal power, Basic geothermal steam power plant, Binary fluid geothermal plant , Geothermal preheat hybrid power plant. Advantages and disadvantages of geothermal energy.Applications of geothermal energy in India.

UNIT V :(05 Hrs)

Energy from Oceans : Oceans thermal electric conversion (OTEC) , Claude & Anderson cycle, Evaporators,Bio-fueling,Hybrid cycle,Site selection, Component of OTEC for power generation.Energy from Tides: Introduction, Basic principles of Tidal power, Component of Tidal Power Plant, Operation methods of utilization of Tidal Energy,Estimation of Energy & Power in simple single basin Tidal system,Estimation of Energy & Power in double basin Tidal system , Advantages & limitations of Tidal Power Generation.

UNIT VI:(04 Hrs)

Other nonconventional Energy Sources: Brief intriduction to operating principles of small scale hydro electric power generation,Energy from Bio-Mass, Ethanol production, MHD power generation, Fuel cell, Energy from waste.

Text Books:

1. Non Conventional Energy Sources : G.D. Rai , Khanna publishers
2. Non Conventional Energy Resources : B. H. Khan, 2 nd , The McGraw Hill Companies
3. Energy Technology : Nonconventional, Renewable and Conventional : S. Rao& B. B. Parulekar, 1 st, Khanna Publisher
4. Solar Energy: Principles of thermal collection and storage : S. P. Sukhatme, 2 nd edition, Tata McGraw Hill Publishing Company Ltd.
5. Solar Photovoltaics : Fundamental, Technologies and Applications : Chetan Singh Solanki, PHI Learning Pvt. Ltd.

Reference Books:

1. A. N. Mathur: Non-Conventional Resources of Energy. 2010
2. V. V. N. Kishore: Renewable Energy Engineering and Technology, TERI. 2006

EE5TE01 (B)	Elective I- Electromagnetic Field	3 Credit

COURSE OBJECTIVES:

1. Static electric and magnetic fields.
2. Laws of electromagnetic & electrostatic fields.
3. The nature of dielectric materials like in parallel plate capacitance

COURSE OUTCOMES:

CO1	Remember, Understand Scalars & vector analysis, vector and scalars conversion for different coordinate system.
CO2	Apply Gauss law, Divergence theorem to electric field intensity.
CO3	Apply Faradays law of electromagnetic induction (as a component of Maxwell's equations) to solve and analyze problems of Performance and behavior of electromechanical devices such as Motors, Generators and Transformers.
CO4	Apply effective analysis tool like Poisson's and Laplace equations to current, current density, dielectrics and capacitances.
CO5	Analyze& Apply Biot-Savorts law.
CO6	Solve & Analyze problems of Capacitance of parallel plate capacitor, Capacitance of two wire line, Poissons.

Unit I: Review of Mathematics (05 Hrs)

Scalar and vector fields, calculus of scalar and vector fields (Vector Algebra, Vector addition, vector subtraction, Dot product, Scalar product) in Cartesian and curvilinear coordinates, conversion of variables from Cartesian to cylindrical of Cartesian to spherical.

Unit II: Electrostatics (06 Hrs)

Electric field, divergence & curl of electric field, Coulombs' law, the principle of superposition, point charges, field due to continuous volume charge distribution, field of line charge, field of sheet charges concept of flux density.

Unit III: Gauss's law, Energy and Potential of charge system (05 Hrs)

Gauss's law, Application of Gauss's law, divergence theorem, definition of potential difference and potential, potential of a point charges, potential field of system of charge, potential gradient, Energy density in Electrostatic field.

Unit IV: Conductors, Dielectric and Capacitance and Poisson's and Laplace's Equations (06 Hrs)

Current and current density, continuity of current, metallic conductors, conductor properties and Boundary conditions, Nature of Dielectric materials capacitance and capacitances, Capacitance of parallel plate capacitor, Capacitance of two wire line, Poissons and Laplace equations.

Unit V: Magneto Statics (08 Hrs)

Magnetic force between two small moving charges and the concept of magnetic field. Bio Savart's law, Magnetic flux density vector B and Magnetic flux .The law of conversation of magnetic flux, Ampere's law, magnetic scalar potential, application to various configurations. Magnetic fields of currents in presence of magnetic materials— current loop in a magnetic field (torque and behavior), elementary current loop and aggregates of current loops.Magnetization vector.Generalization of Ampere's law. Magnetic fields intensity and its interpretation. Boundary conditions, effect of applied magnetic field on materials substances, magnetic characteristics of ferromagnetic materials, B-H curve of iron and hysteresis loops, magnetic circuit, magnetic field problems.

Unit VI: Maxwell Equations (06 Hrs)

The equation of continuity and displacement current, Maxwell's equations in different forms and the constitutive relations consequence of Maxwell's equations, plane electromagnetic waves in free space, boundary conditions with generalizations.

Text Books:

1. Matthew N. O. Sadiku, “Elements of Electromagnetics”, Oxford University publication, 6 th Edition, 2014.
2. A.Pramanik, ”Electromagnetism - Theory and applications”, PHI Learning Pvt. Ltd, New Delhi, 2nd Edition, 2009.
3. A.Pramanik,”Electromagnetism-Problems with solution”, Prentice Hall of India, Pvt. Ltd., 2nd Edition, 2012.

Reference Books:

1. G.W.Carter,”The electromagnetic field in its engineering aspects”, Longmans, 1st Edition, 1954.
2. W.J.Duffin,”Electricity and Magnetism”, McGraw Hill Publication, 3rd Edition (Rev), 1980.
3. W.J.Duffin,”Advanced Electricity and Magnetism”, McGraw Inc. US, 1968.
4. E.G.Cullwick,”The Fundamentals of Electromagnetism”, Cambridge University Press, 3rd Edition, 1966.
5. B.D.Popovic,”Introductory Engineering Electromagnetics”, Addison-Wesely, Educational Publishers Inc, International Edition, 1971.
6. WiilaimHayt, “ Engineering Electromagnetics”, Tata McGraw Hill Education Pvt. Ltd., 7th Edition, 2012.

E-notes:

• nptel.ac.in/downloads/

EE5TE01 (C)Elective I-Introduction to Special Machines	**3 Credit**

PRE REQUISITES: Electrical Machines -I

COURSE OBJECTIVES:

1. To develop a basic foundation of some special electrical machines.
2. Understand the basic principle, construction &operation, of special electrical machines.
3. Understand & evaluate the performance & operational characteristics of special electrical machines
4. Have the detailed knowledge regarding applications of special electrical machines in day today life.

COURSE OUTCOME:

CO1. **Remember** basic principles of some special electrical machines.
CO2. **Understand** the basics of construction & principle of operation of special electrical machines.
CO3. To **identify** the different operational characteristics related to the special electrical machines.
CO4. **Analyze** the performance indices of special electrical machines.
CO5. **Evaluate** the operation & characteristics of special electrical machines.
CO6. **Solve** the different problems related to operation, supply conversion & performance indices of special electrical machines.

UNIT-I: SPECIAL AC MACHINES (07 Hrs)
Inverted Induction Machine, Synchronous Induction motor, Linear induction Motors (LIM), High efficiency Induction motors, Repulsion motors, Schrage motors. (Only Elementary Aspects).

UNIT-II: FRACTIONAL KILOWATT MACHINES (07 Hrs)
Reluctance motors, AC tachometers, AC Series Motor-Universal Motor, Stepper Motor & its types, Hysteresis Motor, (Only Elementary Aspects).

UNIT-III: SPECIAL D.C. MACHINES (06 Hrs)
PMDC motors: Construction, Working, Characteristics & applications,
BLDC Motors: Construction, Working, Characteristics & applications.

UNIT-IV: PERMANENT MAGNET SYNCHRONOUS MOTORS (07 Hrs)
Introduction, Construction, Working, Ideal PMSM, EMF and Torque equations, Armature MMF, Phasor diagram, Torque/speed characteristics, Applications.

UNIT-V: SERVOMOTORS (07 Hrs)
DC servomotors: Construction, working, torque speed characteristics, applications.
AC servomotors: Construction, working, torque speed characteristics, applications, Comparison of servomotors with conventional motors.

UNIT-VI: SOFTWARE APPLICATIONS (03 Hrs)
NPTEL, (Swayam) courses, Software Applications in Electrical Machines.

Text Books

1. I.J Nagrath, D. P. Kothari,“Electric Machines”, Fourth Edition, Tata McGraw-Hill Publishing Company Ltd.

2. AshfaqHussain ,“Electric Machines”,SecondEdition,DhanpatRai& Co. Ltd.
3. P.S. Bhimbra, “Electrical Machinery”, Seventh Edition,1995,Khanna Publishers
4. Miller, T. J. E., Brushless Permanent Magnet and Reluctance Motor Drives, Oxford Science Publications, 1989.
5. Venkataratnam K., Special Electrical Machines, CRC Press, 2009.

Reference Books

1. Krishnan, R., “Permanent Magnet and BLDC Motor Drives”, CRC Press, 2009.
2. Chang-liang, X., "Permanent Magnet Brushless DC Motor Drives and Controls", Jun 2012.

EE5TE01 (D) Elective I-Electrical Power Utilization & Practice	3 Credit

COURSE OBJECTIVES:

1. Introduce various methods of effectively and efficiently utilizing Electrical Energy for different and desired applications.
2. Teach the various Electrical Lighting principles and their applications.
3. Impart knowledge on effective utilization of Electro Mechanical process.

COURSE OUTCOMES:

CO1: The students should be able to understand the process and application of different types of Electric Heating equipments.
CO2: The students should be able to understand the process and application of different types of Welding equipments.
CO3: Students should be able to understand basics of illumination and working principles of different light sources.
CO4: The students shall be able to apply the fundamentals of illumination systems for lighting design for indoor/ outdoor installations for residential/ commercial and industrial applications.
CO5: The students should be able to understand the working principles and applications for various electrolytic processes for industrial applications.
CO6: The students should be able to understand the Refrigeration cycle process and electrical circuit used in different cooling system.

Unit I: Electric Heating **(7 Hrs)**

Heating transfer methods, construction, working and applications Resistance heating,Induction heating; principle of core type and coreless induction furnace, Electric arc heating; direct and indirect arc heating, Dielectric heating, Infra-red heating and its applications, Microwave heating

Unit II: Electric Welding **(7 Hrs)**

Principles of resistance welding, types, Principle of arc production, electric arc welding, characteristics of arc; Power supply required. Advantages of using coated electrodes, comparison between AC and DC arc welding, welding control circuits, welding of aluminium and copper, Introduction to TIG, MIG Welding

Unit III: Illumination Fundamental **(7 Hrs)**

Nature of light, visibility spectrum curve of relative sensitivity of human eye andwave length of light, Basic terms in lighting systems ,laws of illumination, polar curves, construction & operation of light sources (Incandescent, Fluorescent Tube, Sodium Vapor Lamp, Mercury Vapor Lamp, Neon tube).

Unit IV: Design of Lightning System **(7 Hrs)**

Lux level requirements for various applications, classification of light fittings and luminaires, factors affecting the design of indoor lighting installations, total lumen method of calculation, Illumination schemes; indoor and outdoor. Illumination levels General ideas bout street lighting, flood lighting, monument lighting and decorativelighting, light characteristics etc.

Unit V: Electrolytic Processes **(6 Hrs)**

Need of electro-deposition, Laws of electrolysis, process of electro-deposition, Equipment and accessories for electroplating, Factors affecting electro-deposition, Principle of galvanizing, anodizing and its applications, Electroplating on non-conducting materials, Manufacture of chemicals by electrolytic process, Manufacturing of chemicals by electrolysis process.

Unit VI: Other Applications of Electrical Energy **(6 Hrs)**

Terminology, Refrigeration cycle, Vapor compression type, vapor absorption type, Electrical circuit of a Refrigerator, Room Air conditioner window type & split type.

Description of Electrical circuit used in
a) refrigerator,
b) air-conditioner, and
c) water cooler

Text Books

1. Art and Science of utilization of electrical energy by H. Partab, DhanpatRai and Sons, Delhi.
2. Uppal S.L, "Electric Power", Khanna Publishers, 1988
3. Open Shaw Taylor, "Utilization of Electrical Energy", Oriented Longmans Limited (Revised in SI Units), 1971.
4. Soni A. Chakrabarti, M.L.Soni, P.V.Gupta, U.S.Bhatnagar, “A text book on Power System Enggineering”, Khanna Publishers, 2000.
5. A.I.Starr, “Generation, Transmission and Utilization of Electric Power”, ELBS, 1978.

Reference Books

Guide book for National Certification Examination for Energy Managers and Energy Auditors, Bureau of Energy Efficiency.

EE5TE02(A) ElectiveII-Advance Renewable Energy System	4 Credit

PRE REQUISITES: Introduction to Non-Conventional energy sources

COURSE OBJECTIVES:

1. Study working principles of various renewable energy sources and their utilities.
2. Study economics of harnessing energy from renewable energy sources.
3. Study of various features of Ecosystem.

COURSE OUTCOME:

CO1: To Define the principle of energy conversion technique from biomass, geothermal and hybrid energy systems.
CO2: To Summarize the effects of air pollution and ecosystems Unit Contents Contact
CO3: To Identify the essential characteristics and technical requirements of photovoltaic and biomass energy systems.
CO4: To Analyze the need of various forms of non conventional energy sources, historical and latest developments
CO5 : Illustrate design of biogas, geothermal and hybrid power plant.
CO6 : Discuss about the environmental aspects of renewable energy resources.

Unit I: Biomass Energy (8 Hrs)

Introduction, Biomass conversion technologies, Biogas generation, classification of biogas plants and their Operating system.Biomass as a source of energy, methods of obtaining energy from biomass, thermal gasification of biomass, Applications.

Unit II: Geothermal Energy (6 Hrs)

Introduction, Geothermal sources , hydrothermal resources, Vapor dominated systems, Liquid dominated systems, hot water fields, Geo pressure resources, hot dry rocks, magma resources, volcanoes. Interconnection of geothermal fossil systems, geothermal energy conversion and applications.

Unit III: Hybrid energy systems (6 Hrs)

Need for hybrid systems, types of hybrid systems site specific examples; PV–Diesel and battery systems, PV– Gas Hybrid system, Biomass gasifier based thermal back up for Solar systems, natural convection solar driers in combination with biomass back up heater. Biogas and solar energy hybrid system, typical applications.

Unit IV: Air pollution (6 Hrs)

Primary, secondary, chemical and photochemical reactions, effects of CO, NO, CH and particulates, acid rain, global warming and Ozone depletion; monitoring and control of pollutants; noise pollution-sources and control measures; thermal-, heavy metals- and nuclear pollutions; industrial pollution from paper, pharmacy, distillery, tannery, fertilizer, food processing and small scale industries.

Unit V: Environment and Social Structure (6 Hrs)

Environment impact assessment policies and auditing, conflicting world views and environmentally sustainable economic growth, introduction to Design For Environment (DFE), product lifecycle assessment for environment and ISO 14000; triple bottom line of economic, environment and social performance.

Unit VI :Ecosystem(7 Hrs)

Ecosystem definition, concepts, structure, realm of ecology, lithosphere, hydrosphere, biosphere, atmosphere-troposphere-stratosphere; Nonrandom high quality solar energy flow/ balance to earth, greenhouse effect, matter and nutrient recycling in ecosystems; nitrogen, oxygen, carbon and water cycles, food producers, consumers and decomposers, food chains; biodiversity, threat and conservation of biodiversity

Text Books/Reference Books

1. Non-conventional energy sources by G.D. Rai, Khanna Publishers
2. Solar Energy: Principles of Thermal Collection and Storage by S,P Sukhatme, Tata McGraw Hill

EE5TE02 (B)	ElectiveII- Analog Digital Electronics	3 Credit

COURSE OBJECTIVES:

1. Understand the diode Circuits
2. Understand the MOSFET Circuits
3. Understand the sequential Circuits

COURSE OUTCOMES:

CO1 Understand the operation and analyze the characteristics of semiconductor diodes, MOSFET, and BJT

CO2 Examine and design electronic circuits containing non-linear elements such as diodes, MOSFET, & BJT using the concepts of biasing, load lines, operating point and incremental analysis

CO3 Apply feedback techniques in amplifier and examine its effect on parameters of amplifiers (ex. Gain, bandwidth, i/p and o/p impedance, etc) and the stability of amplifier

CO4 Design different combinational circuits for various applications

CO5 Design various sequential circuits for different applications

CO6 Design and verify digital systems using combinational and sequential circuits

Unit I: Diode Circuits: (7 Hrs)

P-N junction diode, V-I characteristics of a diode; half-wave and full-wave rectifiers, Zener diodes, clamping and clipping circuit.

Unit II: BJT Circuits (7 Hrs)

Structure and V-I characteristics of a BJT; BJT as a switch. BJT as an amplifier: small-signal model, biasing circuits; common-emitter, common-base and common-collector amplifiers; Small signal equivalent circuit, high-frequency equivalent circuits.

Unit III: MOSFET Circuits: (7 Hrs)

MOSFET structure and V-I characteristics.MOSFET as a switch. MOSFET as an amplifier: small-signal model and biasing circuits, common-source, common-gate and common-drain amplifiers; small signal equivalent circuit - gain, input and output impedances, trans-conductance, high frequency equivalent circuit

Unit IV:Number Systems(7 Hrs)

Logic Simplification Binary/Hexa/octal/BCD Number system, Binary Arithmetic, Boolean Algebra and De Morgan's Theorem, Logic Gates, SOP & POS forms, Logic Optimization Technique, Karnaugh maps. Introduction to logic families, TTL and CMOS logic, Tri-state logic, Memory- classification, organization, operation and interfacing.

Unit V: Combinational logic Design: (6 Hrs)

Comparators, Multiplexers, Demultiplexer, Encoder, Decoder, Arithmetic Circuit Design, Barrel Shifter, ALU.

Unit VI: Sequential logic Design: (6 Hrs)

Sequential Logic Design Latches, Flip flop – S-R, J-K, D, T and Master-Slave JK FF, counters, Shift registers.

Text books:-

1. Digital Electronic Principles, By Malvino PHI, 3 Edition.
2. Modern Digital Electronics, R. P. Jain, McGraw Hill Education, 2009.

3. Sergio Franco,“Design with Operational Amplifiers and Analog Integrated Circuits,” Fourth Edition, McGraw-Hill Education, 2014.

Reference books: -

1. Digital logic and Computer design, M. M. Mano, Pearson Education India, 2016.
2. Fundamentals of Digital Circuits, A. Kumar, Prentice Hall India, 2016.
3. DonaldNeamen, “Electronic Circuits: Analysis and Design,” Third Edition, McGraw-Hill Publication, 2006.
4. Donald Neamen, “Semiconductor Physics and Devices: Basic Principles,” Fourth edition, McGraw-Hill, 2011.
5. Jacob Millman, Christos Halkias, Chetan Parikh, “Millman's Integrated Electronics,” Second edition, McGraw Hill Education, 2017.
6. J. V. Wait, L.P. Huelsman and G. A. Korn, Introduction to Operational Amplifier theory and applications, 2nd Edition, McGraw Hill, New York, 1992.
7. P. R. Gray, R. G. Meyer and S. Lewis, “Analysis and Design of Analog Integrated Circuits”, John Wiley & Sons, 2001.

EE5TE02 (C)ElectiveII-Electrical Machine Design	**3 Credit**

COURSE OBJECTIVES:

1. To study mmf calculation and thermal rating of various types of electrical machines.
2. To design armature and field systems for D.C. machines.
3. To design core, yoke, windings and cooling systems of transformers.
4. To design stator and rotor of induction machines.

COURSE OUTCOMES:

CO1. **Remember** appropriate ratings, material, heating and cooling time constants.
CO2. **Understand** magnetic, electric materials, windings and transformers.
CO3. **Apply** concepts in design of electrical apparatus, devices and computer aided designing of transformer.
CO4. **Analyze** different materials, windings and modes of heat generation and heat dissipation in electrical machines.
CO5. **Evaluate** fault parameters in windings, voltage regulation and efficiency in transformer.
CO6. **Design** different types of transformers, heating coils and field coils.

Unit I: Review of material used in construction of electrical machines(7 Hrs)
Classification of magnetic, electric and insulating materials, Design of Electrical machines along with their parts and special features, rating, Specifications, Standards, Performance and other criteria to be considered

Unit II: Design of Induction Motor (7 Hrs)
Construction, Output equation of Induction motor, Main dimensions, choice of specific loadings,Design of squirrel cage rotor and wound rotor,Operating characteristics, Magnetizing current,Short circuit current, Circle diagram

Unit III: Design of synchronous machines (7 Hrs)
Output equations, choice of specific loadings, Design of salient pole machines, Short circuit ratio, Armature design, Estimation of air gap length, Design of rotor,Design of damper winding, Determination of full load field mmf, Design of field winding, Design of turboalternators

Unit IV: Design of transformer (7 Hrs)
Design of distribution and power transformers, Types,Classification and specifications, Design and main dimensions of core, yoke, winding,tank (with or without cooling tubes) and cooling tubes, Estimation of leakage reactance,resistance of winding, No load current, Losses, Voltage regulation and efficiency,Mechanical force developed during short circuits, Their estimation and measures tocounteract them, Testing of transformers as per I.S.S., Numerical examples.

Unit V: Heating, Cooling and Ventilation (6 Hrs)
Study of different modes of heat generation,Temperature rise and heat dissipation, Heating and Cooling cycles, heating and coolingtime constants, their estimation, dependence and applications, Methods of cooling /ventilation of electrical apparatus, Thermal resistance, radiated heat quantity of cooling medium (Coolant) Numerical.

Unit VI: Computer aided Design of Electrical machine(6 Hrs)
Introduction, advantages various approaches of Computer Aided Designing, Computer Aided Designing of transformer, Winding of rotating Electrical Machines. Optimization of Design.

Text Books

1. Sawhney, A.K., ‘A Course in Electrical Machine Design’, DhanpatRai& Sons, New Delhi, Fifth Edition, 1984.

2. M V Deshpande ‘Design and Testing of Electrical Machines’ PHI learning Pvt Ltd, 2011
3. Sen, S.K., ‘Principles of Electrical Machine Designs with Computer Programmes’, Oxford andIBH Publishing Co. Pvt. Ltd., New Delhi, Second Edition, 2009.

Reference Books

1. J Pyrhonen,T. Jokinen and V.Hrabovcova, “ Design of Rotating Electrical Machines” , Wiley,2009.
2. K.M.Vishnumurthy ‘Computer aided design of electrical machines’ B S Publications,2008

EE5TE02(D) Electrical Installation & Design	**3 Credit**

PRE REQUISITES: Electrical Installation & Design

COURSE OBJECTIVES:

1. To explain how the Regulations and Codes are intended to be applied in practice, with the emphasis on design and specification of electrical installation.
2. Acquire knowledge of standard clearances, design and estimation methods of service connections and its safety aspects.

COURSE OUTCOME:

CO1: To Define various terms related to electrical installation system.
CO2: To Illustrate methods of installation, testing and commissioning of electrical apparatus and conductors.
CO3: To Apply knowledge to design the distribution system for residential, commercial, industrial applications and utility distribution networks and illumination design.
CO4: To Examine fault level at various locations in radial networks and be able to find rating and location of series reactors.
CO5 : Design single line diagrams with specifications for distribution networks, motor and power control centers for industrial installations and design reactive power compensation.
CO6 : Understand the fundamental principles for the design and installation of associated protective systems relating to electrical installations and understand the fundamental transformer testing and recognizes the limits of acceptance of each test.

Unit 1: **(7 Hrs)**
Electrical load assessment:
Concept of electrical load, categories of load, types of loads, connected load, demand factor, Maximum demand, diversity factor, load factor, power factor, TOD Tariff, Industrial Electric Bills.
Cables, conductors & bus-bars:
Construction, selection, installation, testing of LT/ HT cables, overload & short circuit ratings, rating factors; Overhead line conductors, copper and aluminiumbusbars.

Unit 2:
Switching & protection devices: **(7 Hrs)**
Types, specifications; selections of isolators, switches, switch fuse units, MCB, ELCB, MCCB,ACB, VCB, SF6 breakers, dropout/ horn gap fuses, AB switches, contactors for voltages upto 33 kV.
Symmetrical Short Circuit Calculations: **(7 Hrs)**
Determining symmetrical short circuit currents at various locations for selecting proper circuit breaker rating & determining value of series reactors for limiting short circuit current.

Unit 3:
Electric supply to Induction Motors in industries:**(7 Hrs)**
Types of motors, SLD and working of DOL/ Star-Delta/ Autotransformer starters; types, specifications, selection of power contactors, Overload relays, short circuit protective devices.
Reactive power management in industries:
Reactive power compensation in industries using static capacitors, use of Power Triangle, Calculating payback period for capacitor investment due to reduced system currents.

Unit 4
Transformers: **(6 Hrs)**

Specifications, ratings, selection, installation, testing & commissioning of transformers, protective device for transformers.
Substations: Types of Substation, Substation scheme and components, 11kV & 33 kV, indoor/ outdoor substations, plan/ elevations, Earthing Arrangements.

Unit 5:Earthing: **(7 Hrs)**
Necessity of earthing, concept of system & equipment earthing, Dimension & drawings of typical earth electrodes 1) Pipe Earthing 2) Plate Earthing , Earth tester & measurement of earth resistance , Megger. Definition of various terms – Referene earth, earth electrode, earth grid, earth electrode resistance, earth leakage current, earthing conductor, earth mat.

Unit 6: **(6 Hrs)**
General awareness of IS codes (IS 3043,IS 732,IS 2675, IS 5216,IS 2309), The India Electricity act 1910, The Indian Electricity supply Act 1948, Indian Electricity rule 1956, The electricity regulation commission act 1998, Electricity act 2003, National Electric Code (NEC), scope and safety aspects applicable to residential, commercial & Industrial installation.

Text Books

1. Electric Power Distribution system by A.S.Pabla, Tata Mcgraw Hill.
2. Electrical Engineering Handbook, C. L. Wadhwa.
3. Design of Electrical Installations, V.K.Jain,Amitab Bajaj, Laxmi Publications Pvt Limited, 01-Jan-1993.

EE5TO01	OpenElective-I	Electrical Safety & Management	4 Credit

COURSE OUTCOMES
CO1: Explain the objectives and precautions of Electrical Safety, effects of Shocks and their Prevention.
CO2: Summarize the Safety aspects during Installation of Plant and Equipment.
CO3: Describe the electrical safety in residential, commercial and agricultural installations.
CO4: Describe the various Electrical Safety in Hazardous Areas, Equipment Earthing and System Neutral Earthing.
CO5: State the electrical systems safety management and IE rules.

UNIT-I (7Hr)
INTRODUCTION TO ELECTRICAL SAFETY, SHOCKS AND THEIR PREVENTION:
Terms and definitions, objectives of safety and security measures, Hazards associated with electric current, and voltage, who is exposed, principles of electrical safety, Approaches to prevent Accidents, scope of subject electrical safety. Primary and secondary electrical shocks, possibilities of getting electrical shock and its severity, medical analysis of electric shocks and its effects, shocks due to flash/ Spark over's, prevention of shocks, safety precautions against contact shocks, flash shocks, burns, residential buildings and shops.

UNIT-II (7Hr)
SAFETY DURING INSTALLATION OF PLANT AND EQUIPMENT:
Introduction, preliminary preparations, preconditions for start of installation work, during, risks during installation of electrical plant and equipment, safety aspects during installation, field quality and safety during erection, personal protective equipment for erection personnel, installation of a large oil immersed power transformer, installation of outdoor switchyard equipment, safety during installation of electrical rotating machines, drying out and insulation resistance measurement of rotating machines.

UNIT-III (7Hr)
ELECTRICAL SAFETY IN RESIDENTIAL, COMMERCIAL AND AGRICULTURAL INSTALLATIONS:
Wiring and fitting – Domestic appliances – water tap giving shock – shock from wet wall – fan firing shock – multi-storied building – Temporary installations – Agricultural pump installation – Do's and Don'ts for safety in the use of domestic electrical appliances.

UNIT-IV (7Hr)
ELECTRICAL SAFETY IN HAZARDOUS AREAS:
Hazardous zones – class 0,1 and 2 – spark, flashovers and corona discharge and functional requirements – Specifications of electrical plants, equipments for hazardous locations – Classification of equipment enclosure for various hazardous gases and vapours – classification of equipment/enclosure for hazardous locations. SF6 Breaker, Vaccum Circuit Breaker, AB Switches, HRC Fuses,etc.

UNIT – V
EQUIPMENT EARTHING AND SYSTEM NEUTRAL EARTHING: (7Hr)
Introduction, Distinction between system grounding and Equipment Grounding, Equipment Earthing, Functional Requirement of earthing system, description of a earthing system, , neutral grounding(System Grounding), Types of Grounding, Methods of Earthing Generators Neutrals.

UNIT-VI
SAFETY MANAGEMENT OF ELECTRICAL SYSTEMS: (5Hr)
Principles of Safety Management, Management Safety Policy, Safety organization, safety auditing, Motivation to managers, supervisors, employees.Review of IE rules and acts and their significance:

Objective and scope – ground clearances and section clearances – standards on electrical safety - safe limits of current, voltage –Rules regarding first aid and fire fighting facility. The Electricity Act, 2003, (Part1, 2, 3,4& 5)

Text books:

1. S. Rao, Prof. H.L.Saluja, “Electrical safety, fire safety Engineering and safety management”, Khanna Publishers. New Delhi, 1988.(units-I to V)
2. www.apeasternpower.com/downloads/elecact2003.pdf (Part of unit-V)

Reference Books:

1. PradeepChaturvedi, “Energy management policy, planning and utilization”, Concept Publishing company, New Delhi, 1997.

EE5L001	**Power Electronics Lab**	**1 Credit**

List of Practical:-

SrNo	Title of Experiment
1	To study Gate drive circuit
2	To study Reverse recovery time of diode
3	To study Single phase half wave controlled converter
4	To study Characteristics of junction gate fet
5	To study Unsymmetrical half wave bridge rectifier
6	To study SCR parallel inverter
7	To study Lamp dimmer using DIAC and TRIAC
8	To study Simulation of 3 phase full wave controlled rectifier
9	To study Simulation of 3 phase inverter
10	To study Simulation of buck converter

EE5L002	**Control Systems Lab**	**1 Credit**

List of Practical:-

Sr No	Title of Experiment
1	Potentiometer error detector
2	Time response of second order systems
3	Characteristics of synchros
4	A.C. position control system
5	D.C. position control system
6	Determination of step & impulse response for a first order unity feedback system
7	Lag and lead compensation - magnitude and phase plot
8	Stability analysis (Bode, Root locus, Nyquist) of linear time invariant system using MATLAB
9	State space model for classical transfer function using MATLAB
10	Study the effect of addition of poles to the forward path transfer function of a closed loop system
11	Effect of P, PD, PI, PID controller on second order systems

EE5L003	Power Systems-II Lab	1 Credit

List of Practical:-

Expt No	Title of Expt
1	Formation of Bus Admittance Matrix Y-BUS
2	Load flow study using Newton Raphsonmethod .
3	Load flow study using Gauss Seidal Iteration Method .
4	Study of AC network analyzer
5	Measurement of sequence reactance of salient pole synchronous machine
6	Measurement of sub transient reactance of salient pole synchronous machine
7	Steady state stability of synchronous motor
8	Steady sate power limit of transmission line
9	Fault study on AC network analyzer
10	Load flow study on AC network analyzer

EE5P003	Mini Project (Phase I)	**2 Credit**

Mini project should consist of Circuit design, PCB fabrication, & software testing of small digital or analog application circuit. Mini Project work should be carried out by a group of maximum three students. Student should use standard software available for drawing circuit schematic, simulating the design and PCB (single/double sided) layout of circuit.

SYLLABUS of VI Semester

EE6T001	Microprocessor and microcontroller	3 Credit

COURSE OBJECTIVES:

1.To know the architecture of 8085 and 8051.
2.To understand interfacing and interrupt features of 8085 and 8051.
3.To develop program for basic applications.

COURSE OUTCOMES:
CO1: To remember the architecture of 8085 and 8051.
CO2: To understand interfacing and interrupt features of 8085 and 8051.
CO3: To develop program for basic applications
CO4: To distinguish and analyze the properties of Microprocessors & Microcontrollers
CO5:To explain programming logic and concepts of 8085 microprocessors and 8051 micro-controller.
CO6:To build strong foundation for designing real world applications using microprocessors and microcontrollers.

Unit 1 : 8085architecture:(6 Hrs)
Architecture, register structure, addressing modes, instruction set of 8085, timing diagrams,Assembly Language Programming of 8085

Unit 2 : Interfacing: (7 Hrs)
Memory Interfacing: Interface requirements, Address space partitioning,Buffering of Buses, timing constraints, Memory control signals, Read and write cycles,interfacing SRAM, EPROM and DRAM sections. I/O Interfacing: Memory mapped I/OScheme, I/O mapped I/O scheme, Input and Output cycles, Simple I/O ports,Programmable peripheral interface (8255). Data transfer schemes: Programmable datatransfer, DMA data transfer, Synchronous, Asynchronous and interrupt driven datatransfer schemes, Interfacing, Simple keyboards and LED displays.

Unit 3 : Interrupts and DMA:(6 Hrs)
Interrupt feature, Need for interrupts, Characteristics of Interrupts,Types of Interrupts, Interrupt structure, Methods of servicing interrupts, Developmentof Interrupt service subroutines, Multiple interrupt request and their handling, need fordirect memory access, Devices for Handling DMA, Programmable DMA controller8237.

Unit 4 : Applications: (7 Hrs)
Interfacing of A/D converters (ADC 0800/ADC 0808/ADC 0809),Interfacing of D/A converters (DAC 0800), Waveform generators, Multiplexed seven segment LED display systems, Measurement of frequency, phase angle and powerfactor-Traffic light controller, Stepper motor control

Unit 5 : Introduction to microcontroller:(6 Hrs)
8051 architectures, 8051 Internal resources, pin diagram, I/O pins, ports and their internal logic circuits, counters, serial ports, interrupt structure, SFRs and their addressing, watch-dog timer, internal code memory, data memory, stack pointer, flags, bit addressable memory, study of instruction set of 8051.

Unit 6 : 8051 Peripheral Functions :(6 Hrs)
8051 interrupt structures, Timer and serial functions, parallelport features : Modes of operation, Power control, features, Interfacing of 8051, Typicalapplications, MCS 51 family features

Text Books

1. Goankar, R.S., “Microprocessor Architecture Programming and Applications with the 8085/8080A‟, 3rd Edition, Penram International Publishing House, 1997.
2. Singh. I.P., “Microprocessor Systems”, Module 9: Microcontrollers and their Applications”, IMPACT Learning Material Series IIT, New Delhi, 1997.

Reference Books

1. Douglas, V.Hall. “Microprocessor and Interfacing Programming and Hardware”, 2ndEdition, McGraw Hill Inc., 1992.
2. Kenneth, L.Short., “Microprocessors and Programmed Logic”, Prentice Hall of India, 2nd Edition, 1987

EE6T001	**Advanced Control Systems**	**3 Credit**

PRE REQUISITES: Control System-I

COURSE OBJECTIVES:

1. To introduce students about state variable approach and feedback design problems and also to introduce concept of Optimal Control theory, digital control system, Non Linear Control System
2. To Impart the knowledge of stability analysisforOptimal Control theory, digital control system, Non Linear Control System

COURSE OUTCOME:

After completion of syllabus, students must be able:

CO1: To remember the basic concepts of compensation, State variable analysis, Non linear Control System, Digital Control system.

CO2: To understand the basic concepts of compensation, State variable analysis, Nonlinear Control System, Digital Control system.

CO3: To apply different concepts to find controllability, observability and stability of non-linear control system, sampled data control system.

CO4: To analyze continuous time system using state space technique and investigate Controllability and Observability of the system, digital systems using the Z-transformation, and nonlinear system using the describing function technique and phase plane analysis

CO5: To evaluate various parameters of continuous time system, digital systems using the Z-transformation, and nonlinear system using various methods.

CO6: To design controllers to achieve desired specification

UNIT I: COMPENSATION [07 Hrs]

Need for compensation. Performance Analysis of Lead, Lag and Lag-lead Compensators in time & frequency domain, Bode Plots of Lead, Lag and Lag-lead Compensators.

UNIT II: DESIGN BY STATE VARIABLE FEEDBACK [07 Hrs]

Review of state variable representation. Eigen Values, Eigen Vectors, State Transition Matrix (STM), Model Matrix, Solution of state equation.Controllability and Observability. Design of SVF

UNIT III: OPTIMAL CONTROL SYSTEM [07 Hrs]

Performance Index (PI), Desirability of single P.I., Integral square error.Parameter Optimization with & without constraints. Optimal control problem with T.F. approach for continuous time system only.

UNIT IV: CONTROLLER TUNING [07 Hrs]

Review of analog PID controller, PID tuning methods in process control (Ziegler-Nichols tuning method), digital PID controllers.

UNIT V: NON LINEAR CONTROL SYSTEM (NLCS) [07 Hrs]

Non Linear Control System: Types of non-linearities, characteristics of NLCS. Inherent & intentional non- linearities. Describing function method for Analysis Describing functions of some common non-linearities. Stability analysis. Limit cycles & stability of limit cycles. Phase -Plane Method: Singular points stability from nature of singular points Construction of trajectory by Isocline and Delta Method Computation oftime.

UNIT VI: DIGITAL CONTROL SYSTEM [07 Hrs]

Representation of SDCS.Sample & Hold Circuit. Z – Transform. Inverse Z- Transform & solution of difference equation.Z & S domain relationship.Stability by bilinear transformation & Jury's test.Comparison of time response of continuous and digital control system, Effect of sampling period on transient response characteristic Discretization of continuous time state equation.Solution of Discrete time state equations. Controllability &Observability of Discrete time systems.

Text Book:

4. Benjamin C Kuo, “Automatic Control Systems”, Prentice Hall of India.
5. M. Gopal, “Control Systems- Principle of Design”, Fourth Edition, 2012, McGraw Hill.
6. I.J. Nagrath, “Control Systems Engineering” ,New Age International Ltd. , 2000

Reference Books:

5. D’AzzoHoupis, Logakusha, Huelsoman, “Linear System Analysis”, McGraw Hill.
6. Richard C. Dorf and Robert H. Bishop, “Modern Control Systems”, Pearson Education Inc.
7. Norman S Nise, “Control System Engineering”, John Wiley & Sons.
8. Katsuhiko Ogata, “Modern Control Engineering”, Prentice Hall of India

EE6TE03(A)	Elective III- Electrical Energy Conservation &Audit	4 Credit

COURSE OBJECTIVES:

To understand the need of energy audit and the mechanism through which it should be carry out and also to manage the electric and thermal energy.

COURSE OUTCOME:

CO1: Know Present energy scenario with need of energy audit and energy conservation.
CO2: Classify and Manage electric and thermal energy in the industry.
CO3: Identify various aspects of energy audit such as planning, monitoring and implementation
CO4: Analyze the energy flow diagram of an industry and identify the energy wasted or a waste stream.
CO5: Evaluate the techno economic feasibility of the energy conservation technique adopted.
CO6 : Choose appropriate energy conservation method to reduce the wastage of energy

Unit 1: Basics of Energy Management and Conservation (10 Hrs)

Global and Indian energy scenario. Global environmental concerns, Climate Change, Concept of energy management, energy demand and supply, economic analysis; Carbon Trading & Carbon foot prints. Energy Conservation: Basic concepts, Energy conservation in household, transportation, agricultural, service and industrial sectors; Lighting & HVAC systems in buildings.

Unit 2: Energy Audit (8 Hrs)

Definition, need, and types of energy audit; Energy management (audit) approach: Understanding energy costs, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements; Fuel & energy substitution; Energy audit instruments; Energy Conservation Act; Duties and responsibilities of energy managers and auditors.

Unit 3: Material & Energy balance and Waste Heat Recovery (8 Hrs)

Facility as an energy system; Methods for preparing process flow; material and energy balance diagrams. Cogeneration and waste heat recovery;

Unit 4: Energy Action Planning, Monitoring and Targeting: (8 Hrs)

Energy Action Planning : Key elements; Force field analysis; Energy policy purpose, perspective, contents, formulation, ratification; Organizing the management: location of energy management, top management support, managerial function, roles and responsibilities of energy manager, accountability; Motivation of employees: Information system-designing barriers, strategies; Marketing and communicating: Training and planning.
Monitoring and Targeting : Defining monitoring & targeting; Elements of monitoring & targeting; Data and information analysis; Techniques: energy consumption, production, cumulative sum of differences (CUSUM); Energy Service Companies; Energy management information systems; SCADA systems.

Unit 5: Electrical Energy Management: (8 Hrs)

Supply side: Methods to minimize supply-demand gap, renovation and modernization of power plants, reactive power management, Demand side management: conservation in motors, pumps and fan systems; energy efficient motors.

Unit 6: Thermal energy Management : (8 Hrs)

Energy conservation in boilers, steam turbines and Furnaces; Application of FBC, Heat exchangers and heat pumps.

Text Books/Reference books :

1) Principles of Energy Conservation, Archie, W Culp, Published by McGraw Hill, 1991.
2) Energy Management, P. O'Callaghan, McGraw - Hill Book Company, 1993.
3) Energy Management Handbook, Wayne C. Turner, Wiley Inter Science Publication

EE6TE04 (B)	Linear Electronic Circuits	3 Credit

COURSE OBJECTIVES:

CO1 To understand characteristics of IC and Op-Amp and identify the internal structure.
CO2 To introduce various manufacturing techniques.
CO3 To study various op-amp parameters and their significance for Op-Amp.
CO4 To learn frequency response, transient response and frequency compensation techniques for Op-Amp.
CO5 To analyze and identify linear and nonlinear applications of Op-Amp.
CO6 To understand functionalities of PLL.

COURSE OUTCOME:

On completion of the course, students will be able to:

CO1 Understand the characteristics of IC and Op-Amp and identify the internal structure.
CO2 Derive and determine various performances based parameters and their significance for Op-Amp.
CO3 Comply and verify parameters after exciting IC by any stated method.
CO4 Analyze and identify the closed loop stability considerations and I/O limitations.
CO5 Analyze and identify linear and nonlinear applications of Op-Amp.
CO6 Understand and verify results (levels of V & I) with hardware implementation
CO7 Implement hardwired circuit to test performance and application for what it is being designed.
CO8 Understand and apply the functionalities of PLL.

Unit I: OP-AMP Basics(7 Hrs)

Block diagram of OP-AMP, Differential Amplifier configurations, Differential amplifieranalysis for dual-input balanced-output configurations, Need and types of level shifter,current mirror circuits. Feedback topologies: Voltage series and voltage shunt feedbackamplifier and its effect on Ri, Ro, bandwidth and voltage gain.

Unit II: Linear Applications of OP-AMP(7 Hrs)

Inverting and non-inverting amplifier configurations, voltage follower, summing, averagingscaling amplifier, difference amplifier, integrator, differentiator, and instrumentationamplifiers.

Unit III: Non-linear Applications of OP-AMP(7 Hrs)

Introduction to comparator, characteristics and applications of comparator, Schmitt trigger,clippers and clampers, voltage limiters, square wave generator, triangular wave generator,Need of precision rectifiers, Half wave and Full wave precision rectifiers.

Unit IV: Converters using OP-AMP(7 Hrs)

V-F, I-V and V-I converter, Digital-to-analog converters (DAC): Weighted resistor, R-2Rladder, resistor string etc. Analog-to-digital converters (ADC): Single slope, dual slope,Successive approximation, flash type.

Unit V: Oscillators(6 Hrs)

Principle of Oscillators, Barkhausen criterion, Oscillator types: RC oscillators (design ofphase shift, Wien bridge etc.), LC oscillators (design of Hartley, Colpitts, Clapp etc.), nonsinusoidaloscillators, and voltage controlled oscillators.

Unit VI: Active filters and PLL(6 Hrs)
Design guidelines of Active filters: Low pass, high pass, band pass and band stop filters, block diagram of PLL and its function.

Text Books

1. Ramakant A. Gaikwad, “Op Amps and Linear Integrated Circuits”, Pearson Education 2000.
2. Salivahanan and KanchanaBhaskaran, “Linear Integrated Circuits”, Tata McGraw Hill, India 2008.
3. George Clayton and Steve Winder, “Operational Amplifiers”, 5th Edition Newnes.
4. Sergio Franco, “Design with Operational Amplifiers and Analog Integrated Circuits”, Tata McGraw Hill.

Reference Book

1. Bali, “Linear Integrated Circuits”, McGraw Hill 2008.
2. Gray, Hurst, Lewise, Meyer, “Analysis & Design of Analog Integrated Circuits”, Wiley Publications on Education.

EE6TE03(C)	**Elective III- Introduction to AC and DC Drive**	**3 Credit**

COURSE OBJECTIVES:

1. Understanding the operation of various drives
2. Learning about selection and control of motors.
3. Idea about AC/DC Contactors/Relays, Traction system and PLC programming & its application in electrical drives.

COURSE OUTCOMES

Students are able to

1. Examine factors governing selection of Electric Motors like speed torque characteristics under starting, running, and braking for particular application in a common electric drive system.
2. Select motor rating, Flywheel of common drive motors for continuous and intermittent periodic duties.
3. Analyze control circuit of ac/dc contactors and relays for automatic starting and braking of ac/dc motors.
4. Analyze the performance and suitability of motors used in ac/dc traction, their performance characteristic, and control and braking.
5. Apply digital control of electric motor, plc programming in electrical drives.

Unit I: Introduction to Drives **(6 Hrs)**

Basics of electrical drives and control ,Factors Governing Selection of Electric Motors, Types of Drives and Types of Load, Starting of electric motors, Speed control of Electric motors. Definition classification and speed torque characteristics of common drive motors and their characteristics under starting, running, Electric Braking. Types of enclosures.

Unit II: Rating **(6 Hrs)**

Rating & Service Capacity: Selection of Motor, Insulating materials, its classification, Temperature rise in Electrical machines, Power Capacity for Continuous and Intermittent Periodic Duties, Load Equalization: Flywheel Effect, Speed-Time Relations. Brief idea about drives commonly used in industries.

Unit III:AC and DC contactors and relays **(6 Hrs)**

Control devices for industrial motors, AC and DC contactors and relays: Lock out contactors, magnetic structure, operation, arc interruption, contactor rating, and H.V. contactors. Control circuits for automatic starting and braking of DC motor and three phase induction motor. Control panel design for MCC.

Unit IV: Electrical Traction **(6 Hrs)**

Electrical Traction: Electric Traction system, Speed time curve. Mechanics of Train movement. Traction motor: Motor Used in AC/DC Traction, Their Performance and Desirable Characteristics, Requirements and Suitability of Motor for Traction Duty. Control of D.C. Traction Motor, Series Parallel Control Starting and Braking of Traction Motor

Unit V:Traction motor control **(6 Hrs)**

Traction motor control – Starting and speed control traction motors. Series parallel control with numerical. Starting and speed control of 3-phase induction motors. Braking of traction motor.

Unit VI: (6 Hrs)

PLC, its programming and its applications in electrical drives.Digital control of Electric motor, Block diagram arrangement, comparison with other methods of control.

Text Books

1. G. K. Dubey, "Fundamentals of electrical drives", Second edition, (sixth reprint), Narosa Publishing house, 2001.
2. G.K Dubey, "Electrical Drives", Second Edition, 2002, PHI.
3. M.L. Soni, P.V. Gupta, U.S.Bhatnagar, "A course in Electrical Power", 1999, DhanpatRai& Sons.

Reference Books

1. VedamSubrahamanyam, "Electric Drives –Concepts & Applications", 1997, Tata McGraw-Hill.
2. H.Partab, "Art & Science of Utilization of Electrical Energy", 1999, DhanpatRai& Sons.
3. H.Partab, "Modern Electrical Traction", 1973, PritamSurat& Brothers.

EE6TE03 (D) Elective III-Electrical Power Distribution System Credit 3

COURSE OBJECTIVES:

1.To calculate different distribution factors

2.Understand classification of load, types of load curves.

3.Control of voltage and reactive power in distribution system

4.Understanddistribution automation

COURSE OUTCOME:

CO1. **Remember** basic principles of distribution systems and reliability indices.
CO2. **Understand** the principle of operation of feeder, substation and data acquisition system.
CO3. To **identify** the different factors related to distribution systems.
CO4. **Analyze** the effect of various equipments on voltage control and substation protection requirements.
CO5. **Evaluate** voltage drop, power loss and line drop in distribution system
CO6. **Solve** different problems related to radial networks, reactive power requirements and substation protection

UNIT-1: Distribution systems (6 hrs)
Introduction to Distribution systems, Explanation of basic terms like demand factor, utilization factor, load factor, plant factor, diversity factor, coincidence factor, contribution factor and loss factor, Relationship between the load factor and loss factor, Classification of loads , Changes in load curve due to loads, use of captive generation & cogeneration in distribution network, Electricity Act 2003, Energy conservation act-2001, electricity rules-2005

UNIT-2: **Feeders (6 hrs)**
Radial and loop types, engineering considerations for voltage levels and loading, causes of unbalance and unequal drops.
System analysis : Voltage drop and power loss calculations, manual methods of solution of radial networks, three-phase & non-three-phase primary lines load flow and symmetrical component applications.

UNIT-3 :**Distribution System Reliability (6 hrs)**
Basic definition, appropriate levels of distribution reliability, Series & Parallel System, Markov Processes, Distribution reliability Indices, System and customer based indices, load and energy based indices, usage of reliability indices.

UNIT-4: **Voltage control (6 hrs)**
Equipment for voltage control, effect of series capacitors, effect of AVB/AVR, line drop calculations and compensations, Reactive power requirements, economic consideration & best location.

UNIT-5: DistributionAutomation(6 hrs)

Introduction to Distribution Automation, Data acquisition system and decentralized control, data acquisition and protection considerations of control panel, circuit breakers, fuses, relays, earthing.

UNIT-6: Substation (6 hrs)

Substation layout, selection criteria, voltage and spacing load, space and location, distribution substation protection needs, distribution substation construction methods, trends in distribution substation, insulation coordination, voltage regulation, theoretical consideration for fault calculations.

Text Books

1. A. S. Pabla,“Electric Power Distribution”, Fourth Edition, 1997, Tata McGraw-Hill Publishing Company.

2. Kamaraju ,“Electrical Power Distribution System”,Tata-McGraw Hill Publications.

3. TuranGonen, “Electric Power Distribution SystemEngineering”, 2nd Edition,2008,CRC Press

Reference Books

1.M. K. Khedkar& G. M. Dhole., “Electric Power Distribution Automation”, University Science Press.

EE6TE04(A)	**Elective IV- Solar Photovoltaic Devices**	**3 Credit**

COURSE OBJECTIVES:

1. To make the student aware about potential of solar photovoltaic energy source,
2. Introduce modeling of PV cell,
3. Understand the maximum PV power harnessing
4. familiarize with PV power conversion devices.

COURSE OUTCOME:

CO1: Calculate and analyse solar insolation on a collecting surface by locating the sun position at anygiven location and time, interpret sun path diagrams.
CO2. Interpret I-V curves from the circuit model of a PV cell, understand the impact of temperature andsolar insolation on I-V curves.
CO3. Evaluate the algorithms used for the maximum power point tracking of PV array.
CO4. Understand the principle of DC-AC power conversion in Grid connected PV system
CO5. Design standalone PV system by estimating the load, sizing and selecting the batteries, sizing and
selecting the PV modules and other components
CO6. Understand the various issues in PV systems.

Unit I:Introduction : (6 Hrs)

Fossil fuel energy usage and global warming; role of renewable energy in sustainable development; renewable energy sources; global potential for solar electrical energy systems.

Unit II Solar Radiation :(6 Hrs)

Extra-terrestrial and terrestrial solar spectrum; clear sky direct-beam radiation; total clear sky Insolation on a collecting surface; radiation on the collector in tracking systems; calculation of average monthly insolation from measured data.

Unit III: PV Cells and Modules :(6 Hrs)

Photovoltaic cell and its simple model; i-v and p-v characteristics; PV modules and arrays ; effect of shading, use of bypass and blocking diodes; influence of temperature; types of solar cells and their performance; Charge controller, Introduction of maximum power point tracking algorithms

Unit IV: PV Inverters: (7 Hrs)

Principle of DC-AC conversion, Working of Grid-connected PV inverter, schemes and basic control; Introduction to Grid Interfacing standards.

Unit V: PV Systems with Battery Energy Storage: (7 Hrs)

Power processing schemes and control for stand-alone applications; batteries for energy storage – types, charging, battery sizing and turn-around efficiency; other types of energy storage for PV systems; grid connected schemes with standby energy storage.

Unit VI :System Level Issues: (6 Hrs)

Design related issues; grounding, dc arcing and other safety related issues; islanding; harmonics; electro-magnetic interference; energy yield and economics of a PV installation.

Text Books

1. Solar Photovoltaic: Fundamentals, Technologies and Applications: Solanki, PHI Learning Pvt Ltd, 2009

Reference Books

1. Photovoltaic Systems Engineering: Roger A. Messenger & Jerry Ventre, CRC Press, 2004, 2nd edition.
2. Renewable and Efficient Electric Power Systems: Gilbert M. Masters, John Wiley & Sons, 2004

EE6TE04(B)	**High Power Semiconductor Devices**	**3 Credit**

COURSE OBJECTIVES:

1. To review principle of construction, operation and characteristics of Power switching devices
2. To understand and analyse performance of Power switching devices.
3.To understand various types of Firing and Protecting Circuits.
4. To understand various types of Thermal Protection.

COURSE OUTCOME:

CO1: To remember the principle of operation of various Power switching devices
CO2: To Understand the characteristics of various types of Power switching devices
CO3: To make use of steady state and dynamic models of Power switching devices
CO4: To analyse various types of Thermal Protection required for protection of Power switching devices
CO5: To compare various Thermal Protections and firing protection Circuits of Power switching devices
CO6: To design the Firing and Protecting Circuits for various Power switching devices.

Unit I: Power switching devices overview(6 Hrs)
Attributes of an ideal switch, application requirements, circuit symbols; Power handling capability – (SOA); Device selection strategy – On-state and switching losses – EMI due to switching - Power diodes - Types, forward and reverse characteristics, switching characteristics – rating.

Unit II :Current Controlled Devices: (6 Hrs)
BJT's – Construction, static characteristics, switchingcharacteristics; Negative temperature co-efficient and secondary breakdown; Power darlington –Thyristors – Physical and electrical principle underlying operating mode, Two transistor analogy– concept of latching; Gate and switching characteristics; converter grade and inverter grade andother types; series and parallel operation; comparison of BJT and Thyristor – steady state and dynamic models of BJT &Thyristor.

Unit III: Voltage Controlled Devices: (6 Hrs)
Power MOSFETs and IGBTs – Principle of voltage controlled devices, construction, types, static and switching characteristics, steady state and dynamic models of MOSFET and IGBTs - Basics of GTO, MCT, FCT, RCT and GATT.

Unit IV: Firing and Protecting Circuits: (6 Hrs)
Necessity of isolation, pulse transformer, optocopler – Gate drives circuit: SCR, MOSFET, IGBTs and base driving for power BJT. - Over voltage, over current and gate protections; Design of snubbers.

Unit V: Thermal Protection: (6 Hrs)

Heat transfer – conduction, convection and radiation; Cooling – liquid cooling, vapour – phase cooling; Guidance for hear sink selection – Thermal resistance and impedance -Electrical analogy of thermal components, heat sink types and design – Mounting types

Unit VI: Phase Controlled Converters: (6 Hrs)
Performance measures of single and three-phase converters with discontinuous load current for R, RL and RLE loads. Effect of source inductance for single and three-phase converters.

Text Books:

1. Rashid M. H., "Power Electronics Circuits, Devices and Applications", Prentice Hall India,Third Edition, New Delhi.

Reference Books:

1. B.W. Williams 'Power Electronics: Devices, Drivers, Applications and Passive Components, Tata McGraw Hill.
2. M. D. Singh and K. B. Khanchandani, "Power Electronics", Tata McGraw Hill.
3. Mohan, Undeland and Robins, "Power Electronics – Concepts, applications and Design, John Wiley and Sons, Singapore.

EE6TE04(C)	Elective IV -Power Semiconductor Based Drive	3 Credit

COURSE OBJECTIVES:

1.To study the converter and Chopper control of DC drives.
2.To study the semiconductor based control of Induction and Synchronous motors.
3.To learn the basics of Switched reluctance motor and Brushless DC motor.
4.To study the non conventional and renewable energy based drives.

COURSE OUTCOMES:

CO1. **Remember** fundamental principles of power electronics and electric drives.
CO2. **Understand** the basics of construction & principle of operation ofvarious electric drives.
CO3. **Apply** suitable control methods to different motor drives.
CO4. **Analyze** the output of conventional drives and semiconductor based drives.
CO5. **Evaluate** the power factor, harmonics and ripple in motor current.
CO6. **Solve** the problems related starting, braking and speed control of motor drives.

Unit I:Dynamics of Electric Drives (7 Hrs)
Fundamentals of torque equations, speed torque convention and multiquadrant operation, components of load torques, classification of load torques, steady state stability, load equation. Speed control and drive classification, close loop control of drives.

Unit II:D.C. motor drives(7 Hrs)
Controlled rectifier fed d.c. drives, single phase and three phase rectifier control of d.c. separately excited motor. Dual converter control of D.C separately excited motor. Power factor, supply harmonics and ripple in motor current. Chopper controlled dc drives of separately excited dc motor, chopper control of series motor, source current harmonics.

Unit III:Induction motor drives(7 Hrs)
Stator voltage control, variable frequency control usingvoltage source invertors, and current sources invertors. Concept of scalar control of 3-ph Induction Motor, Basic philosophy of vector control of 3-ph I.M. their advantages and list of applications.Basic idea of energy conservation in fan and pump type loads using scalar controlled induction motordrives.(Numericals excluded)

Unit IV:Synchronous Motor Drives(7 Hrs)
Starting Braking of synchronous motor, variable frequency control selfcontrolled synchronous motor drive employing load commutated thyristor inverter or cycloconverter, starting oflarge synchronous motors.

Unit V:Advanced Motor Drives(7 Hrs)

Brushless DC motor, stepper motor drives, Introduction tosolar and battery powered drives.Energy conservation in electric drives.

Unit VI:Traction drives: **(7 Hrs)**

Conventional dc and ac traction drives, semiconductors converter controlled Drives, 25KV AC traction using semiconductor converter controlled dc motor. DC traction using semiconductor, chopper controlled dc motors, polyphase AC motors for traction drives.

Text Books

1.M. H. Rashid, “Power Electronics Circuits Devices and Applications”, Prentice Hall India

2.G. K. Dubey, “Fundamentals of Electric drives”, CRC Press

3.HPartab, “Modern Electric Traction”, PritamSurat, 1973.

4.Venkataratnam K., Special Electrical Machines, CRC Press, 2009.

Reference Books

1.Ned Mohan, “Power Electronics”, John Wiley and Sons, 3rd Edition

2. VedamSubramanhyam, "Electrical drives concepts and applications ", McGraw Hill 1996

EE6TE04(D)	Elective 4-High Voltage DC transmission(HVDC)	4 Credit

PRE REQUISITES: Electrical Power Systems I & II

COURSE OBJECTIVES:

1. To expose the students to the state of the art HVDC technology.
2. Methods to carry out modelling and analysis of HVDC system for inter-area power flow regulation

COURSE OUTCOME:

CO1. **Remember** basic principles of some HVDC Systems.
CO2. **Understand** the basics of HVDC Systems and their implementation.
CO3. To **identify** the different operational characteristics related to HVDC Systems.
CO4. **Analyze** the performance of HVDC Systems.
CO5. **Evaluate** the operation & characteristics of HVDC Systems.
CO6. **Solve** the different problems related to operation of HVDC Systems.

UNIT-I: DC POWER TRANSMISSION FUNDAMENTALS (07 Hrs)
Introduction, Economics of Dc Power transmission, comparison with AC system, Types of DC links, major components of converter station, planning of HVDC system.

UNIT-II: HVDC CONVERTERS (07 Hrs)
Choice of converter configuration, analysis of Gratz circuit with and without overlap, working of converter as rectifier and inverter, equivalent circuit for HVDC link.

UNIT-III: HVDC SYSTEM CONTROL (06 Hrs)
HVDC System Control: Principles of DC link control, converter control characteristics, firing angle control, current and extinction angle control, Starting and stopping of HVDC link.

UNIT-IV: CONVERTER FAULTS AND PROTECTION (07 Hrs)
Converter Faults and Protection: Types of faults-commutation failure, Arc through, Misfire, short circuit in bridge, Over current and over voltage protection, Detection of line faults, Principle of DC circuit interruption, DC breakers, Types and characteristics of DC breakers, effects of proximity of AC and DC transmission lines.

UNIT-V: Multi -Terminal DC (MTDC) Systems (05 Hrs)
Introduction to MTDC Systems, Importance of Multi-Terminal HVDC Systems, Control of MTDC Systems, Interaction between AC-DC Power Systems.

UNIT-VI: Modelling& Representation of HVDC systems (05 Hrs)

Modeling Of HVDC Systems, Per Unit System, Representation for Power Flow Solution, and Representation for Stability Studies.

Text Books

1. J. Arrillaga,"High Voltage Direct Transmission", Peter Peregrinus Ltd. London, 1983.
2. K. R. Padiyar, "HVDC Power Transmission Systems", Wiley Eastern Ltd., 1990.

Reference Books

1. E. W. Kimbark, "Direct Current Transmission", Vol.I, Wiley Interscience, 1971.
2. Erich Uhlmann, "Power Transmission by Direct Current", B.S. Publications, 2004.

EE6TO01	OpenElective I-Industrial Instrumentation	**4 Credit**

COURSE OBJECTIVES:

The objective of the course is to prepare the students:

1. To equip the students with relevant knowledge to suit the industrial requirements.
2. To provide the knowledge about various techniques used for the measurement of industrial parameters.
3. To have an adequate knowledge about electrical and mechanical transducers for measurements of various physical quantities.

COURSE OUTCOME:

At the completion of this course, students will be able to:

1. Select the instruments for measurement of various physical quantities,
2. Select a transducer based on its operating characteristics for the required application.
3. Check various available techniques and select appropriate to obtain satisfactory task for the parameter to be measured.
4. Know advantages and limitations of selected techniques.

Unit I: Introduction to Industrial Instrumentation: (6 Hrs)

Definitions, Dynamic Characteristics of Instruments, Zero-Order Instrument, First-Order Instrument, Second-Order System.

Pressure Measurement: Introduction, Basic terms, Pressure formulas, Pressure measuring instruments, Application considerations.

Unit II: Temperature and Heat Measurement: (6 Hrs)

Introduction, basic terms, Temperature and heat formulas, Temperature measuring devices, Application considerations.

Unit III: Level Measurement &Flow Measurement: **(6 Hrs)**

Introduction, basic terms, Level formulas, Level sensing devices, Application considerations. Flow formulas, Flow measuring instruments, Application considerations.

Unit IV: Position and motion sensing: (6 Hrs)

Basic definitions, measuring devices, application considerations.

Force, Torque and Load cell: Basic definitions, measuring devices, application considerations

Unit V: Transducers:

Introduction to instrumentation system, static and dynamic characteristics of an instrumentation system, Principles and classification of transducers, Electrical transducers, basic requirements of transducers.

Unit VI: Digital Data Acquisition systems & control:

Use of signal conditioners, scanners, signal converters, recorders, display devices, A/D & D/A circuits in digital data acquisition.Instrumentation systems.Types of Instrumentation systems.Components of an analog Instrumentation Data –Acquisition system.Multiplexing systems.Uses of Data Acquisition systems.Use of Recorders in Digital systems.Digital Recording systems.Modern Digital Data Acquisition system. Analog Multiplexed operation, operation of sample Hold circuits.

Text Books

1. Industrial Instrumentation: K Krushnaswamy, New Age International
2. E.O. Doebelin, 'Measurement Systems – Application and Design', Tata McGraw Hill publishing company, 2003.
3. R.K. Jain, 'Mechanical and Industrial Measurements', Khanna Publishers, New Delhi, 1999.

Reference Books

1. Fundamentals of Industrial Instrumentation and Process Control:
   William C. Dunn, TMH Publication, 2nd edition.
2. D. Patranabis, 'Principles of Industrial Instrumentation', Tata McGraw Hill Publishing Company Ltd, 1996.
3. A.K. Sawhney and P. Sawhney, 'A Course on Mechanical Measurements, Instrumentation and Control', DhanpathRai and Co, 2004.
4. B.C. Nakra&K.K.Chaudary, 'Instrumentation Measurement & Analysis', Tata McGraw Hill Publishing Ltd, 2004
5. S.K. Singh, 'Industrial Instrumentation and Control', Tata McGraw Hill, 2003.
6. D.P. Eckman', Industrial Instrumentation', Wiley Eastern Ltd.,

EE6L001	Microprocessor and microcontroller **Lab**	**1 Credit**

List of Practical:-

Sr.No	Title of Experiment
1	Study of architecture of 8085
2	Assembly language programmes for determination of smaller and larger no
3	Assembly language programmes for ascending and descending order
4	Multiplication/division of numbers
5	Assembly language programmes for led flashing (Interfacing of 8051 Microcontroller with various display devices.
6	Programming for speed and direction control of dc motor(Interfacing of 8051 Microcontroller with DC motor.
7	Programming for speed and direction of stepper motor
8	Study of hexadecimal, modulo-9, BCD counter
9	Write a program to move a block of data using 8085 & verify
10	Write a program using 8085 & verify for :A. Addition of Two 8-Bit Numbers,B. Addition of Two 16-Bit Numbers (With Carry).

11	Write a Program Using 8085 & Verify for :a. Subtraction of Two 8-Bit Numbers. (Display Of Borrow),b Subtraction of Two 16-Bit Numbers. (Display Of Borrow)

EE6L003	CAD **Lab**	**1 Credit**

List of Practical:-

Sr.No	Title of Experiment
1	**Introduction to CAD**
2	Study of AutoCAD software basics - GUI, limits and units, drawing tools, editing tools, annotations etc.
3	Study of Coordinate systems- Cartesian and Polar (absolute and relative system of measurement) and practice drawing by using following tools: Grid, span, O-snap, Lines, Erase, Zoom.
4	Create a 2D drawing of a given diagram by using drawing tools: circle, arc, rectangle, polygon, ellipse, and Editing tools: trim, move, copy, rotate, and practice of drawing using these commands.
5	Study and create drawing by using Geometry modifying tools: fillet, chamfer, scale, stretch.
6	Study and create drawing by using copying tools like array, mirror, block and offset.
7	Draw regular solids: Cube, Prism, Pyramid, Cylinder, Cones
8	Study and draw 3D drawing of the given object by using AutoCAD commands and tools.
9	Study and draw 3D drawing of the given object by using AutoCAD commands and tools.

10	Study and draw 3D drawing of the given object by using AutoCAD commands and tools.

EE6P004	**Mini Project (Phase II)**	**2 Credit**

Hardware Mini project should consist of Circuit design, PCB fabrication, & hardware designing of small digital or analog application circuit. Mini Project work should be carried out by a group of maximum three students. Student should use standard software available for drawing circuit schematic, simulating the design and PCB (single/double sided) layout of circuit. Project report should consist of details of work carried out including layouts, circuits, datasheets, list of components, cost .

EE6T003	**Research Methodology**	**2 Credit**

Course Objectives:

Student will be able to

1.Understand the basics of research and the research process.

2.Understand the conducting research work and formulating research synopsis andreport.

Know how to develop data analytics skills and meaningfulinterpretation to the data sets so as to solve the business/Research problem.

Course Outcomes

Student should be able to:

CO1. Remember the basic framework of research process.

CO2. Demonstrate various sources of information for research.

CO3. Develop an understanding of various research design and techniques.

CO4. Compare various sources of information for literature review and data collection.

CO5. Interpret the fundamental functions and working of analytical instruments used in research.

CO6.Discuss different methodologies and techniques used in research work.

Unit-I:

Introduction to Research Methodology Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, and Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Importance of Knowing How Research is Done, Research Process and Criteria of Good Research. Defining the Research Problem: Selecting the Problem, Necessity of Defining the Problem and Technique Involved in Defining a Problem

Unit-II:

Research Design Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs: Exploratory research, Descriptive research, diagnostic research, Basic principles of experimental Design and Important Experimental Designs.

Unit-III:

Sampling Design, Measurement and Scaling Techniques Census and Sample Survey, Implications of a Sample Design, Steps in Sampling Design, Criteria of Selecting a Sampling Procedure, Characteristics of a Good Sample Design, Different Types of Sample Designs, How to Select a Random Sample, Random Sample from an Infinite Universe, Complex Random

Sampling Designs. Measurement in Research, Measurement Scales, Sources of Error in Measurement, Tests of Sound Measurement, Technique of Developing Measurement Tools, Scaling, Meaning of Scaling, Scale Classification Bases, Important Scaling Techniques

Unit-IV:

Methods of Data Collection Collection of Primary Data, Observation Method, Interview Method, Collection of Data through Questionnaires, Collection of Data through Schedules, Difference between Questionnaires and Schedules, Some Other Methods of Data Collection, Collection of Secondary Data, Selection of Appropriate Method for Data Collection and Case Study Method.

Unit-V:

Simulation in Research

Meaning of Simulation, Need of Simulation, Appropriateness of Simulation, Advantages and Disadvantages of Simulation, Areas of Application, Study of any one tool relevant to electrical engineering area is compulsory

Text Books/References:

1. C. R. Kothari, Research Methodology: Methods and Techniques, Second Revised Edition, New Age International Publication, 2004.
2. J. Banks, J. C. Carson II, B. L. Nelson, D. M. Nicol, Discrete Event System Simulation, Fourth Edition, Prentice Hall of India Publication, 2006.
3. K. N. Krishanaswamy, Appa lyer Sivakumar, M. Mathiranjan, Management Research Methodology: Integration of Principles, Methods and Techniques, Pearson Education, New Delhi, 2006.

Course Structure and Syllabus

Curriculum for Semester- III [Second Year]

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				Credit
				L	T	P	CA	MSE	ESE	Total	
1	HSMC	AI3T001	Organization Behaviour	2	0	0	20	20	60	100	2
2	BSC	AI3T002	Mathematics-III	3	1	0	20	20	60	100	4
3	ESC	AI3T003	Statistical Data Analysis	3	0	0	20	20	60	100	3
4	PCC	AI3T004	Computer Architecture Organization	3	0	0	20	20	60	100	3
5	PCC	AI3T005	Internet of Things	2	0	0	20	20	60	100	2
6	PCC	AI3T006	Data Structure & Algorithm	3	1	0	20	20	60	100	4
7	ESC	AI3L007	Introduction to IoT (Lab)	0	0	2	60	0	40	100	1
8	ESC	AI3L008	Data Structure & Algorithm (Lab)	0	0	2	60	0	40	100	1
9	ESC	AI3L009	Data Analytics (Lab)	0	0	2	60	0	40	100	1
10	UHV	AI3T010	Universal Human Values	3	0	0	20	20	60	100	3
				19	2	6	320	140	540	1000	24

AI3T001	**Organizational Behaviour**	**2 Credit**

COURSE OBJECTIVES:

1. To help the students to develop cognizance of the importance of human behaviour.
2. To enable students to describe how people behave under different conditions and understand why people behave as they do.
3. To provide the students to analyze specific strategic human resources demands for future action.
4. To enable students to synthesize related information and evaluate options for the most logical and optimal solution such that they would be able to predict and control human behaviour and improve results.

COURSE OUTCOMES:

1. Students will be able to remember various methods and terms used in different organizational behaviour models.
2. Students will be able to understand Individual as well as Group Behaviour like attitude, perception, motivation, personality, misbehavior and emotions.
3. Students will be able to apply the Principles of Organization Behaviour through leadership, Power & Politics.
4. Students will be able to analyze the dynamics of organizational behaviour and managing change.
5. Students will be able to evaluate the importance of Advanced Communication tools and Techniques for the decision making Process.
6. Students will be able to design a Policy or Frame Rules and Regulation which will be useful for the employees working under any organization.

Course Contents:

Unit 1:Introduction to organization Behaviour **[4Hrs]**

Meaning, Fundamental concepts, Definition, Approaches to OB, Characteristics and limitations of OB, Challenges and Opportunities of OB, Models of OB, Impact of technology on organizational behaviour.

Organization Culture: Meaning and dimensions, Role of founders' values and vision in creating and sustaining culture, Types of organizational cultures, Impact of culture on image and performance of the organization.

Unit 2: Organizational Design, Change And Innovation **[4 Hrs]**

Designing an organizational structure, Division of labour, Delegation of authority, Departmental biases, Span of control, Dimensions of structure, Organizational design models, Multinational Structure and Design, Virtual Organizations.

Communication: The importance of communication, The communication process, Communicating within organizations, Information richness, How technology affects communication, Interpersonal communication, Multicultural communication, Barriers to effective communication, Improving Communication in organizations, Promoting ethical communications

Technical Report Writing : Characteristics of Technical Communication, Types of Technical Documents, Establishing Goals in Technical Writing, Technical Writing Process: Prewriting, writing, rewriting, Examples of Industries user manuals.

Unit3: Personality **[4 Hrs]**

Meaning of personality, Nature and Determinants of Personality, Personality Traits - Big Five, Locus of Control, Self-esteem, Type A/ Type B Personality, Risk Taking, Machiavellianism, Self-Monitoring, Personality and OB.

Attitude: Attributes of personality- Transactional Analysis – Ego states – Johari window - Nature and dimensions of attitude – Developing the right attitude, ABC model of Attitude, Managerial Implications of Attitude

Unit 4: Groups and Organizations **[4 Hrs]**

Groups and Teams, Group Dynamics - Groups versus teams, Nature and types of groups and teams, five stages of group/team development, Determinants of group behaviour, Typical teams in organizations.

Leadership: Leadership as a concept and its essence, Leaders versus managers, Blake and Mouton's managerial grid, Hersey and Blanchard's situational leadership, Transactional versus Transformational leadership, Women as leaders, Leadership in entrepreneurial and family business, organizations.

Unit 5: Motivation **[4 Hrs]**

Power and purpose of motivation, Theories of motivation - Locke's goal setting theory, Vroom's expectancy theory, Porter and Lawler's model, Adam's equity theory, McClelland's theory of needs, Motivational Techniques – Job design/enlargement /enrichment / rotation, Managing rewards - Job status based rewards, Competency based rewards, performance based rewards, Empowerment and Self Managed Teams.

Power and Politics: The concept of power, Sources of power, Interdepartmental power, Illusion of power, Political strategies and tactics, Ethics, power and politics, using power to manage effectively.

Empowerment and Participation: The nature of empowerment and participation, How participation works, Programs for participation, Important considerations in participation.

Unit 6: Conflict Management **[4 Hrs]**

Definition. Traditional vs Modern view of conflict – Types of conflict – Intrapersonal, Interpersonal, and Organizational, Constructive and Destructive conflict, Conflict management

Stress and Counselling: What is stress? Stress model, Work stressors, Stress outcomes, Stress moderators, Stress prevention and management, Employee counselling, Types of counselling

Text Books:

1. V.G.Kondalkar , "Organization Behaviors" , New Age International Publisher,2007.

2. Uma Sekaran, "Organization Behaviors" , McGraw Hill Company, New Delhi ,2011.

3.Nair, Banerjee, Agarwal , "Organization Behaviors" , PrgathiPrakashan, New Delhi,2006.

Reference Books:

1.LM Prasad , "Organization Behavior", S. Chand and Co. Ltd, New Delhi,2008.

2. S.S. Khanka , " Organization Behavior", S. Chand and Co. Ltd, New Delhi , 2008

3. Fred Luthans , " Organization Behavior",McGraw Hill Book Co,2005

AI3T002	Mathematics-III	4 Credit

COURSE OBJECTIVES:

1. To understand the concept of Laplace Transform , Fourier transform, complex variables Numerical Linear algebra, Stochastic calculus, Computational graph theory.
2. To understand the application of Mathematics in engineering and in real life
3. To enable students to apply mathematical tools to solve problems in real life.
4. To enable students to apply mathematical tools to analyze problems in real life.
5. To enable students to evaluate the problem based on the concept of Laplace Transform, Fourier transform, complex variables, Numerical Linear Algebra, Stochastic calculus, Computational graph theory.
6. To enable students to create the new concept by using the theory of Laplace Transform, Fourier transform, complex variables, Numerical Linear Algebra, Stochastic calculus, Computational graph theory.

COURSE OUTCOME:

At the end of the course the student will be able to:

1. Describe the concept of Laplace Transform, Fourier transform, complex variables, Numerical Linear Algebra, Stochastic calculus, Computational graph theory.
2. Illustrate the concept of Laplace Transform, Fourier transform, complex variables, Numerical Linear Algebra, Stochastic calculus, Computational graph theory by using examples.
3. Apply the concept of Laplace Transform, Fourier transform, complex variables, Numerical Linear Algebra, Stochastic calculus, Computational graph theory to solve the problem.
4. Analyze the problem by using the concept of Laplace Transform, Fourier transform, complex variables, Numerical Linear Algebra, Stochastic calculus, Computational graph theory.
5. Evaluate the problem basedon the concept of Laplace Transform, Fourier transform, complex variables, Numerical Linear Algebra, Stochastic calculus, Computational graph theory.
6. Create the new concept by using the theory of Laplace Transform, Fourier transform, complex variables, Numerical Linear Algebra, Stochastic calculus, Computational graph theory.

[Unit1] **8Hrs**

Laplace transform: Definition ;Transforms of elementary functions; Properties of Laplace transform; Inverse Laplace transform; Convolution Theorem for finding inverse

Laplace transforms ; Applications of Laplace transform to find the solutions of differential equations. Introduction to Latex. Calculation of Laplace transform by using software.

[Unit2] **8Hrs**

Fourier transform: Definitions – Fourier transforms ; Properties of Fourier transforms ; Fourier sine and cosine transforms ; Properties of Fourier transforms ; Parseval's identity for Fourier Transforms; Finite Fourier transform.

[Unit3] **8Hrs**

Functions of complex variables : Analytic functions; Harmonic functions in Cartesian form; fundamental theorem of algebra; Cauchy's integral theorem; Cauchy's integral formula; Residues; Cauchy's residue theorem.

[Unit4] **8Hrs**

Numerical linear algebra: Introduction to linear algebra; condition number of a matrix; sensitivity analysis; Norm ; stability of numerical algorithms; stability of nonlinear system; SVD; Power method; Google page rank algorithm.
Introduction about meta-heuristic method; Nature-inspired method :ant colony optimization .

[Unit5] **8Hrs**

Stochastic calculus: Stochastic Processes: Definition and classification of random processes; Discrete-time Markov chains; Poisson process; Continuous-time Markov chains; Stochastic integration, Itôintegral ,Itôformula. Stochastic differential equations. Application of stochastic calculus in computer science.

[Unit6] **8Hrs**

Computational graph theory : Basic terminology in graph theory; Invariant of a graph; Adjacency matrix of a graph; Laplacian matrix of a graph; Algebraic connectivity of a graph; Properties of eigenvalues and eigenvectors of an adjacency matrix and Laplacian matrix of a graph.

Text Books:

1. Higher Engineering Mathematics by B. S. Grewal, Khanna Publishers, New Delhi.

2. Advanced Engineering Mathematics by Erwin Kreyszig, John Wiley & Sons, New York.
3.A Course in Engineering Mathematics (Vol III) by Dr. B. B. Singh, Synergy Knowledgeware, Mumbai.
4.A Text Book of Applied Mathematics (Vol I & II) by P. N. Wartikar and J. N. Wartikar,PuneVidyarthiGrihaPrakashan, Pune.
5.Higher Engineering Mathematics by H. K. Das and Er. RajnishVerma, S. Chand &CO.Pvt. Ltd., New Delhi.
6. D. S. Watkins, Fundamentals of Matrix Computations, John Wiley, 1991.
7. G. H. Golub and C. F. Van Loan, Matrix Computations, 3rd Edition, John Hopkins University Press, 1996.
8. S.M. Ross, Stochastic Processes, 2nd Edition, Wiley, 1996.
9. J. Medhi, Stochastic Processes, New Age International, 1994.
10. J. A. Bondy and U. S. R. Murty. Graph Theory with Applications.North-Holland, 1976.
11. J. M. Aldous. Graphs and Applications. Springer, LPE, 2007.
12. D. M. Cvetkovic, M. Doob and H. Sachs, Spectra of Graphs: Theory and Applications, Academic Press, 1980.
13. C. Godsil and G. Royale, Algebraic Graph Theory, Graduate Texts in Mathematics 207, Springer, 2001.
14. R. B. Bapat, Graphs and Matrices, Texts and Readings in Mathematics, Hindustan Book Agency, New Delhi, 2010.

Reference Books:

1. Higher Engineering Mathematics by B. V. Ramana, Tata McGraw-Hill Publications, NewDelhi.
2. A Text Book of Engineering Mathematics by Peter O' Neil, Thomson Asia Pte Ltd.,Singapore.
3. Advanced Engineering Mathematics by C. R. Wylie & L. C. Barrett, Tata Mcgraw-HillPublishing Company Ltd., New Delhi.
4. Integral Transforms and Their Engineering Applications by Dr. B. B. Singh, Synergy .Knowledge ware, Mumbai.
5. Integral Transforms by I. N. Sneddon, Tata McGraw-Hill, New York.
6. L. N. Trefethen and D. Bau III, Numerical Linear Algebra, SIAM, 1997.
7. J. W. Demmel, Applied Numerical Linear Algebra, SIAM, 1997.
8. S. Shreve, Stochastic Calculus for Finance, Vol. 2, Springer, 2004.
9. J. M. Steele, Stochastic Calculus and Financial Applications, Springer, 2001

10. R. M. Patne, G. R. Avachar, note on an adjacency matrix of a graph G, Advances in Mathematics: Scientific Journal, volume 9(3), 1281–1291,2020

11. D. Lamberton and B. Lapeyre, Introduction to Stochastic Calculus Applied to Finance, Chapmans& Hall/CRC, 2000.

12. M. Baxter and A. Rennie, Financial Calculus, Cambridge University Press, 1996.

13. F. Harary: graph theory, addison-wesley reading, massachusetts, 1996.

AI3T003	Statistical Data Analysis	3 Credit

COURSE OBJECTIVES:

1. To understand the concept of Sampling from a distribution & sum of binomial.
2. To understand the concept of number of its definition & applications.
3. To learn the Base shifting, Splicing of index number series,
4. To learn the Consumer Price Index.
5. To understand the concept of Demand Analysis & Time Series Analysis .
6. To understand the concept of Estimation of elasticity from time series.

COURSE OUTCOMES:

1. To understand the concept of Sampling Drawing random samples from standard distributions, Distribution of a function of random variables:
2. To understand the Concept of a statistic and its sampling distribution.
3. To understand the concept & applications of index numbers. Laspeyre's, Paasche's, Marshall Edgeworth's, Walsch's, Kelly's DrobishBowley's and Fisher's quantity and price index numbers.
4. To learn the Demand and Supply function, Static laws of demand and supply, price elasticity of demand, price elasticity of supply.
5. To understand the concept of Economic time series, its different components.
6. To understand the concept illustrations, additive and multiplicative models.

Course Contents:

Unit – I **[6 HRS.]**

Sampling from a distribution: Definition of a random sample, Drawing random samples from standard distributions, Distribution of a function of random variables: Concept of a statistic and its sampling distribution, Transformation of variables technique: mgf and cdf techniques, univariate and bivariate transformations of discrete and continuous variables. Theoretical problems on these topics. R commands for drawing a random sample from binomial, Poisson, Uniform, exponential and Normal distributions

Unit – II **[6 HRS.]**

Sampling distribution of sum of binomial, Poisson variables and mean of normal variables, derivations Chi-square, t and F distributions (mgf, mean, variance, mode, additive property - if it exists), independence of sample mean and variance in random sampling from a normal distribution (without derivation).

UNIT III: **[6 HRS.]**

Index number: Its definition, applications of index numbers, price relatives and quantity or volume relatives, link and chain relatives, problems involved in computation of index numbers, use of averages, simple and weighted aggregative and simple and weighted average methods, Laspeyre's, Paasche's, Marshall Edgeworth's, Walsch's, Kelly's DrobishBowley's and Fisher's quantity and price index numbers, Time and Factor reversal tests of index numbers.

UNIT IV: **[6 HRS.]**

Base shifting, Splicing of index number series, Consumer Price Index: steps in its construction, methods and uses, Index of Industrial Production: method of construction and its uses, Wholesale price index number: method of construction and its uses, concept of purchasing power of money, inflation and deflation, Methods of computation of national income.

UNIT V: **[6 HRS.]**

Demand Analysis: Demand and Supply function, Static laws of demand and supply, price elasticity of demand, price elasticity of supply, Income and cross elasticity of demand. Engel' law and Engel's curves, analysis of income and allied size distribution – Pareto distribution, fitting of Pareto's law, Lorenz curve and Gini's coefficient.

UNIT VI: **[6 HRS.]**

Time Series Analysis: Economic time series, its different components, illustrations, additive and multiplicative models, methods of determination of trend, analysis of seasonal fluctuations, methods of construction of seasonal indices. Estimation of elasticity from time series data: Leontief'smethod, Pigou's method.

Text Books:

1. Freund J.E. (2001): Mathematical Statistics, Prentice Hall of India.

2. Goon A.M., Gupta M.K., Dasgupta B.(1991): Fundamentals of Statistics,Vol.I, World Press, Calcutta.

3. Goon A.M., Gupta M.K., Das Gupta. B. (1986): Fundamentals of Statistics, Vol.II, World Press, Calcutta

4. Hodges J.L. and Lehman E.L.(1964): Basic concepts of Probability and Statistics, Holden Day.

Reference Books:

1. Mood A.M., Graybill F.A. and BoesD.C.(1974): Introduction to the theory of Statistics, McGraw Hill.

2. Hogg R. V. and Craig A. T.: Introduction to Mathematical Statistics , McMillan Publishing Company

3. SudhaPurohit, GoreS.D.,Deshmukh S. R.: Statistics Using R,Narosa

4. Christian S. Albright, Wayne L. Winston, Zappe Christopher J. : Decision Making using Microsoft Excel (CENGAGE Learning)

5. KVS Sarma, Statistics Made Simple: Do it yourself on PC (PHI)

AI3T004	Computer Architecture Organization	3 Credit

Course Objectives:

1. To understand the relationship between instruction set architecture, architecture, and system architecture and their roles in the development of the computer.
2. To be aware of the various classes of instruction: data movement, arithmetic, logical and flow control. Explain how interrupts are used to implement I/O control and data transfers..
3. To Understand how a CPU's control unit interprets a machine –level instructions.
4. To Identify various types of buses in Computer systems.
5. To Understand memory hierarchy.
6. To Understand various peripheral devices.

Course outcomes:

Students will be able to:

1	Describe the fundamental organisation of a computer system
2	Interpret the functional architecture of computing systems. (Understanding)
3	Explain addressing modes, instruction formats and program control statements
4	Distinguishtheorganizationofvariouspartsofasystemmemoryhierarchy
5	Describe basic concept of parallel computing and Describe fundamentals concepts of pipeline and vector processing
6	Identify, compare and assess issues related to ISA, memory, control and I/O functions. (Applying, Analyzing, Evaluating)

Course Contents:

Unit 1 **[8 Hrs]**

Basic Structure of Computer: Hardware & Software, Addressing Methods, Program Sequencing, Concept of Memory Locations & Address, Main Memory Operation, Instructions & Instruction Sequencing, Number representation, Design of Fast Adders, Signed Addition and Subtraction. Multiplication of Positive numbers, Floating-Point Numbers and related operations Basic I/O Operations, Stacks, Queues & Subroutines.

Unit 2 **[8 Hrs]**

Processing Unit: Fundamental Concepts, Execution of a Complete Instruction, Hardwired Control, Performance Consideration, Micro-programmed Control, Microinstructions, Micro-program Sequencing, Microinstruction Pre-fetching, Emulation., Booth's Algorithm, Integer Division.

Unit 3 **[8 Hrs]**

I/O Organization: Accessing I/O Devices, Interrupts, Addressing Modes, Direct Memory Access, Bus arbitration, I/O Hardware, Processor Bus and Interfacing Circuits, Standard I/O Interfaces, SCSI Bus, Backplane Bus Standard.

Unit 4 **[8 Hrs]**

Memory Unit: Basic Concepts, Semiconductor RAM Memories, Internal Organization, Static & Dynamic RAMs, ROMs, Speed, Size& Cost Considerations. Cache Memories: Performance considerations. Virtual Memories, Address Translation, Memory Management Requirements.

Unit 5 **[8 Hrs]**

Arithmetic: RISC philosophy, pipelining, basic concepts in pipelining, delayed branch, branch prediction, data dependency, influence of pipelining on instruction set design, multiple execution units, performance considerations.

Unit 6 **[8 Hrs]**

Computer Peripherals: Input-Output Devices like Video displays, Video terminals, Graphics input devices, Printers. Online storage devices: Magnetic disks, Magnetic tape, Systems, CD-ROM systems. Communication devices: Modems.

Text-Book:

1. V. Carl Hamacher& S. Zaky: Computer Organization, Fourth Edition, McGraw-Hill (ISE).

References:

1. Stallings. W: Computer Organization &Arcitecture, Fifth Edition, Pearson Education.

2. Tananbaum A. S: Structured Computer Organization, Fifth Edition, Pearson Education.

3. Hayes J. P: Computer Architecture & Organization, Fourth Edition, McGraw- Hill.

4. M. Mano&KimeLogic: Computer Design Fundamentals, Second Edition, Pearson Education.

AI3T005	Internet Of Things	2 Credit

COURSE OBJECTIVES::

1. Understand the definition and significance of the Internet of Things
2. Discuss the architecture, operation, and business benefits of an IoT solution
3. Examine the potential business opportunities that IoT can uncover
4. Explore the relationship between IoT, cloud computing, and big data
5. Identify how IoT differs from traditional data collection systems
6. Implement the IoT applications using Arduino and **RaspberryPi**
7. To acquaint the students with the basics of computers system, its components, data representation inside computer and to get them familiar with various important features of procedure oriented programming language i.e. C.

Course Outcomes:

1. Apply the concept and application areas of IoT.
2. Identify the different technology
3. Apply IoT to different applications.
4. Analysis and evaluate protocols used in IoT
5. Design and develop smart city in IoT
6. Analysis and evaluate the data received through sensors in IoT
7. Able to understand the application areas of IOT•
8. Able to realize the revolution of Internet in Mobile Devices, Cloud &SensorNetworks
9. Able to understand building blocks of Internet of Things and characteristics.

Course Contents:

Unit 1 **[4 Hrs]**

Introduction of Internet of Things -- Concepts and definitions of IoT, History of Iot , Application , Requirements of Iot, IoT enabling technologies, , IoT Standards, IoT Entities : Sensors, Actuators, Gateways, Cloud, Mobile/Web Applications

Unit 2 **[4 Hrs]**

IOT ARCHITECTURE - IoT Open source architecture ,IoT Devices and deployment models- An Open source IoT stack. Sensing, Actuation, Basics of Networking, M2M and IoT Technology Fundamentals Devices and gateways, Data management, Everything as a Service(XaaS), Role of Cloud in IoT, Security aspects in IoT.

Unit 3 **[4 Hrs]**

Elements of IoT-Hardware Components Computing (Arduino, Raspberry Pi), Communication, Sensing, Actuation, I/O interfaces, Software Components Programming API's (using Python / Node.js / Arduino) for Communication Protocols-MQTT, ZigBee, Bluetooth, CoAP, UDP, TCP,Smart devices and sensors , Cloud, Analytics, User interface.

Unit 4 **[4 Hrs]**

IoT Application Development

1) Implementation of Device integration, Data acquisition and integration, Device data storage-Unstructured data storage on cloud/local server, Authentication, authorization of devices.

2) Protocols – SCADA and RFID Protocols – Issues with IoT – Protocols – IEEE802.15.4–BACNet Protocol– Modbus – KNX – Zigbee– Network layer – APS layer Security

Unit 5 **[4 Hrs]**

IOT APPLICATIONS - IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications. Study of existing IoT platforms/middleware Wearables, Health , Traffic monitoring , Fleet management, Agriculture.Hospitality, Smart grid and energy saving,Watersupply.etc

Unit 6 **[4 Hrs]**

WEB OF THINGS - Web of Things versus Internet of Things – Two Pillars of the Web, Architecture StandardizationforWoT– Platform Middleware for WoT – Unified Multitier WoT Architecture – WoT Portals andBusiness Intelligence.

Text Books:

1. YashwantKanetkar, "Let us C", BPB Publications, 2nd Edition, 2001.
2. Herbert Schildt, "C: The complete reference", OsbourneMcgraw Hill, 4th Edition, 2002.
3. V. Raja Raman, "Computer Programming in C", Prentice Hall of India, 1995.

Reference Books:

1. Vijay Madisetti, ArshdeepBahga, Ïnternet of Things, "A Hands on Approach", University Press
2. Dr. SRN Reddy, RachitThukral and Manasi Mishra, "Introduction to Internet of Things: A practical Approach", ETI Labs
3. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press

AI3T006	Data Structure & Algorithms	4 Credit

COURSE OBJECTIVES:

1. To understand the concepts of ADTs.
2. Choose the appropriate data structure and algorithm design method for a specified application.
3. To learn linear data structures – lists, stacks, and queues.
4. To understand sortings, searching and hashing algorithms.
5. To apply Tree and Graph structures.
6. Solve problems using data structures such as linear lists, stacks, queues, hash tables, binary trees, heaps, tournament trees, binary search trees, and graphs and writing programs for these solutions.

COURSE OUTCOMES:

1. Students shall be able to implement abstract data types for linear data structures.
2. Students shall be able to apply the different linear and non-linear data structures to problem solutions.
3. Students shall be able to critically analyze the various sorting algorithms.
4. Ability to program data structures and use them in implementations of abstract data types.
5. Ability to estimate the algorithmic complexity of simple, non-recursive programs
6. Ability to sensibly select appropriate data structures and algorithms for problems and to justify that choice.

Unit 1 **[8Hrs]**

Complexity Analysis: Time and Space complexity of algorithms, asymptotic analysis, big O and other notations, importance of efficient algorithms, program performance measurement, data structures and algorithms.

Unit 2 **[8Hrs]**

ADT Array-Searching and sorting on arrays: Linear search, binary search on a sorted arrays. Bubble sort, Insertion sort, merge sort and analysis; Emphasis on the comparison based sorting model, Counting sort, Radix sort, and bucket sort. (Reference IITK)

Unit 3 **[8 Hrs]**

Stacks and Queues: Abstract data types, sequential and linked implementations, exception handling in classes, representative applications such as parenthesis matching, towers of Hanoi, wire routing in a circuit, finding path in a maze, simulation of queuing systems, equivalence problem.

Unit 4 **[10Hrs]**

Linked Lists: Abstract data type, sequential and linked representations, comparison of insertion, deletion and search operations for sequential and linked lists, list and chain classes, exception and iterator classes for lists, doubly linked lists, circular lists, linked lists through simulated pointers, lists in STL, skip lists, applications of lists in bin sort, radix sort, sparse tables.

Unit 5

[8Hrs]

Trees: Binary trees and their properties, terminology, sequential and linked implementations, tree traversal methods and algorithms, heaps as priority queues, heap implementation, insertion and deletion operations, heap sort, heaps in Huffman coding, leftist trees, tournament trees, use of winner trees in merge sort as an external sorting algorithm, bin packing.

Unit 6

[6 Hrs]

Graphs: Breadth first search and connected components. Depth first search in directed and undirected graphs.

Text Books:

1. Mark Allen Weiss, —Data Structures and Algorithm Analysis in C, 2nd Edition, Pearson Education,1997.
2. ReemaThareja, —Data Structures Using C, Second Edition , Oxford University Press, 2011
3. Ellis Horowitz, SartajSahni, Susan Anderson-Freed, —Fundamentals of Data Structures in C, Second Edition, University Press, 2008.

Reference Books:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest, Clifford Stein, —Introduction to Algorithms", Second Edition, Mcgraw Hill, 2002.
2. Aho, Hopcroft and Ullman, —Data Structures and Algorithms‖, Pearson Education,1983.
3. Stephen G. Kochan, —Programming in C‖, 3rd edition, Pearson Education.

AI3L007	Internet Of Things Lab	1 Credit

COURSE OBJECTIVES:

To create an environment for research, design, development and testing of IoT solutions, in the field of energy management, communication systems, distributed sensor devices and advanced user interfaces

COURSE OUTCOMES:

Investigate a variety of emerging devices and technologies such as smart sensing, pervasive connectivity, virtual interfaces & ubiquitous computing and their potential applications in consumer, retail, healthcare and industrial contexts

List of Experiments:

1) Study of Raspberry-Pi, Beagle board, Arduino and other micro controller.

2) Familiarization with Arduino/Raspberry Pi and perform necessary software installation

3) Study of different operating systems for Raspberry-Pi. Understanding the process of OS installation on Raspberry-Pi.

4) MQTT Protocol Configuration Using Python

5) Write an application using Raspberry-Pi to control the operation of a hardware simulated lift elevator.

6) To interface Bluetooth with Arduino/Raspberry Pi and write a program to send sensor data to smartphone using Bluetooth

7)To install MySQL database on Raspberry Pi and perform basic SQL queries.

8) Write a program to create TCP server on Arduino/Raspberry Pi and respond with humidity data to TCP client when requested.

9) Create a small dashboard application to be deployed on cloud. Different publisher devices can publish their information and interested application can subscribe

10) Hands-on exercise on sensors and actuator interfacing with ESP8266 (Reading temperature, light intensity based device control and dc motor control).

Experiment Beyond Syllbus

11)Hands-on exercises on programming arduino development board using simulation software.

12) Understanding the connectivity of Raspberry-Pi circuit with IR sensor. Write an application to detect obstacle and notify user using LEDs

A13L008	Data structure and Algorithms (Lab)	1 Credit

Course Objectives:

1. To develop skills to design and analyze simple linear and non linear data structures.
2. To identify and apply the suitable algorithm for the given real world problem.
3. To gain knowledge in practical applications of data structures and algorithms

Course Outcomes:

1. To design and analyze the time and space efficiency of the data structure
2. To identity the appropriate data structure for given problem
3. To apply the knowledge of data structures and algorithm to solve the problem

List of Experiments:

1. Write a program to implement stack using arrays.
2. Write a program to evaluate a given postfix expression using stacks.
3. Write a program to convert a given infix expression to postfix form using stacks.
4. Write a program to implement circular queue using arrays.
5. Write a program to implement double ended queue (de queue) using arrays.
6. Write a program to implement a stack using two queues such that the push operation runs in constant time and the pop operation runs in linear time.
7. Write a program to implement a stack using two queues such that the push operation runs in linear time and the pop operation runs in constant time.
8. Write a program to implement a queue using two stacks such that the enqueue operation runs in constant time and dequeue operation runs in linear time.
9. Write a program to implement a queue using two stacks such that the enqueue operation runs in linear time and dequeue operation runs in constant time.
10. Write programs to implement the following data structures:

    (a) Single linked list

    (b) Double linked list
11. Implement the following sorting algorithms:

    (a) Insertion sort

    (b) Merge sort

    (c) Quick sort

    (d) Heap sort

AI3L009	Data Analytics (Lab)	1 Credit

COURSE OBJECTIVES:

1. Understand essential statistical concepts.
2. Learn how to interpret data in R Command using multi-dimensional arrays in NumPy, manipulate DataFrames in pandas.
3. Understand the nuances of lists, sets, dictionaries.
4. Understand the conditions and branching, objects and classes
5. Understand the Gain an in-depth understanding of the basics of R
6. Learning how to write your own R scripts.

COURSE OUTCOMES:

1. Understand random samples from uniform, and Normal distributions.
2. Get introduced to the latest simple and weighted average of price relatives using arithmetic mean and geometric mean.
3. Become an expert on series using least square method.
4. Understand the mechanics of least square method.
5. Understand base shifting of index numbers.
6. Become an expert seasonal indices using ratio to moving average method

List of Practical's

1. Drawing random samples from uniform, and Normal distributions.

2. Drawing random samples from uniform and normal populations using R-commands

3. Exercises on finding moments and correlation coefficient of bivariate probability distributions.

4. Construction of price and quantity Index numbers by simple aggregative method.

5. Construction of price and quantity Index numbers by weighted aggregative method. usingLaspeyre's, Paasche's, MashallEdgeworth's, Walsch's, Drobish-Bowley's, Fisher's method and Kelly's fixed weight method.

6. Construction of price indices using simple and weighted average of price relatives using arithmetic mean and geometric mean.

7. Construction of chain base indices.

8. Problems on base shifting of index numbers.

9. Construction of cost of living index numbers by (i) aggregate expenditure method (ii) family budget method.

10. Determination of trend in a time series using moving average method.

Experiment Beyond Syllabus

11. Determination of trend in a time series using least square method.

12. Construction of seasonal indices using ratio to moving average method.

13. Construction of seasonal indices using ratio to trend method.

14. Construction of seasonal indices using link relative method.

AI3T011	Universal Human Values	3Credit

COURSE OBJECTIVES

1. To understand the meaning and nature of ethics, human values and holistic life for leading a good, successful and happy life through continuous examination of thoughts and conduct in day to day life.

2. To know the status and responsible role of individual in abatement of value crisis in contemporary world in order to develop a civilized and human society.

COURSE OUTCOMES

At the end of the course students will be able to

1. To enable students to understand the concept of contemporary ethics at different levels: Individual, local and Global and enable them to cross examine the ethical and social consequences of the decisions of their life-view and world view.

2. To develop the ability of students to create a balance between their individual freedom and social responsibilities and enable them to identify the personal, professional and social values and integrate them in their personality after cross examination

3. To enable students to cross examine their earlier decisions taken in life and understand the meaning of ethical dilemma to overcome the ethical dilemmas and engage in critical reflection.

4. To develop positive habits of thought and conduct and work cohesively with fellow beings who have variety of strengths, experiences, shortcomings and challenges, hence to enable them to handle diverse type of personalities.

5. To enable students to develop a method for making ethically sound decisions for themselves, within hostels, classrooms, university campus and society.

Unit 1: **[07 Hours]**

Human Life, its aim and significance: The concept of a successful life, happy life and a meaningful life. Ethical and decision making capability and its development: Meaning of Ethical dilemma, sharing real life experiences.

Unit 2: **[07 Hours]**

(Creative and Leadership ability and their development: Intellectual, Emotional, Creative, Ethic spiritual development, Aesthetic sense, Self-dependency, Activeness. Development of positive attitude.

Unit 3: **[06 Hours]**

Harmony in Personal and Social Life: Concept of personal and group Ethics; Balance between - rights and duties-welfare of self and welfare of all. Creating a value based work culture in hostel, classroom and other places in the campus and society. Character, Righteousness and Virtues for a Meaningful Life: Egolessness, Humility, Righteousness, Purity, Truthfulness, Integrity, Self-restraint, Self-control, Sense of responsibility, Empathy, Love, Compassion, Maitri/ Comradeship, Cooperation, Tolerance.

Unit 4: **[06 Hours]**

Dilemma Between materialistic development and human welfare: Science, Technology, Consumerism, Relation with Nature and Environment. New dimension of Global Harmony: Democracy, Equality, Social Justice

Text Books

1) "Foundational Course in Human Values & Professional Ethics" by R Sangal, RR Gaur and G P Bagaria.

2) http://www.madhyasth-darshan.info.

Curriculum for Semester- IV [Second Year]

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				Credit
				L	T	P	CA	MSE	ESE	Total	
1	PCC	AI4T001	Theory of Computation	3	1	0	20	20	60	100	4
2	PCC	AI4T002	Design & Analysis of Algorithm	3	1	0	20	20	60	100	4
3	PCC	AI4T003	Operating System & Virtualization	3	0	0	20	20	60	100	3
4	PCC	AI4T004	Neural Networks & Fuzzy System	3	0	0	20	20	60	100	3
5	PCC	AI4T005	Discrete Mathematics & Graph Structures	3	0	0	20	20	60	100	3
6	PCC	AI4T006	Database Management Systems	3	0	0	20	20	60	100	3
7	PCC	AI4L007	Introduction to Robotics-(Lab)	0	0	2	60	0	40	100	1
8	PCC	AI4L008	Neural Networks & Fuzzy System (Lab)	0	0	2	60	0	40	100	1
9	PCC	AI4L009	DBMS-(Lab)	0	0	2	60	0	40	100	1
10	MC	AI4T010	Consumer Affairs	2	0	0	10	15	25	50	Audit
				20	**2**	**6**	**310**	**135**	**505**	**950**	**23**

AI4T001	Theory of Computation	4 Credit

Course Objective:

1. To introduce students to the mathematical foundations of computation including automata theory; the theory of formal languages and grammars; the notions of algorithm, decidability, complexity, and computability.
2. To Enhance/develop students' ability to understand and conduct mathematical proofs for computation and algorithms

Course outcomes:

Students will be able to:

1. Students shall able to define the mathematical principles behind theoretical computer science.
2. Students shall able to Differentiate and give examples for the different types of automata like finite automata, push down automata, linear bounded automata and turing machine.
3. Students shall able to correlate the different types of automata to real world applications.
4. Students shall able to Choose and design appropriate automata for the different requirements outlined by theoretical computer science.
5. Students shall able to identify the different computational problems and their associated complexity.

Unit 1 **[8Hrs]**

Fundamentals : Strings, Alphabet, Language, Operations, Finite state machine, definitions, finite automaton model, acceptance of strings, and languages, deterministic finite automaton and nondeterministic finite automaton, transition diagrams and Language recognizers.

Finite Automata: Introduction to Finite Automata, Structural Representations, Automata and Complexity, Central Concepts of Automata Theory, DFA, NFA, and NFA & epsilon Machine. Conversions and Equivalence: Equivalence between NFA with and without epsilon transitions, NFA to DFA conversion, minimization of FSM, equivalence between two FSM's, Finite Automata with output- Moore and Melay machines.

Unit 2 **[8Hrs]**

Regular Languages : Regular Expressions, Finite Automata and Regular Expressions, Applications of Regular Expressions, Algebraic Laws for Regular Expressions, Properties of Regular Languages, Constructing finite Automata for a given regular expressions, Conversion of Finite Automata to Regular expressions, Pumping Lemma for Regular Languages, Applications of the Pumping Lemma, Closure Properties of Regular Languages, Decision Properties of Regular Languages.

Grammar Formalism: Regular grammars-right linear and left linear grammars, equivalence between regular linear grammar and FA, inter conversion, Context free grammar, derivation trees, sentential forms, Right most and leftmost derivation of strings.

Unit 3 **[8Hrs]**

Context Free Grammars: Context-Free Grammars: Definition of Context-Free Grammars, Derivations Using a Grammar, Leftmost and Rightmost Derivations, the Language of a Grammar, Sentential Forms, Parse Tress, Applications of Context-Free Grammars, Ambiguity in Grammars and Languages.

Push-Down Automata: Push down automata, definition, model, acceptance of CFL, Acceptance by final state and acceptance by empty state and its equivalence, Equivalence of CFL and PDA, interconversion, Introduction to DCFL and DPDA.

Unit 4: Turing Machine **[8Hrs]**

Definition of Recursive and Recursively Enumerable , Church's Hypothesis , Computable Functions , Methods for Turing Machine Construction, Modifications of the Basic Turing Machine Model, Multiple Tape , Multiple Tracks, Non-determinism, etc. Equivalence of the different TM Models and the Basic TM Model.

Unit 5: Computability Theory **[8Hrs]**

Chomsky hierarchy of languages, linear bounded automata and context sensitive language, LR(0) grammar, decidability of, problems, Universal Turing Machine, undecidability, Posts Correspondence problem, Turing reducibility, Definition of P and NP problems, NP complete and NP hard problems.

TEXT BOOKS:

1. "Introduction to Automata Theory Languages and Computation". Hopcroft H. E. and Ullman J. D. Pearson Education.
2. Introduction to Theory of Computation – Sipser 2nd edition Thomson.

REFERENCES BOOKS:

1. Introduction to Formal languages Automata Theory and Computation Kamala Krithivasan Rama R.
2. Introduction to Computer Theory, Daniel I.A. Cohen, John Wiley.
3. Theory of Computation: A Problem - Solving Approach, Kavi Mahesh, Wiley India Pvt. Ltd.
4. Elements of Theory of Computation, Lewis H.P. &Papadimition C.H. Pearson /PHI.
5. Theory of Computer Science – Automata languages and computation -Mishra and Chandrashekaran, 2nd edition, PHI.

AI4T002	Design and Analysis of Algorithm	4 Credit

COURSE OBJECTIVES:

1. To learn fundamentals of algorithms design techniques.
2. To understand basic knowledge of computational complexity, approximation and randomized algorithms, selection of the best algorithm to solve a problem.
3. To analyze the performance of algorithms, to compare algorithms with respect to time and space complexity.
4. To develop proficiency in problem solving and programming.

COURSE OUTCOMES:

After learning the course the students should be able:

1. Develop efficient algorithms for simple computational tasks.
2. Gain understanding of concepts of time and space complexity, worst case, average case and best case complexities and the big-O notation.
3. Design standard algorithms such as sorting, searching, and problems involving graphs.
4. Compute complexity measures of algorithms, including recursive algorithms using recurrence relations

Course Contents:

Unit 1 : **[8 Hrs]**

Introduction to Algorithm, Iterative Algorithm Design and Issue, Use of Loops, Efficiency of Algorithm, Estimating & Specifying Execution Time and Space, Order Notation (O, Θ, Ω Notations), Algorithm Strategies, Mathematical Analysis for Recursive and Non-Recursive algorithm.

Unit 2 **[8Hrs]**

Introduction to Divide and Conquer, Binary Search, Merge Sort, Quick Sort, Strassen's Matrix Multiplication, Finding median, Closest Pair, Convex Hulls Problem.

Unit 3 **[8Hrs]**

Greedy Methods, Fractional Knapsack Problem, Job Sequencing with Deadlines, Optimal Merge Pattern, Huffman Coding, Minimum Spanning Tree – Kruskal's and Prim's Algorithm, Dijkstra's Shortest Path Algorithm.

Unit 4 **[8Hrs]**

Introduction to Dynamic Programming, Elements of Dynamic Programming, Multistage Graphs, Traveling Salesman Problem, Matrix-chain multiplication, Optimal Polygon Triangulation, Longest common subsequence, Floyd-Warshall algorithm

Unit 5 **[8Hrs]**

Introduction to Backtracking, N-Queen Problem, Combinational Search, Backtracking Strategies, Search & Traversal Techniques – BFS, DFS, Sum of Subsets, Graph coloring, Hamiltonian Circuit Problem, Tower of Hanoi Problem, State Space Tree, Branch & Bound, Least cost (LC) Search, Control Abstractions for LC search, FIFO Branch & Bound..

Unit 6 **[8Hrs]**

Efficiency of Algorithms: Polynomial Time & Non-Polynomial Time Algorithms, NP-Complete, NP-Hard, Limitation of Algorithm, Worst and Average Case Behavior, Efficiency of Recursion, Complexity Calculation for Various Sorting Algorithms, Approximation of Algorithms, Time-Space Trade off in algorithms research.

Text Books:

1. Parag Dave, Himanshu Dave, Design and Analysis of Algorithm, Pearson Education India, 2nd Edition.
2. Thomas H. Cormen, Charles E Leiserson, Introduction to Algorithms, PHI Publication, 3rd Edition.
3. S. Sridhar, Design and Analysis of Algorithms, Oxford University Press, India.

Reference Books:

1. Aho, Ullman, Data Structure and Algorithms, Addison-Wesley Publication, 1st Edition, 1983.
2. Michel Goodrich, Roberto Tamassia, Algorithm Design - Foundation, Analysis & Internet Examples, Wiley Publication, 2nd Edition, 2006.
3. George T. Heineman, Gary Pollice, Stanley Selkow, Algorithms in a Nutshell, A Practical Guide, O'Reilly Media, 2nd Edition, 2016.

AI4T003	Operating System & Virtualization	3 Credit

Course Objective:

At the end of the Course, Student will be able to:

1 To understand the services provided by and the design of an operating system.

2 To understand the structure and organization of the file system.

3 To understand what a process is and how processes are synchronized and scheduled.

4 To understand different approaches to memory management.

5 Students should be able to use system calls for managing processes, memory and file system.

6 Students should understand the data structures and algorithms used to implement an OS.

Course Outcomes:

1 Learn and understand the concepts, core structure of Operating Systems and basic architectural components involved in operating systems design.

2 Understand the process management policies and scheduling of processes by CPU.

3 Evaluate the requirement for process synchronization and coordination handled by operating system.

4 Describe and analyze the memory management and its allocation policies.

5 Analyze various device and resource management techniques for timesharing

6 Conceptualize the components involved in designing a contemporary Operating Systems

Course Contents:

Unit 1 [6 Hrs]

Introduction: Architecture, Goals & Structures of O.S, Evolution of OS, types of OS, services provided by OS, system programs and system calls, system design and implementation.

Unit 2 [6 Hrs]

Processes and Threads: Process Concept, Process Scheduling, Operations on Processes, Cooperating Processes, Interprocess Communication, Communication in Client – Server Systems,Multithreading Models, Threading Issues.CPU Scheduling: Scheduling Criteria, Scheduling Algorithms, Multiple-Processor Scheduling, Real- Time Scheduling, Algorithm Evaluation, Process Scheduling Models.

Unit 3 **[6 Hrs]**

Concurrency Control: -Process Synchronization: Synchronization background, The Critical-Section Problem, Semaphores, Classic Problems of Synchronization, CriticalRegions.Monitors. Readers-Writers, Producer Consumer, and Dining Philosopher problem.

Deadlocks :- Deadlock definition, Prevention, Avoidance, Detection and recovery,

Goals of Protection, access matrix, implementation, Security problem.

Unit 4 **[6 Hrs]**

Memory Management : Memory Management requirements, Memory partitioning: Fixed and Variable Partitioning, Memory Allocation: Allocation Strategies (First Fit, Best Fit, and Worst Fit), Fragmentation, Swapping, and Paging. Segmentation, Demand paging Virtual Memory: Concepts, management of VM, Page Replacement Policies (FIFO, LRU, Optimal, Other Strategies), Thrashing

Unit 5 **[6 Hrs]**

File systems Management: File concept, Access methods, Disk space management and Allocation methods strategies, Directory structures, Recovery, Log-structured File System, Disk arm scheduling strategies.

Unit 6 **[6 Hrs]**

Virtualization Concepts:- Virtual machines; supporting multiple operating systems simultaneously on a single hardware platform, running one operating system on top of another. True or pure virtualization.

Approaches to Virtualization: Processor Issue, Memory Management, I/O Management, VMware ESXi, Microsoft Hyper-V and Xen Variants, Java VM, Linux VServer Virtual Machine Architecture, Android Virtual Machine.

Textbook:

1. Abraham Silberschatz, Peter B. Galvin and Greg Gagne, Operating System Concepts, Wiley Publication, 8 th Edition, 2008.

2. Andrew S. Tanenbaum, Modern Operating System, PHI Publication, 4 th Edition, 2015

3. Modern Operating Systems-By Andrew S. Tanenbaum (PHI)

4. Richard Stevens, Stephen Rago, Advanced Programming in the UNIX Environment, Pearson Education, 2/e

Reference Books:

1. D. M. Dhamdhere, Systems Programming and Operating Systems, McGraw-Hill, 2 nd Edition,1996.

2. Garry Nutt, Operating Systems Concepts, Pearson Publication, 3rd Edition, 2003.

3. Harvey M. Deitel, An Introduction to Operating Systems, Addison-Wesley Publication, 2 nd Edition, 1990.

4. Thomas W. Doeppner, Operating System in Depth: Design and Programming, Wiley

AI4T004	Neural Network and fuzzy System	3 Credit

COURSE OBJECTIVES:

1.To focus on the foundations of neural network theory and the application of neural network models in engineering,cognitive science, and artificial intelligence

2.To introduce the neural networks as means for computational learning and to present the basic network architectures and learning algorithms for classification and regression

3.To demonstrate neural network applications on real-world tasks

4.To emphasize the need for fuzzy logic as a means to model linguistic knowledge in human experts5.To know fuzzy Arithmetic and inference techniques

6.To understand fuzzy inference and reasoning so as to build systems based on fuzzy control

COURSE OUTCOMES:

1.Students will be able to focus on the mathematical foundations of neural network theory and to understand the working of Neural Networks as pattern classifier.

2.Students will be able to comprehend the neural networks as means for computational learning and to analyze the basic network architectures and algorithms for supervised learning.

3.Students will be able to comprehend the neural networks as means for computational learning and to analyze the basic network architectures and algorithms for unsupervised learning.

4.Students will be able to understand the basics of fuzzy sets, its operations and the need for fuzzy logic.

5.Students will be able to understand fuzzy numbers, fuzzy relations and extension principle.

6. Apply basic fuzzy system modelling methods.

Course Contents:

UNIT I **[06Hrs.]**

Fundamentals concepts and models of artificial neural systems: Biological neurons and their artificial models, models of artificial neural networks, learning and adaption, neural network learning rules, feed forward and feedback networks, single-layer perceptron classifiers, Discriminant functions, linear machine and minimum distance classification, training and classification using the perceptron, SDTA algorithm, MCPTA algorithm.

UNIT II **[06Hrs.]**

Single layer perceptron networks for linearly separable classification, RDPTA algorithm. Multilayer feed forward networks: linearly non-separable pattern classification, delta learning rule. Feed forward recall and error back-propagation training, learning factors.

UNIT III **[06Hrs.]**

Mathematical foundations of Discrete time Hopfield networks,, Hopfield learning algorithm, clustering and similarity measures, Self-Organizing Feature Maps, Applications of artificial neural networks

UNIT IV **[06Hrs.]**

From classical (CRISP) sets to fuzzy sets, characteristics and significance of the paradigm shift, fuzzy sets versus crisp sets, representation of fuzzy sets, properties of fuzzy sets. Operations on fuzzy sets: types of operations, fuzzy complements, fuzzy intersection s-norms, fuzzy unions: t-Conorms.

UNIT V **[06Hrs.]**

Fuzzy Arithmetic: fuzzy numbers, Linguistics variables, arithmetic operations on fuzzy numbers, Fuzzy relations, extension principles for fuzzy sets.

UNIT VI **[06Hrs.]**

Fuzzy rules and reasoning, fuzzy inference, fuzzification, evaluation of fuzzy rules, aggregation of output fuzzy sets Defuzzification methods, design of a fuzzy controller

Text Book:

1. Introduction to Artificial Neural Systems2ndEditionJ. M. ZuradaJaico Publishing House.
2. Fuzzy sets and Fuzzy logic, Theory and Applications1stEditionGeorge J. Klir and Bo Yuan Prentice Hall,
3. Neuro-fuzzy and Soft Computing 1996 Jang.Sun and E. Mizutani Prentice Hall

Reference Books:

1. Fuzzy Logic With Engineering Applications 2004. J. Ross McGraw Hill

2. An introduction to Fuzzy Control 2nd EditionD. DriankovNarosa Pub. House,
3. Artificial Neural Networks 1999 Yegnanarayana PHI

AI4T005	Discrete Mathematics & Graph Structures	3 Credit

COURSE OBJECTIVES:

1. To understand the concept of probability, statistics, logic and concept of set, group theory, graph theory, combinatorics.
2. To understand the application of Mathematics in engineering and in real life.
3. To enable students to apply mathematical tools to solve problems in real life.
4. To enable students to apply mathematical tools to analyze problems in real life.
5. To enable students to evaluate the problem based on the concept of probability, statistics, logic and concept of set, group theory, graph theory, combinatorics.
6. To enable students to create the new concept by using the theory of probability, statistics, logic and concept of set, group theory, graph theory, combinatorics.

COURSE OUTCOMES:

1. Describe the concept of probability, statistics, logic and concept of set, group theory, graph theory, combinatorics.
2. Illustrate the concept of probability, statistics, logic and concept of set, group theory, graph theory, combinatorics by using examples.
3. Apply the concept of probability, statistics, logic and concept of set, group theory, graph theory, combinatorics to solve the problem.
4. Analyze the problem by using the concept of probability, statistics, logic and concept of set, group theory, graph theory, combinatorics.
5. Evaluate the problem based on the concept of probability, statistics, logic and concept of set, group theory, graph theory, combinatorics.
6. Create the new concept by using the theory of probability, statistics, logic and concept of set, group theory, graph theory, combinatorics.

[Unit1] **6Hrs**

Probability: Definition of Probability. Random variables. Uniform, normal, exponential, Poisson and binomial distributions. Mean, median, mode and standard deviation. Conditional probability and Bayes theorem, application of probability in computer science

[Unit2] **6Hrs**

Statistics: Linear Regression, Multivariate Regression, Subset Selection, Shrinkage Methods, Principal Component Regression, Partial Least squares, Linear Classification, Logistic Regression, Linear Discriminant Analysis. Application to machine learning.

[Unit3] **6Hrs**

Logic and concept of set: Propositional and first order logic. Sets, relations, functions, partial orders and lattices, application to PROLOG.

[Unit4] **6Hrs**

Group theory: Definition and elementary properties of groups, semigroups, monoids, rings, fields, vector spaces and lattices, application of group theory in computer science.

[Unit5] **6Hrs**

Combinatorics: counting, recurrence relations, generating functions, application of combinatorics in computer science.

[Unit6] **6Hrs**

Graph theory: Elements of graph theory, Euler graph, Hamiltonian path, trees, tree traversals, spanning trees, matching, coloring.

Text Books:

1. Higher Engineering Mathematics by B. S. Grewal, Khanna Publishers, New Delhi.
2. C.L.Liu, Elements of Discrete Mathematics, second edition 1985, McGraw-Hill Book Company. Reprinted 2000.
3. K.H. Rosen, Discrete Mathematics and applications, fifth edition 2003, Tata McGraw Hill publishing Company.
4. Trevor Hastie, Robert Tibshirani, Jerome H. Friedman, The Elements of Statistical Learning
5. Christopher Bishop, Pattern Recognition and Machine Learning

Reference Books:

1. J .L.Mott, A.Kandel, T.P .Baker, Discrete Mathematics for Computer Scientists and Mathematicians, second edition 1986, Prentice Hall of India.
2. W.K.Grassmann and J.P.Tremblay, Logic and Discrete Mathematics, A Computer Science.
3. F. Harary: graph theory, addison-wesley reading, Massachusetts, 1996.

AI4T006	Database Management System	3 Credit

COURSE OBJECTIVES:

1. Eliminate redundant data.
2. Make access to the data easy for the user.
3. Provide for mass storage of relevant data.
4 . Make the latest modifications to the data base available immediately
5. Protect the data from physical harm and un-authorised systems
6. Allow for multiple users to be active at one time

COURSE OUTCOMES:

1. To understand the need of database management.

2.To design and implement a database schema for a given problem-domain
3. To normalize a database
4. To create and query a database using SQL DML/DDL commands, stored procedures and functions.

5 To declare and enforce integrity constraints on a database

Course Contents:

Unit 1 **[6 Hrs]**

Introduction: Database applications, purpose, accessing and modifying databases, need for transactions, architecture - users and administrators, data mining, information retrieval. Relational Databases: relational model, database schema, keys, relational query languages, algebra, tuple and domain calculus example queries, (optional: equivalence of relational calculus and relational algebra)..

Unit 2 **[6 Hrs]**

SQL: Data definition, basic SQL query structure, set operations, nested subqueries, aggregation, null values, database modification, join expressions, views.

Database Design: E-R model, E-R diagram, reduction to relational schema, E-R design issues, database integrity, specifying integrity constraints in SQL: unique columns, foreign key, triggers.

Unit 3 **[6 Hrs]**

Relational Database Design: features of good design, Functional Dependency theory, decomposition using functional dependency and normal forms, algorithms for decomposition, normal forms, (optional: multi-valued dependency and 4th normal form).

Unit 4 **[6Hrs]**

Query Processing: Overview, measures of query cost, selection, sorting, join processing algorithms-nested loops, merge-sort, hash join, aggregation.

Query Optimization: purpose, transformation of relational expressions, estimating cost and statistics of expression, choosing evaluation plans, linear and bushy plans, dynamic programming algorithms

Unit 5 **[6 Hrs]**

Transactions: Concept and purpose, ACID properties and their necessity, transactions in SQL. Problems with full isolation and levels of isolation.

Concurrency Control: lock-based protocols, 2-phase locking, deadlock handling, multiple granularity, timestamp based protocols, index locking, (optional: validation protocols, multi-version protocols, snap shot isolation, predicate locking, concurrency control for index structures).

Unit 6 **[6 Hrs]**

Data warehousing, heterogeneous component systems, data scrubbing. Data mining and knowledge discovery, basic mathematical, numerical and statistical techniques; Applications in information retrieval..

Text Books:

1. Database system concepts" Abraham Silberschatz, Henry F. Korth, and S. Sudarshan publication by McGraw Hill Education 6th edition, , 2011
2. "Fundamental Database Systems" RamezElmasri and Shamkant B. Navathe PHI Publication 7th edition, Pearson Education, 2015
3. H Garcia-Molina, JD Ullman and Widom, Database Systems: The Complete Book,2nd Ed., Prentice-Hall, 2008.

Reference Books:

1. A Silberschatz, H Korth and S Sudarshan, Database System Concepts, 6th Ed., McGraw-Hill, 2010.
2. R Elmasri, S Navathe, Fundamentals of Database Systems, 6th edition, Addison-Wesley, 3. 2010.
3. R Ramakrishnan, J Gehrke, Database Management Systems, 3rd Ed., McGraw-Hill, 2002

AI4L007	**Introduction to Robotics Lab**	**1 Credit**

COURSE OBJECTIVES:

1. To introduce different types of robotics and demonstrate them to identify different parts and components.
2. To write programming for simple operations.
3. To understand the working of different sensors
4. To understand the interfacing of different components with Arduino board
5. To understand the interfacing of different motors with Microcontroller
6. To design the different robots.

COURSE OUTCOME:

Upon Completion of the course, the students will acquire knowledge about :

1. Microcontroller Atmega8, Arduino Board., different sensors
2. Various types of robots .
3. Interfacing of Microcontroller and Arduino board with stepper motors, servo motor etc.

LIST OF EXPERIMENTS

1. Study of Microcontroller Atmega16 , Arduino and software Installation of Arduino
2. Study of Arduino IDE programing .
3. Study of different types of robot sensors such as light sensors, proximity sensors, temperature sensors, sound sensors, acceleration sensors and so on.
4. Study of types of robots: Mobile robots, industrial robot, autonomous robot, remote controlled robot.
5. Study of robot locomotion: Wheel locomotion, Legged locomotion, Tracked Slip/skid Locomotion, Combination of legged and wheeled locomotion.
6. Interfacing stepper motor, servo motor, potentiometer, DC motor with microcontroller.
7. Interfacing stepper motor, servo motor, potentiometer, DC motor with Arduino.
8. Design Microcontroller based line follower robot.
9. Design Colour sensor robot with Arduino
10. Design obstacle avoiding robot with Arduino and ultrasonic sensors.

AI4L0008	Neural Network and Fuzzy System (Lab)	1 Credit

COURSE OBJECTIVES:

1.To familiarize with neural networks and learning methods for neural networks

2.To introduce the neural networks as means for computational learning and to present the basic network architectures and learning algorithms for classification

3.To demonstrate neural network applications on real-world tasks

4.To introduce the ideas of fuzzy sets, fuzzy logic and to emphasize the need for fuzzy logic to model linguistic knowledge in human experts

5.To know fuzzy Arithmetic and inference techniques along with its applications

6.To understand principles of neural networks.

COURSE OUTCOMES:

1.Focus on the mathematical foundations of neural network theory and to understand the working of Neural Networks as pattern classifier
2.Comprehend the neural networks as means for computational learning and to analyze the basic network architectures and algorithms
3.Effectively use existing software tools to solve real problems using a neural network approach
4.To understand the basics of fuzzy sets, its operations and the need for fuzzy logic
5.To apply fuzzy numbers, their operations and fuzzy inference techniques to model the human intelligence
6.Explain the concepts of neural networks, fuzzy logic, and genetic algorithms.

List of Experiments:

1. Implement McCulloch-Pits Neuron Model using NAND and NOR gate.
2. Implement two-layer Feed forward Neural Network.
3. Implement Feedback Neural Network
4. Implement A-Z character recognition using Feed forward Neural Network.
5. Implement clustering algorithm
6. Implement Dichotmizer using threshold logic unit (TLU).
7. Implement T-norms and S-norms.
8. Implement fuzzy system for dilation and concentration.
9. Implement a fuzzy system for Fan Speed Controller.
10. Implement classical relationship between Fuzzy set

Experiment Beyond Syllabus

1. Implement following relation of composition : Min-Max, Max-Product, Max-average
2. Implement neuro fuzzy system

Course Objectives:

1. To explain basic database concepts, applications, data models, schemas and instances.
2. To demonstrate the use of constraints and relational algebra operations. IV. Describe the basics of SQL and construct queries using SQL.
3. To emphasize the importance of normalization in databases.
4. To facilitate students in Database design
5. To familiarize issues of concurrency control and transaction management

Course Outcomes:

At the end of the course the students are able to:

1. Apply the basic concepts of Database Systems and Applications.
2. Use the basics of SQL and construct queries using SQL in database creation and interaction.
3. Design a commercial relational database system (Oracle, MySQL) by writing SQL using the system.
4. Analyze and Select storage and recovery techniques of database system

List of Experiments:

1. Draw E-R diagram and convert entities and relationships to relation table for college scenario

2. Write relational algebra queries for a given set of relations.

3 Viewing all databases, Creating a Database, Viewing all Tables in a Database, Creating Tables (With and Without Constraints), Inserting/Updating/Deleting Records in a Table, Saving (Commit) and Undoing (rollback)

4. Altering a Table, Dropping/Truncating/Renaming Tables, Backing up / Restoring a Database

5. Perform the set of aggregate relation function.

6. For a given set of relation tables perform the following a. Creating Views (with and without check option), Dropping views, Selecting from a view

7. Write a Pl/SQL program using FOR loop to insert ten rows into a database table.

8. Given the table EMPLOYEE (EmpNo, Name, Salary, Designation, DeptID) write a cursor to select the five highest paid employees from the table.

9. Write a PL/SQL program to find the total and average of six subject and display the grade

10. Illustrate how you can embed PL/SQL in a high-level host language such as C/Java .

CS4T010	Consumer Affairs	Audit

Objective: This paper seeks to familiarize the students with their rights and responsibilities as a consumer, the social framework of consumer rights and legal framework of protecting consumer rights. It also provides an understanding of the procedure of redress of consumer complaints, and the role of different agencies in establishing product and service standards. The student should be able to comprehend the business firms' interface with consumers and the consumer related regulatory and business environment.

Unit 1: Conceptual Framework **06 Lectures**

Consumer and Markets: Concept of Consumer, Nature of markets: Liberalization and Globalization of markets with special reference to Indian Consumer Markets, E-Commerce with reference to Indian Market, GST, and Digital consumer issues.

Experiencing and Voicing Dissatisfaction: Consumer buying process, Consumer Satisfaction/dissatisfaction-Grievances-complaint, Consumer Complaining Behaviour: Alternatives available to Dissatisfied Consumers; Complaint Handling Process: ISO 10000 suite

Unit 2: The Consumer Protection Law in India **06 Lectures**

Objectives and Basic Concepts: Consumer rights and UN Guidelines on consumer protection, Consumer goods, defect in goods, spurious goods and services, service, deficiency in service, unfair trade practice, and restrictive trade practice.

Unit 3: Grievance Redressal Mechanism under the Indian Consumer Protection Law

06 Lectures

Who can file a complaint? Grounds of filing a complaint; Limitation period; Procedure for filing and hearing of a complaint; Disposal of cases, Relief/Remedy available; Temporary Injunction, Enforcement of order, Appeal, frivolous and vexatious complaints; Offences and penalties.

Unit 4: Role of Industry Regulators in Consumer Protection **06 Lectures**

i. Banking: RBI and Banking Ombudsman

ii. Insurance: IRDA and Insurance Ombudsman

iii. Telecommunication: TRAI

iv. Food Products: FSSAI

v. Electricity Supply: Electricity Regulatory Commission

vi. Real Estate Regulatory Authority

Text Books

1. Khanna, Sri Ram, Savita Hanspal, Sheetal Kapoor, and H.K. Awasthi. (2007) *Consumer Affairs,* Universities Press.
2. Choudhary, Ram Naresh Prasad (2005). *Consumer Protection Law Provisions and Procedure,* Deep and Deep Publications Pvt Ltd.
3. G. Ganesan and M. Sumathy. (2012). *Globalisation and Consumerism: Issuesand Challenges*, Regal Publications
4. Suresh Misra and Sapna Chadah (2012). Consumer Protection in India: Issuesand Concerns, IIPA, New Delhi
5. Rajyalaxmi Rao (2012), *Consumer is King,* Universal Law Publishing Company
6. Girimaji, Pushpa (2002). *Consumer Right for Everyone* Penguin Books.
7. E-books :- www.consumereducation.in
8. Empowering Consumers e-book, www.consumeraffairs.nic.in
9. ebook, www.bis.org
10. *The Consumer Protection Act, 1986 and its later versions.*

Reference Books

1. 1. Misra Suresh, (Aug 2017) "Is the Indian Consumer Protected? One India One People.
2. Raman Mittal, Sonkar Sumit and Parineet Kaur (2016) Regulating Unfair Trade Practices: An Analysis of the Past and Present Indian Legislative Models, Journal ofConsumer Policy.
3. Chakravarthy, S. (2014). MRTP Act metamorphoses into Competition Act. CUTS Institute for Regulation and Competition position paper. Available online at www.cuts-international.org/doc01.doc.
4. Kapoor Sheetal (2013) "Banking and the Consumer" Akademos (ISSN 2231-0584)
5. Bhatt K. N., Misra Suresh and Chadah Sapna (2010). Consumer, Consumerism and Consumer Protection, Abhijeet Publications.
6. Kapoor Sheetal (2010) "Advertising-An Essential Part of Consumer's Life-Its Legal and Ethical Aspects", Consumer Protection and Trade Practices Journal, October 2010.
7. Verma, D.P.S. (2002). Regulating Misleading Advertisements, Legal Provisions and Institutional Framework. Vikalpa. Vol. 26. No. 2. pp. 51-57.

Website

www.ncdrc.nic.in
www.consumeraffairs.nic.in
www.iso.org
www.bis.org.in
www.consumereducation.in
www.consumer-voice.in

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JAIDEV EDUCATION SOCIETY'S

J D COLLEGE OF ENGINEERING AND MANAGEMENT

KATOL ROAD, NAGPUR

Education to Eternity

SESSION 2020-21

1st Semester (AI)

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				Credit
				L	T	P	CA	MSE	ESE	Total	
1	HSMC	HU1T002	Introduction to Computer programming	2	0	0	20	20	60	100	2
2	BSC	MA1T001	Engineering Mathematics- I	3	1	0	20	20	60	100	4
3	BSC	AI1T005	Engineering Physics	3	1	0	20	20	60	100	4
4	ESC	AI1T006	Energy and Environment Engineering	3	0	0	20	20	60	100	3
5	HSMC	HU1L002	Introduction to Computer programming Lab	0	0	4	60	0	40	100	2
6	ESC	AI1L001	Workshop Practices	0	0	4	60	0	40	100	2
7	BSC	AI1L005	Engineering Physics Lab	0	0	2	60	0	40	100	1
8			Induction Programme	3 Weeks							
9	ESC	AI1T008	Introduction to AI and its Application	2	0	0	10	15	25	50	Audit
				13	2	10					18

2nd Semester (AI)

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				Credit
				L	T	P	CA	MSE	ESE	Total	
1	HSMC	HU2T001	Communication Skills	2	0	0	60	0	40	100	2
2	BSC	MA2T001	Engineering Mathematics-II	3	1	0	20	20	60	100	4
3	BSC	AI2T002	Engineering Chemistry	3	1	0	20	20	60	100	4
4	ESC	AI2T003	Engineering Graphics	1	0	0	20	20	60	100	1
5	HSMC	HU2L001	Communication Skills Lab.	0	0	4	60	0	40	100	2
6	BSC	AI2L002	Engineering Chemistry Lab	0	0	2	60	0	40	100	1
7	ESC	AI2L003	Engineering Graphics Lab	0	0	4	60	0	40	100	2
8			Societal Internship/ Field Training	Report submission						50	1
9	ESC	AI2T009	Introduction to Drones	2	0	0	10	15	25	50	Audit
				11	2	10					17

Prof. Swati Raut
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JAIDEV EDUCATION SOCIETY'S

J D COLLEGE OF ENGINEERING AND MANAGEMENT

KATOL ROAD, NAGPUR

SESSION 2021-22

3rd Semester Artificial Intelligence

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				
				L	T	P	CA	MSE	ESE	Total	Credit
1	HSMC	AI3T001	Organization Behaviour	2	0	0	20	20	60	100	2
2	HSMC	AI3T002	Universal Human Rights	2	1	0	20	20	60	100	3
3	BSC	AI3T003	Mathematics-III	2	1	0	20	20	60	100	3
4	ESC	AI3T004	Statistical Data Analysis	3	0	0	20	20	60	100	3
5	PCC	AI3T005	Computer Architecture and Organisation	3	0	0	20	20	60	100	3
6	PCC	AI3T006	Internet of Things	2	1	0	20	20	60	100	3
7	PCC	AI3T007	Data Structure & Algorithm	2	1	0	20	20	60	100	3
8	ESC	AI3L008	Introduction to IoT (Lab)	0	0	2	60	0	40	100	1
9	ESC	AI3L009	DSA (Lab)	0	0	2	60	0	40	100	1
10	ESC	AI3L010	Data Analytics (Lab)	0	0	2	60	0	40	100	1
				16	**4**	**6**	**320**	**140**	**540**	**1000**	**23**

4th Semester Artificial Intelligence

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				Credit
				L	T	P	CA	MSE	ESE	Total	
1	PCC	AI4T001	Theory of Computation	2	1	0	20	20	60	100	3
2	PCC	AI4T002	Design & Analysis of Algorithm	2	1	0	20	20	60	100	3
3	PCC	AI4T003	Operating System & Virtualization	3	0	0	20	20	60	100	3
4	PCC	AI4T004	Neural Networks & Fuzzy System	3	0	0	20	20	60	100	3
5	PCC	AI4T005	Discrete Mathematics & Graph Structures	3	0	0	20	20	60	100	3
6	PCC	AI4T006	Database Management Systems	3	0	0	20	20	60	100	3
7	PCC	AI4L007	Introduction to Robotics-(Lab)	0	0	2	60	0	40	100	1
8	PCC	AI4L008	Neural Networks & Fuzzy System (Lab)	0	0	2	60	0	40	100	1
9	PCC	AI4L009	DBMS-(Lab)	0	0	2	60	0	40	100	1
10	MC	AI4T010	Consumer Affairs	2	0	0	10	15	25	50	Audit
11	PROJECT	AI4P011	Field Training/ Industrial Visit	0	0	0	30	0	20	50	1
				18	**2**	**6**	**340**	**135**	**525**	**1000**	**22**

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JAIDEV EDUCATION SOCIETY'S

J D COLLEGE OF ENGINEERING AND MANAGEMENT

KATOL ROAD, NAGPUR

SESSION 2022-23

Education to Eternity

5th Semester Artificial Intelligence

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				Credit
				L	T	P	CA	MSE	ESE	Total	
1	PCC	AI5T001	AI & Cognitive Robotics	3	0	0	20	20	60	100	3
2	PCC	AI5T002	Digital Image Techniques and Analysis	2	1	0	20	20	60	100	3
3	PCC	AI5T003	Machine Learning & Deep Learning	2	1	0	20	20	60	100	3
4	PCC	AI5O001	Open Elective -I	3	0	0	20	20	60	100	3
5	PEC	AI5TE01	Elective -I	3	0	0	20	20	60	100	3
6	PCC	AI5L004	Machine Learning & Deep Learning (Lab)	0	0	2	60	0	40	100	1
7	PCC	AI5L005	Digital Image Techniques and Analysis (Lab)	0	0	2	60	0	40	100	1
8	PCC	AI5L006	AI & Cognitive Robotics (Lab)	0	0	2	60	0	40	100	1
9	PROJECT	AI5P007	Mini Project	0	0	2	0	0	50	50	1
10	PROJECT	AI5P008	Field Training/ Industrial Visit	0	0	0	30	0	20	50	1
11	IED	AI5T008	Innovation and Enterprenership Development	2	0	0	10	15	25	50	Audit
				15	**2**	**8**	**290**	**115**	**495**	**900**	**21**

Open Elective 1: Ethics in IT

6th Semester Artificial Intelligence

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				Credit
				L	T	P	CA	MSE	ESE	Total	
1	PCC	AI6T001	Advanced Computer Vision	2	1	0	20	20	60	100	3
2	ESC	AI6T002	Data Science	2	1	0	20	20	60	100	3
3	PEC	AI6TE02	Elective -II	3	0	0	20	20	60	100	3
4	PEC	AI6TE03	Elective-III	3	0	0	20	20	60	100	3
5	OEC	AI6O002	Open Elective-II	3	1	0	20	20	60	100	4
6	PCC	AI6L003	Data Science Using R -Lab	0	0	2	60	0	40	100	1
7	PCC	AI6L004	Advanced Computer Vision (Lab)	0	0	2	60	0	40	100	1
8	PCC	AI6L005	Big Data Tools & Techniques(LAB)	0	0	2	60	0	40	100	1
9	PROJECT	AI6P006	Mini Project	0	0	2	25	0	25	50	1
10	PROJECT	AI6P007	CRT(Campus Recruitment Traini	0	0	2	60	0	40	100	1
11	PROJECT	AI6P008	Skill Development	0	0	2	15	0	35	50	1
12	IPR	AI6T007	Intellectual Property Rights	2	0	0	10	15	25	50	Audit
				15	**3**	**12**	**390**	**115**	**545**	**1050**	**22**

Open Elective 2: Object Oriented Methodology

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KATOL ROAD, NAGPUR

SESSION 2023-24

Education to Eternity

7th Semester Artificial Intelligence

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme L	T	P	Evaluation Scheme CA	MSE	ESE	Total	Credit
1	PCC	AI7T001	AI in Intelligence Systems	3	0	0	20	20	60	100	3
2	PEC	AI7TE04	Elective-IV	3	0	0	20	20	60	100	3
3	PEC	AI7TE05	Elective -V	3	0	0	20	20	60	100	3
4	PCC	AI7T002	Sequential NLP	3	0	0	20	20	60	100	3
5	OEC	AI7O003	Open Elective-III	3	1	0	20	20	60	100	4
6	PCC	AI7L003	AI in Intelligence System-Lab	0	0	2	60	0	40	100	1
7	PCC	AI7L004	Data Security & Privacy (Lab)	0	0	2	60	0	40	100	1
8	PROJECT	AI7P005	Project phase-I	0	0	6	75	0	75	150	5
9	RM	AI7T006	Research Methedology	2	0	0	10	15	25	50	Audit
				17	**1**	**10**	**305**	**115**	**480**	**900**	**23**

8th Semester Artificial Intelligence

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				
				L	T	P	CA	MSE	ESE	Total	Credit
1	PEC	AI8TE06	Elective –VI	3	0	0	20	20	60	100	3
2	OEC	AI8O004	Open Elective -IV	3	1	0	20	20	60	100	4
(Sr. No. 1, 2) OR (3)											
3	PROJECT	AI8P001	Internship	0	0	0	100	0	100	200	7
4	PROJECT	AI8P002	Project phase-II	0	0	4	50	0	50	100	3
5	PEC	AI8P003	NPTEL	0	0	0	25	0	25	50	2
				6	**1**	**4**	**215**	**0**	**175**	**350**	**12**

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JAIDEV EDUCATION SOCIETY'S
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Course Title : **Communication Skills**
Course Code :**HU1T001/ HU2T001**
Pre-requisite : **Basic knowledge of English**
Stream :**Theory subject**

Semester : **I&II**
Course Type : **Compulsory**
L – T – P : **2 – 0 – 0**
Credits : **2**

Course Objectives:

The main objective of the subject is to enhance the employability skills of engineering studentsas well as communication skills at work place.

The sub-objectives are:

1) To develop students' reading skills and pronunciation.
2) To develop technical communication skills through drafting, letter writing, and précis writing.
3) To develop literary skills through essay writing.
4) To develop public speaking skills of the students.

Course Outcomes:

At the end of the course students will be able to

1) to better reading comprehension, pronunciation, and functional English grammar.
2) to write letters and resumes
3) to organize their thoughts for effective presentation and writing.
4) to learn skills to present themselves well in an interview, and handle a Group Discussion

To expose the students to the ethics of English language by teaching grammar

Unit 1: Communication and Communication Processes **(06 hrs)**

Introduction to Communication, Types and functions of Communication, Barriers to Communication and overcoming them, Role of Communication Skills in Society

Reading: Introduction to Reading, Barriers to Reading, Types of Reading: Skimming, Scanning, Intensive and Extensive, Strategies for Reading Comprehension.

Listening : Importance of Listening, Types of Listening, Barriers to Listening.

Unit 2: Study of Sounds in English and Vocabulary Building **(06 hrs)**

Introduction to phonetics, Study of Speech Organs, Study of Phonemic Script, Articulation of Different Sounds in English.

Vocabulary Building: The concept of Word Formation, Root words from foreign languages and their use in English, Use of prefixes and suffixes from foreign languages in English to form derivatives, Synonyms, antonyms, and standard abbreviations

Unit 3: English Grammar **(06 hrs)**

Grammar: Forms of Tenses, Articles, Prepositions, Use of Auxiliaries and Modal Auxiliaries, Sentence Structures, Use of phrases and clauses in sentences, Importance of proper punctuation, Common Errors. Misplaced modifiers

Unit 4: Professional Verbal Communication **(06 hrs)**

Components of an effective talk, Idea of space and time in public speaking, Tone of voice, Body language, Timing and duration of speech, Audio-Visual Aids in speech. Presentation Skills, Group Discussion and Job Interviews

Unit 5: Developing Business Writing Skills, Styles and Practice **(06 hrs)**
Writing Emails, Report Writing: Format, Structure and Types, Letter Writing: Types, Parts, Layouts, Writing Job Application Letter and Resume.
Nature and Style of sensible Writing and Practice: Describing, Defining, Classifying, Providing examples or evidence, writing introduction and conclusion, Writing Practices: Comprehension, Précis Writing, Essay Writing

Text book:

Mohd. Ashraf Rizvi, Communication Skills for Engineers, Tata McGraw Hill

Reference Books:

1) Sanjay Kumar, Pushp Lata, Communication Skills, Oxford University Press, 2016
2) Meenakshi Raman, Sangeeta Sharma, Communication Skills, Oxford University Press, 2017
3) Teri Kwal Gamble, Michael Gamble, Communication Works, Tata McGraw Hill Education, 2010
4) Anderson, Kenneth. Joan Maclean and Tossny Lynch. Study Speaking: A Course in Spoken English for Academic Purposes. Cambridge: CUP, 2004.
5) Aswalthapa, K. Organisational Behaviour, Himalayan Publication, Mumbai (1991).
6) Atreya N and Guha, Effective Credit Management, MMC School of Management, Mumbai (1994).
7) Balan,K.R. and Rayudu C.S., Effective Communication, Beacon New Delhi (1996).
8) Bellare, Nirmala. Reading Strategies. Vols. 1 and 2. New Delhi. Oxford University Press, 1998.
9) Bhasker, W. W. S & Prabhu, N. S.: English through Reading, Vols. 1 and 2. Macmillan,

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Education to Eternity

Course Title : Communication Skills-Lab **Semester : I& II**
Course Code : HU1L001/ HU2L001 **Course Type : Compulsory**
Pre-requisite : Basics of English grammar **L – T – P : 0 – 0– 4**
Stream :Theory subject **Credits : 2**

COURSE OBJECTIVES:

1. Apply appropriate communication skills. Students are able to enhance their employability skills as well as communication skills at work place.
2. Demonstrate knowledge of communication theory and application. Students have better reading comprehension, pronunciation, and functional English grammar.

3.Practice critical thinking to develop innovative and well-founded perspectives related to the students' emphases.

4.Build and maintain healthy and effective relationships. Students are able to write letters and resumes.

5.Use technology to communicate effectively in various settings and contexts. Students are able to organize their thoughts for effective presentation and writing.

6.Demonstrate appropriate and professional ethical behavior. Students are able to learn skills to present themselves well in an interview, and handle a Group Discussion

COURSE OUTCOMES

Students will be able to

CO1.Remember Communication Skills by giving adequate exposure in reading, writing, listening and speaking.
CO2. Understand the communication process by identifying, explaining, and applying current communication theories as they relate to a variety of contexts.
CO3. Apply proficiency, both in spoken and written English.
CO4. Analysing the communication behaviours of others and themselves in a variety of scenario (e.g. interpersonal, intercultural, group, public and professional communication, and mass media).
CO5. Evaluate and organize their thoughts for effective presentation and writing.
CO6. Improve research, organizational, and critical thinking skills by finding and evaluating reference material and organizing and presenting effective messages adapted to specific situations.

List of Practical Sessions (Any 10 PR sessions can be conducted):

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Education to Eternity

1) Pronunciation, Intonation, Stress and Rhythm(02 hrs)
2) Introduction to Phonemic symbols (02 hrs)
3) Articulation of sounds in English with proper manner (02 hrs)
4) Practice and exercises on articulation of sounds (02 hrs)
5) Read Pronunciations/transcriptions from the dictionary (02 hrs)
6) Practice and exercises on pronunciations of words (02 hrs)
7) Introduce yourself (02 hrs)
8) Importance of Business Communication with the help of a case study.(02hrs)
9) Listening Skills/ Comprehension(02 hrs)
10) Common Everyday Situations: Conversations and Dialogues(02 hrs)
11) Communication at Workplace(02 hrs)
12) Rapid reading sessions (02 hrs)
13) Draft Email(02 hrs)
14) Resume Writing(02hrs)
15) Drafting Business Letter(02 hrs)
16) Preparing technical paper using IEEE format(02 hrs)
17) Extempore (02 hrs)
18) Elocution (02 hrs)
19) Group discussion (02 hrs)
20) Participating in a debate (02 hrs)
21) Presentation techniques (02 hrs)
22) Interview techniques – Job Interviews, Telephonic Interviews(02hrs)
23) Mock interviews and practice sessions(02 hrs)

Program: B.Tech. in Artificial Intelligence

Semester	Course Code	Name of the course	L	T	P	Credits
III	AI3T001	Organizational Behaviour	2	0	0	2

Prerequisites for the course	
1.	Communication skills (verbal and written)
2.	Honesty/integrity.
3.	Interpersonal skills (relates well to others)

Prior Reading Material/useful links	
1.	http://catalog.umd.umich.edu/graduate/coursesaz/ob/ob.pdf

Course Outcomes:

Sr. No	Course Outcome number	CO statement
1	CO1	Students will be able to remember various methods and terms used in different organizational behaviour models.
2	CO2	Students will be able to understand Individual as well as Group Behaviour like attitude, perception, motivation, personality, misbehaviour and emotions.
3	CO3	Students will be able to apply the Principles of Organization Behaviour through leadership, Power & Politics.
4	CO4	Students will be able to analyse the dynamics of organizational behaviour and managing change.
5	CO5	Students will be able to evaluate the importance of Advanced Communication tools and Techniques for the decision-making Process.

Syllabus:

Course Contents		Hours
Unit I	**Introduction to organization Behaviour** Meaning, Fundamental concepts, Definition, Approaches to OB, Characteristics and limitations of OB, Challenges and Opportunities of OB, Models of OB, Impact of technology on organizational behaviour. **Organization Culture** Meaning and dimensions, Role of founders' values and vision in creating and sustaining culture, Types of organizational cultures, Impact of culture on image and performance of the organization. **[7Hrs]**	
Unit II	**Organizational Design, Change and Innovation** Designing an organizational structure, Division of labour, Delegation of authority, Departmental biases, Span of control, Dimensions of structure, Organizational design models, Multinational Structure and Design, Virtual Organizations. **Communication**: The importance of communication, the communication process, communicating within organizations, Information richness, how technology affects communication, Interpersonal communication, Multicultural communication, Barriers	

	to effective communication, Improving Communication in organizations, Promoting ethical communications **Technical Report Writing:** Characteristics of Technical Communication, Types of Technical Documents, Establishing Goals in Technical Writing, Technical Writing Process: Prewriting, writing, rewriting, Examples of Industries user manuals. **[6 Hrs]**
Unit III	**Personality** Meaning of personality, Nature and Determinants of Personality, Personality Traits - Big Five, Locus of Control, Self-esteem, Type A/ Type B Personality, Risk Taking, Machiavellianism, Self-Monitoring, Personality and OB. **Attitude:** Attributes of personality- Transactional Analysis – Ego states – Johari window - Nature and dimensions of attitude – Developing the right attitude, ABC model of Attitude, Managerial Implications of Attitude **[6Hrs]**
Unit IV	**Groups and Organizations** Groups and Teams, Group Dynamics - Groups versus teams, Nature and types of groups and teams, five stages of group/team development, Determinants of group behaviour, Typical teams in organizations. **Leadership:** Leadership as a concept and its essence, Leaders versus managers, Blake and Mouton's managerial grid, Hersey and Blanchard's situational leadership, Transactional versus Transformational leadership, Women as leaders, Leadership in entrepreneurial and family business, organizations. **[7 Hrs]**
Unit V	**Motivation** Power and purpose of motivation, Theories of motivation - Locke's goal setting theory, Vroom's expectancy theory, Porter and Lawler's model, Adam's equity theory, McClelland's theory of needs, Motivational Techniques – Job design/enlargement /enrichment / rotation, Managing rewards - Job status based rewards, Competency based rewards, performance based rewards, Empowerment and Self-Managed Teams. **Power and Politics**: The concept of power, Sources of power, Interdepartmental power, Illusion of power, Political strategies and tactics, Ethics, power and politics, using power to manage effectively. **Empowerment and Participation**: The nature of empowerment and participation, How participation works, Programs for participation, Important considerations in participation. **[6 Hrs]**

Text Books	
1.	V.G.Kondalkar , "Organization Behaviors" , New Age International Publisher,2007.
2.	Uma Sekaran, "Organization Behaviors" , McGraw Hill Company, New Delhi ,2011.
3.	Nair, Banerjee, Agarwal , "Organization Behaviors" , PrgathiPrakashan, New Delhi,2006.

Reference Books

1.	.LM Prasad , “Organization Behavior”, S. Chand and Co. Ltd, New Delhi,2008.
2.	S.S. Khanka , “ Organization Behavior”, S. Chand and Co. Ltd, New Delhi , 2008
3.	Fred Luthans , **“** Organization Behavior”,McGraw Hill Book Co,2005

Useful Links	
1.	http://catalog.umd.umich.edu/graduate/coursesaz/ob/ob.pdf
2.	https://www.investopedia.com/terms/o/organizational-behavior.asp
3.	https://onlinecourses.swayam2.ac.in/cec20_mg03/preview

Semester	Course Code	Name of the course	L	T	P	Credits
4th	AI4T010	Consumer Affairs	2	0	0	2

Prerequisites for the course	
1	A basic concept of Ethics in IT
2	A basic concept of human Universal value

Prior Reading Material/useful links	
1	www.consumeraffairs.nic.in
2	www.consumeraffairs.nic.in
3	www.iso.org

Course Outcomes:

Students will be able to:

Sr. No	Course outcome number	CO statement
1	CO1	The student should be able to comprehend the business firms' interface with consumers
2	CO2	The student should be able to comprehend the consumer related regulatory and business environment.
3	CO3	To provides an understanding of the procedure of redress of consumer complaints,
4	CO4	It Provide different agencies in establishing product and service standards.
5	CO5	To comprehend the social framework of consumer rights and legal framework of protecting consumer rights.

Syllabus:

Course Contents	
Unit I	Consumer and Markets: Concept of Consumer, Nature of markets: Liberalization and Globalization of markets with special reference to Indian Consumer Markets, E-Commerce with reference to Indian Market, GST, and Digital consumer issues. Experiencing and Voicing Dissatisfaction: Consumer buying process, Consumer Satisfaction/Dissatisfaction-Grievances-complaint, Consumer Complaining Behaviour: Alternatives available to Dissatisfied Consumers; Complaint Handling Process: ISO 10000 suite. **[6Hrs]**

Unit II	**Objectives and Basic Concepts**: Consumer rights and UN Guidelines on consumer protection, Consumer goods, defect in goods, spurious goods and services, service, deficiency in service, unfair trade practice, and restrictive trade practice. **[8Hrs]**
Unit III	**Grievance Redressal Mechanism under the Indian Consumer Protection Law** Who can file a complaint? Grounds of filing a complaint; Limitation period; Procedure for filing and hearing of a complaint; Disposal of cases, Relief/Remedy available; Temporary Injunction, Enforcement of order, Appeal, frivolous and vexatious complaints; Offences and penalties. **[8Hrs]**
Unit IV	**Role of Industry Regulators in Consumer Protection** i. Banking: RBI and Banking Ombudsman ii. Insurance: IRDA and Insurance Ombudsman iii. Telecommunication: TRAI iv. Food Products: FSSAI v. Electricity Supply: Electricity Regulatory Commission vi. Real Estate Regulatory Authority **[7Hrs]**
Text Books	
1	Khanna, Sri Ram, Savita Hanspal, Sheetal Kapoor, and H.K. Awasthi. (2007) *ConsumerAffairs*, Universities Press.
2	Choudhary, Ram Naresh Prasad (2005). *Consumer Protection Law Provisions andProcedure*, Deep and Deep Publications Pvt Ltd.
3	Empowering Consumers e-book, ebook, www.bis.org
Reference Books	
1	Misra Suresh, (Aug 2017) "Is the Indian Consumer Protected? One India One People
2	Raman Mittal, Sonkar Sumit and Parineet Kaur (2016) Regulating Unfair Trade Practices: An Analysis of the Past and Present Indian Legislative Models, Journal ofConsumer Policy.
3	Chakravarthy, S. (2014). MRTP Act metamorphoses into Competition Act. CUTSInstitute for Regulation and Competition position paper. Available online at www.cuts-international.org/doc01.doc.
Useful links	
1	www.bis.org
2	www.consumeraffairs.nic.in

Semester	Course Code	Name of the course	L	T	P	Credits
5th	AI5T008	Innovation and Entrepreneurship Development	2	0	0	2

Prerequisites for the course	
1	Business Communication

Prior Reading Material/useful links	
1	https://www.nextiva.com/blog/what-is-business-communication.html

Course Outcomes:
Students will be able to:

Sr. No	Course outcome number	CO statement
1	CO1	To gain an expansive and deep appreciation of entrepreneurship and its pivotal role in the economy.
2	CO2	To approach entrepreneurship with clarity and focus, and an enhanced understanding of the key success factors as well as possible risks and potential mitigation strategies.
3	CO3	To navigate the opportunities and challenges of entrepreneurship more effectively with the additional insights available.
4	CO4	To evaluate the key factors needed to develop a successful business
5	CO5	To recognize the value of problem-solving, effective business management

Syllabus:

Course Contents	
Unit I	Entrepreneurial Journey, Entrepreneurial Discovery, Ideation, and Prototyping **[4hrs]**
Unit II	Testing, Validation, and Commercialisation, Disruption as a Success Driver, Technological Innovation and Entrepreneurship – 1, Technological Innovation and Entrepreneurship – 2 **[6 hrs]**
Unit III	Raising Financial Resources, Education and Entrepreneurship, Beyond Founders and Founder-Families **[4 hrs]**
Unit IV	India as a Start-up Nation, National Entrepreneurial Culture **[4 hrs]**
Unit V	Entrepreneurial Thermodynamics, Entrepreneurship and Employment. Start-up Case Studies. **[6 hrs]**
Text Books	
1	Innovation and Entrepreneurship: Practice and Principles by Peter F Drucker
2	The Innovator's Solution: Creating and Sustaining Successful Growth by Clayton M Christensen
Reference Books	
1	Zero to One: Notes on Startups, or How the Build the Future by Peter Thiel
2	The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses by Eric Ries

Useful links	
1	https://www.lakeforest.edu/academics/majors-and-minors/entrepreneurship-and-innovation/student-learning-
2	https://www.indeed.com/career-advice/career-development/innovative-

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An Autonomous Institute, with NAAC "A" Grade

At: Khandala, Post- Valni, Kalmeshwar Road, Nagpur

Department of Information Technology

"A Place to Learn, A Chance to Grow"

Session: 2020-21

Course Structure and Syllabus (Autonomous)

For

B. Tech. Information Technology Programme

JAIDEV EDUCATION SOCIETY'S

J D COLLEGE OF ENGINEERING AND MANAGEMENT

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INDEX

VISION AND MISSION OF INSTITUTE

VISION

To be a centre of excellence imparting professional education satisfying societal and global needs.

MISSION

Transforming students into lifelong learners through quality teaching, training and exposure to concurrent technologies. Fostering conducive atmosphere for research and development through well-equipped laboratories and qualified personnel in collaboration with global organizations.

VISION AND MISSION OF DEPARTMENT

VISION

To Produce Competent Professionals equipped with technical knowledge and commitment for satisfying the needs of society.

MISSION

1. To impart advanced knowledge with an inclination towards Research with well equipped Lab.

2. To develop an ability to work ethically and Responsive towards the need of society

PROGRAM EDUCATIONAL OBJECTIVES (PEO’s)

PEOs	ATTRIBUTES
PEO 1	Students will have In-depth knowledge of trending technologies, effective communication skills, lifelong learning with leadership qualities in order to work in any multidisciplinary areas in a team or individually.
PEO 2	Students will be able to interpret and analyze the requirements of the software design and development to provide efficient engineering solutions with novel product designs within the jurisdiction of humanity and social constraints
PEO 3	Students will have the attitude to pursue higher studies or research work or initiate entrepreneurial activity

PROGRAM OUTCOMES (PO’s)

POs	ATTRIBUTES
1	An Understanding of IT architecture, software and hardware concepts, functionalities and applications
2	An Ability to design, develop and test computer programs involving various algorithms, methodology and programming languages.
3	Competency of business domains and functional processes that employ IT systems and applications
4	Practical use of communication protocols and their applications in the field of internet and world wide web.
5	Sound understanding of fundamentals of computer as the central enabling platform for information management in 21st century .
6	An Ability to develop, integrate, maintain and innovate software applications deployed in various multi-disciplinary domains.
7	Thought leadership to design and implement practical solutions for global industry needs.
8	An Acumen to embrace and adopt futuristic IT technological developments.
9	Sound knowledge of entrepreneurship traits to succeed.
10	Adoption of practices that are ethical ensuring transparency and accountability.
11	Capability to provide solutions that are socially empowering and environment friendly.
12	Effective communication and collaboration techniques with stakeholders to achieve best results.

PROGRAM SPECIFIC OUTCOMES (PSOS):

At the end of Electronics and Telecommunication program the student will have following Program specific outcomes.

PSO1: The ability to understand, analyze and develop computer programs in the areas related to algorithms, system software, multimedia, web design, big data analytics, and networking for efficient design of computer-based systems of varying complexity

PSO2: The ability to apply standard practices and strategies in software project development using open-ended programming environments to deliver a quality product for business success.

PSO3: The ability o employ modern computer languages, environments, and platforms in creating innovative career paths to be an entrepreneur, lifelong learning & a zest for higher studies and also acts as good citizen by inculcating in them moral values & ethics.

Recommendations for conducting one theory course of curriculum through online Teaching / Learning

1. Only Swayam / NPTEL platform is allowed.

2. One defined subject per semester in online mode and BOS should declare that one subject for online mode based on availability of NPTEL offering before commencement of the semester.

3. Student will be allowed to appear for NPTEL / Institute level / University Examination as applicable.

4. In order to ensure learning, NPTEL lectures to be telecast in the class by including it in regular time table if required.

5. 75% assignment submission is mandatory for these online classes also like regular lecture attendance.

6. One faculty to be allotted for this subject, who will discuss and solve student's doubts. Allot 3 hrs/week load to teacher who is allotted to work as facilitator of online course.

7. For Autonomy Students: For online mode the student should submit all assignment given by nptel then his/her score has weightage of 40% for CA & MSE. And if student clear the nptel final exam and producing certificate then 60% weightage should be given as ESE, otherwise he/she has to appear for Makeup exam of Institute.

If student cannot enroll for NPTEL then he/she has to study online videos / material and these students should appear for Mid Semester, CA-I , CA-II and End sem exams of the Institute.

8. For DBATU students: For online mode he has to appear for CA-I, CA-II, Mid sem exam of the institute and End sem exam of University.

If student can't enroll for NPTEL then he/she has to study online videos / material and these students should appear for Mid Semester, CA-I , CA-II of the institute and End sem exams of the University.

10. If the credits of NPTEL/ SWAYAM courses do not match with the existing subject proper scaling will be done)

This system will ensure real learning; avoid any problem arising due to cancellation of NPTEL exam as it happened in this semester. At least for first year and in the unpredictable situation of covid pandemic these provisions will avoid any last moment chaos.

Course Structure and Syllabus

For

B. Tech. Information Technology Programme

Curriculum for Semester- I [First Year]

1st Semester

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				Credit
				L	T	P	CA	MSE	ESE/Ext. Pra.	Total	
1	HSMC	HU1T002	Introduction to Computer programming	2	0	0	20	20	60	100	2
2	BSC	MA1T001	Engineering Mathematics - I	3	1	0	20	20	60	100	4
3	BSC	IT1T005	Engineering Physics	3	1	0	20	20	60	100	4
4	ESC	IT1T006	Energy and Environment Engineering	3	0	0	20	20	60	100	3
5	HSMC	HU1L002	Introduction to Computer programming Lab	0	0	4	60	0	40	100	2
6	ESC	WS1L001	Workshop Practices	0	0	4	60	0	40	100	2
7	BSC	IT1L005	Engineering Physics Lab	0	0	2	60	0	40	100	1
8			Induction Programme	3 Weeks							
9	ESC	IT1T007	Basic Electrical and Electronics Engineering	2	0	0	10	15	25	50	Audit
				13	**2**	**10**					**18**

HU1T002	Introduction to Computer Programming	4 Credit

Course Objectives:

1. To understand the importance of Programming
2. To understand the application of C Programming.
3. To investigate the key concepts of C Programming.
4. To enable students build a applications based on C programming

Course Outcome:

CO1: Define the algorithms, flowcharts, array, pointer, structure, function, and python.

CO2: Discuss and differentiate between variables, operators, statements, loops, array dimensions.

CO3: Demonstrate working programs using functions, loops, conditional statements, array, pointer, structure and files in C and python language.

CO4:Distinguish between different steps of programming and prioritize levels of programming.

CO5:Find errors and predict outcome in C and python programming.

CO6:Compose and develop any application using C and python programming.

Unit I: Basic of Programming Language [6 Hrs]

HLL, LLL, Language translator, Error checking, Debugging, Programming processes, Flowcharts, Algorithms along with asymptotic notation.

Unit II: Types, Operators and Expressions in C language [6 Hrs]

Variable names, Data types, sizes, constants, declarations, arithmetic operators, relational and logical operators, type conversions, increment and decrement operators, bitwise operators, assignment operators and expressions, conditional expressions precedence and order of evaluation.

Unit III: Control Flow: [6 Hrs]

Statements and Blocks. If-else, else-if, switch, Loops: while and for, do-while break and continue go to and Labels. Initializing arrays, Initializing character arrays, multidimensional arrays, Introduction to pointers.

Unit IV: Functions and Pointers in Python **[6 Hrs]**

Functions and Program Structure: Basic of functions, functions returning non-integers external variables scope rules.

Pointers in Python: Pointers to integers, characters, floats, arrays.

Unit V: **[6 Hrs]**

Structures in Python: Basics of structures, structures with functions, arrays of structures.

File handling in Python: Basics of file handling.

Text Books

1. Let Us C by Yashavant Kanetkar.
2. Let Us C Solutions by Yashavant Kanetkar
3. Data Structure through C by Yashavant Kanetkar.

Reference Books

1. C Programming: A Modern Approach (2nd Edition) - K. N. King (2008). A good book for learning C.
2. Programming in C (4th Edition) - Stephen Kochan (2014). A good general introduction and tutorial.
3. C Primer Plus (5th Edition) - Stephen Prata (2004)
4. A Book on C - Al Kelley/Ira Pohl (1998).
5. The C Book (Free Online) - Mike Banahan, Declan Brady, and Mark Doran (1991).

MA1T001	Engineering Mathematics-1	4 Credit

COURSE OBJECTIVES

1. To understand the importance of Mathematics
2. To understand the application of Mathematics in engineering and in real life.
3. To investigate the key concepts of Mathematics.
4. To enable students to analyse a problem

COURSE OUTCOMES

At the end of the course students will be able to

1. Describe rank, Bernoulli's theorem, Taylor's and Maclaurin's theorems for functions of two variables, – Euler's Theorem for functions containing two and three variables, Lagrange's theorem
2. Illustrate the examples of ordinary differential equation, partial differential equation, matrices.
3. Solve questions related to ordinary differential equation, partial differential equation, matrices and their applications.
4. Apply the knowledge of matrices, ordinary differential equation, partial differential equation, and their applications to real world problems.
5. Interpret the results of matrices, ordinary differential equation, partial differential equation and their applications.
6. Design a method or modal on matrices, ordinary differential equation, and partial differential equation.

Unit 1: Linear Algebra- Matrices **[09 Hours]**

Determinants & Matrix, Inverse of Matrix by adjoin method, Inverse by partitioning method, solution of system of linear equations, Rank of Matrix, Consistency of linear system of equation.

Unit 2: Ordinary Differential Equations of First Order and First Degree and Their Applications **[09 Hours]**

Linear equations; Reducible to linear equations (Bernoulli's equation); Exact differential equations; Equations reducible to exact equations; Applications to orthogonal trajectories, mechanical systems and electrical systems.

Unit3: Linear Differential Equations with Constant Coefficients **[09 Hours]**

Introductory remarks - complementary function, particular integral; Rules for finding complementary functions and particular integrals; Method of variation of parameters; Cauchy's homogeneous and Legendre's linear equations.

Unit 4:Partial Differentiation **[09 Hours]**

Partial derivatives of first and higher orders; Homogeneous functions – Euler's Theorem for functions containing two and three variables (with proofs); Total derivatives; Change of variables.

Unit 5:Applications of Partial differentiation **[09 Hours]**

Jacobians - properties; Taylor's and Maclaurin's theorems (without proofs) for functions of two variables; Maxima and minima of functions of two variables; Lagrange's method of undetermined multipliers.

Text Books

1) Higher Engineering Mathematics by B. S. Grewal, Khanna Publishers, NewDelhi.

2) Advanced Engineering Mathematics by Erwin Kreyszig, John Wiley & Sons, NewYork.

3)A Course in Engineering Mathematics (Vol I) by Dr. B. B. Singh, Synergy Knowledgeware, Mumbai.

4) A Text Book of Applied Mathematics (Vol I & II) by P. N. Wartikar and J. N. Wartikar, Pune Vidyarthi Griha Prakashan, Pune.

5) Higher Engineering Mathematics by H. K. Das and Er. RajnishVerma, S. Chand & CO. Pvt.Ltd., New Delhi.

Reference Books

1) Higher Engineering Mathematics by B. V. Ramana, Tata McGraw-Hill Publications, New Delhi.

2) A Text Book of Engineering Mathematics by Peter O' Neil, Thomson Asia Pte Ltd. , Singapore.

3) Advanced Engineering Mathematics by C. R. Wylie & L. C. Barrett, Tata Mcgraw-Hill Publishing Company Ltd., New Delhi.

ET1T005	**Engineering Physics**	**4 Credit**

COURSE OBJECTIVES:-

1. To provide a firm grounding in the basic physics principles and concept to resolve many Engineering and technological problems.
2. To understand and study the Physics principles behind the developments of Engineering materials.

COURSE OUTCOMES

At the end of the course students will be able to

1. Define the concept of laser, optical fiber, Hall effect, electron Ballistics, Bethe's law, Brewster law, polarization, electromagnetic wave.
2. Illustrate different types of laser, and optical fiber, Band-theory, Effect of electric and magnetic fields, Electric and Magnetic focusing, Interference in thin films, Interference in Wedge shape thin film and electromagnetic wave.
3. Apply the concept of Three and four level laser, pumping, population inversion, Numerical aperture, Attenuation and dispersion, V-I characteristics of PN-junction diode, CRO, Interference in thin films and electromagnetic waves.
4. Analyze the different types of laser and optical fiber, semiconductors, Motion of charged particles in uniform electric and magnetic fields, polarization, relation between electric and magnetic fields of an electromagnetic wave.
5. Interpret different types of laser, and optical fiber, PN- junction diode, Bipolar Transistor action, Velocity filter, polarization, wave plate.
6. Develop models based on laser, optical fiber.

Unit-I: Laser & Optical Fibre **[08 Hrs]**

Interaction of radiation with matter, Population Inversion and Optical resonance cavity , Three and four level laser, Ruby laser, He-Ne laser, Semiconductor laser , Properties and engineering applications of laser.

Optical fibers: Propagation by total internal reflection, structure and classification (based on material, refractive index and number of modes), Modes of propagation in fiber, Acceptance angle, Numerical aperture, Attenuation and dispersion.. Applications: I) As a Sensors - i) Temperature Sensor ii) Pollution / Smoke detector iii) Liquid level sensor. II) As a Detectors- i) PIN detector ii) Avalanche Detector.

Unit-II: Semiconductor Physics **[09Hrs]**

Band-theory based classification of solids into insulators, semiconductors and conductors, Fermi-Dirac distribution Function, Intrinsic semiconductors: Germanium and silicon; Fermi- energy, Typical energy band diagram of an intrinsic semi-conductor, Extrinsic semiconductors, Current conduction in semiconductors.

PN- junction diode; Unbiased, Forward biased& Reverse biased mode with Energy band diagram , Diode rectifier equation, Bipolar Transistor action, Hall effect, Hall coefficient & Hall Angle

Unit-III: Electron Ballistics **[08 Hrs]**

Lorentz force, Motion of charged particles in uniform electric and magnetic fields (parallel, perpendicular and at an acute angle), Effect of electric and magnetic fields on kinetic energy of charged particle, Crossed electric and magnetic field configurations, Velocity filter, Electrostatic and magneto static deflection.

Bethe's law, Electric and Magnetic focusing, Construction & working of Electrostatic lens, Devices: CRT, CRO, Block Diagram, Function & working of each block.

Unit-IV: Wave Optics **[08 Hrs]**

Interference in thin films, Interference in Wedge shape thin film, Newton's rings, Anti-reflection coating, advanced applications of interference in thin film.

Polarization by reflection, Brewster's law, polarization by double refraction, Nicol prism, elliptically and circularly polarized light, Quarter wave plate and half wave plate.

Unit-V: Electromagnetic waves **[06 Hrs]**

The wave equation; Plane electromagnetic waves in vacuum, their transverse nature and polarization; relation between electric and magnetic fields of an electromagnetic wave; energy carried by electromagnetic waves and examples.

Text Books:

1. Fundamentals of Physics: David Halliday, Robert Resnick and Jerle Walker, John-WileyIndia (8e, extended)

2. A text book of Engineering Physics: M. N. Avadhanulu, S. Chand & Co.
3. Nano the Essentials: Understanding Nanoscience and Nanotechnology, T.Praddep; TMH Publications.
4. Introduction to Nanotechnology:Pooly& Owens; Willey Publication
5. Text Book of Optics: Brijlal and Subramanyam (S. Chand and Company)
6. Laser: M. N. Avadhanulu, S. Chand & Co.

Reference Books:

1. LASERS: Theory and Applications: Thyagarajan K and Ghatak A.K.
2. Nanomaterials& Nanotechnologies and Design:M.F.Ashby, Paulo Ferreira and Daniel L.Schodek, Elsevier Publications.
3. University Physics: Young and Freedman (Pearson Education).
4. Optics: Jenkins and White (Tata Mcgraw Hill)

ET1L005	Engineering Physics Lab	1 Credit

List of Experiment

2. Newton's rings - Determination of radius of curvature of Plano convex lens / wavelength

of light

3. Wedge Shaped film - Determination of thickness of thin wire
4. Laser - Determination of wavelength of He-Ne laser light
5. Magnetron Tube - Determination of ‘e/m’ of electron
6. Hall Effect - Determination of Hall Coefficient
7. Measurement of Band gap energy of Semiconductors
8. Study of I-V characteristics of P-N junction diode
9. Experiment on fibre optics
10. Input, output and current transfer characteristics of PNP/NPN transistor in CB and CE mode
11. Study of Cathode Ray Oscilloscope

ET1T006	Energy and Environment Engineering	3 Credit

COURSE OBJECTIVES

1. To understand the importance of Energy and Environment
2. To understand the application of energy saving tool in real life.
3. To investigate the key concepts of Energy and Environment

COURSE OUTCOMES

At the end of the course students will be able to

1) Describe different kind of pollution eg. Water pollution, air pollution, soil pollution etc.

2) Understand the importance of ecosystem for human beings..

3) Discover innovative method of power generation.

4) Correlate the cost of various method of power generation.

5) Judge the quality of air.

Unit 1 [**4 hrs]**

Air Pollution: Environment and Human health - Air pollution, Particulate emission: sources-effects- control measures -, air quality standards, and measurement of air pollution. Disposal of solid wastes, Bio-medical wastes effects- control measures

Unit 2 [**4 hrs]**

Water Pollution and Conservation: Water pollution- types of pollutants, effects- control measures, Water conservation and its methods, rainwater harvesting, methods of rainwater harvesting Surface runoff harvesting, Rooftop rainwater harvesting, Noise pollution –effects and control measures, -Thermal pollution – Soil pollution –Nuclear hazard.

Unit 3 [**4 hrs]**

Conventional Power Generation: Steam power station, Nuclear power plant – Gas turbine power plant- Hydro power station: Schematic arrangement, advantages and disadvantages, Thermo electric and thermionic generators, Environmental aspects for selecting the sites and locations of power plants.

Unit 4 [**4 hrs]**

Renewable Power Generation: Solar, Wind, Biogas and Biomass, Ocean Thermal energy conversion (OTEC), Tidal, Geothermal energy, Magneto Hydro Dynamics (MHD): Schematic arrangement, advantages and disadvantages.

Unit 5 **[4 hrs]**

Energy conservation: Scope for energy conservation and its benefits Energy conservation Principle – Maximum energy efficiency, Maximum cost effectiveness, Methods and techniques of energy conservation in ventilation and air conditioners, refrigerator, compressors, pumps, fans and blowers, Energy conservation in electric furnaces, ovens and boilers, lighting techniques. Tariffs and economic aspects in power generation.

Reference/Text Books:

1. A Chakrabarti, M. L Soni, P. V. Gupta, U. S. Bhatnagar, A Text book of Power System Engineering, DhanpatRai Publication.
2. Rai. G. D., Non-Conventional Energy Sources, Khanna Publishers, Delhi, 2006.
3. Rao S., Parulekar B.B., Energy Technology-Non conventional, Renewable and Conventional, Khanna Publishers, Delhi, 2005.
4. Glynn Henry J., Gary W. Heinke, Environmental Science and Engineering, Pearson Education, Inc, 2004.
5. J. M. Fowler, Energy and the Environment, McGraw-Hill, 2nd Edition, 1984.
6. Gilbert M. Masters, Introduction to Environmental Engineering and Science, 2nd Edition, Prentice Hall, 2003.

HU1L002	**Introduction to Computer Programming Lab**	**2 Credit**

List of Practical:-

1	A simple program to display a message “Hello World” on screen.
2	Write a Program to print addition, subtraction Multiplication and Division of a entered number.
3	Write a Program to LCM of the entered number..

4	Write a program to find GCD of the entered number.
5	Write a program to find the greatest among three number.
6	Write a any menu driven program using if…else statement.
7	Write a any menu driven program using Switch case statement.
8	Write a program to find count of even no ,count of odd number , sum of even no and sum of odd number between 1 to 50.
9	Write a Program to generate prime number up to inputted number.
10	Write a program to check entered no is Armstrong no or not.
11	Write a program to find transpose of a matrix.
12	Write a Program to find multiplication of a two matrix elements.
13	Write a Program to find length of a string.(with and without using a library function)
14	Write a Program to find addition of two numbers using pointer.
15	Open ended Program. (How to execute C program on Linux operating system)
16	Write a Python program to print "Hello World".
17	Write a Python program to display the current date and time.
18	Write a Python program which accepts the radius of a circle from the user and compute the area.
19	Write a Python program to find reverse of the entered number.
20	Write a Python program to get the Python version you are using

WS1L001	Workshop Practices	2 Credit

Instructions to the student:

Each student is required to maintain a „workshop journal‟ consisting of drawing / sketches of the jobs and a brief description of tools, equipment, and procedure used for doing the job.

Contents:

a**) Carpentry:** Technical Terms related to wood working, Types of wood, Joining materials, Types of joints - Mortise and Tenon, Dovetail, Half Lap, etc., Methods of preparation and applications, Wood working lathe, safety precautions.

b) Welding: Arc welding - welding joints, edge preparation, welding tools and equipment, Gas welding - types of flames, tools and equipment, Resistance welding - Spot welding, joint preparation, tools and equipment, safety precautions.

c) Fitting: Fitting operation like chipping, filing, right angle, marking, drilling, tapping etc., Fitting hand tools like vices, cold chisel, etc. Drilling machine and its operation.

e) Machine shop: Lathe machine, types of lathes, major parts, cutting tool, turning operations (Demo), safety precautions

List of Practical:

1. Wood sizing exercises in planning, marking, sawing, chiselling and grooving to make half lap joint and cross lap joint.
2. A job involving cutting, filing to saw cut, filing all sides and faces, corner rounding, drilling and tapping on M. S. plates.
3. Exercise in Arc welding (MMAW) to make a square butt joint.
4. A demo job on turning of a Mild Steel cylindrical job using centre lathe.

Electrical workshop:-

1) To wire for a stair case arrangement using a two-way switch.

2) To measure electrical quantities-voltage current, power & power factor in RLC circuit.

ET1T007	Basics of Electrical and Electronics Engineering	Audit

COURSE OBJECTIVES

1. To provide a basic information and use of electrical and electronics components.
2. To understand and study the materials used for the preparation of electrical and electronics components.
3. To provide basic knowledge of operation and functionality of electrical and electronics components.

COURSE OUTCOMES:

CO1: Define fundamentals of electrical system and choose measuring instruments for measurement of electrical quantities & describe the concept PN junction diode and its characteristics.

CO2: Classify wiring system and compare energy resources for electrical energy generation & elaborate the transistor configuration in CE, CB & CC mode.

CO3: Plan and organize the utilization of energy resources of electrical system & apply transistor characteristics to construct Amplifier devices.

CO4: Compare different sources of electrical system & distinguish various logic gates and simplify the Boolean's equations.

CO5: Justify the utilization of various electrical and electronics components into electrical and electronics circuitries.

CO6: Construct various circuits using Resistors, capacitors, inductors, PN junction diode, Zener diode, transformers, transistors and logic gates.

Unit 1: Elementary Electrical Concepts and Circuit Components [8 Hrs]

Fundamental of Electrical system: Potential difference, Ohm's law, Effect of temperature on resister, resistance temperature coefficient, **Electrical wiring system**: Study of different wire gauges and their applications in domestic and industry. **Resistors:** colour code, type of resistors, material used for resistors, resistance wires, resistance standards, frequency errors in resistors. **Capacitors:** Capacitance standards, variable capacitors, frequency errors in capacitors. Loss angle and power factor of capacitors. **Inductors:** standards of inductance, mutual inductance, self-inductance, variable inductance, inductors for high and low frequency work, frequency errors in inductors.

Unit 2: Measurement of Electrical Quantities, Measuring Instruments & Energy Resources [7 Hrs]

Measurement of Voltage, Current, and Power (1ph and 3ph), Introduction to PMMC instrument, Ohmmeter, galvanometer, potentiometers, power factor meter and frequency meters. Study of circuit breakers & Actuators (MCB & Fuse, Power Contactors & Aux contactors, Electro-Mechanical & Solid state Relays). **Energy Resources and Utilization**: Conventional and nonconventional energy resources; Introduction to electrical energy generation from different resources, transmission, distribution and utilization, Concept of Supply Demand, Power Factor, Need of unity factor.

Unit3: Introduction to diodes, diode circuit and Transducers [8 Hrs]

The P-N Junction Diode, V-I characteristics, Diode as Rectifier, specifications of Rectifier Diodes, Half Wave, Full wave, Bridge rectifiers, Equations for IDC VDC VRMS, IRMS, Efficiency and Ripple Factor for each configuration. Zener Diode, Characteristics, Specifications, Zener Voltage Regulator, Types of Diodes: LED, Photodiode. Introduction to transducer, Classification of transducers, characteristics and choice of transducers.

Unit 4: Semiconductor Devices and Applications: [7 Hrs]

Transistors: Introduction, Classification, CE, CB, and CC configurations, α, β, concept of gain and bandwidth. Operation of **BJT** in cut-off, saturation and active regions (DC analysis). BJT as an amplifier, biasing techniques of BJT, BJT as a switch.

Introduction to Digital Electronics: Number System, Basic logic Gates, Universal Gates, Boolean

Postulates, De-Morgan Theorems

Reference/Text Books:

1. V. N. Mittal and Arvind Mittal, Basic Electrical Engineering, McGraw-Hill Publication.
2. Brijesh Iyer and S. L. Nalbalwar, A Text book of Basic Electronics, Synergy Knowledgeware Mumbai, 2017. ISBN:978-93-8335-246-3
3. Vincent DelToro, Electrical engineering Fundamentals, PHI Publication, 2nd Edition, 2011.
4. A Textbook of Basic Electrical and Electronics Engineering, J.B.Gupta, Katson Publication.
5. A Textbook of Basic Electrical Engineering by S.B. Bodkhe, N.M.Deskar, Professional Publishing House Pvt. Ltd
6. D. P. Kothari and Nagrath, Theory and Problems in Electrical Engineering, PHI Publication, 2011.

7. B. L. Theraja, Basic Electronics, S. Chand Limited, 2007.
8. Millman Halkias, Integrated Electronics-Analog and Digital Circuits and Systems, McGraw-Hill Publication, 2000.
9. Donald Neaman, Electronic Circuit Analysis and Design, McGraw-Hill Publication, 3rd Edition.
10. Donald Neaman, Electronic Circuit Analysis and Design, McGraw-Hill Publication, 3rd Edition.
11. Printed Circuit Boards Design & Technology, Walter C. Bosshart, McGraw-Hill Publication.

Note: Students are advised to use internet resources whenever required

Curriculum for Semester- II [First Year]

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				Credit
				L	T	P	CA	MSE	ESE/ Ext.	Total	
1	HSMC	HU2T001	Communication Skills	2	0	0	60	0	40	100	2
2	BSC	MA2T001	Engineering Mathematics-II	3	1	0	20	20	60	100	4
3	BSC	CS2T002	Engineering Chemistry	3	1	0	20	20	60	100	4
4	ESC	CS2T003	Engineering Graphics	1	0	0	20	20	60	100	1
5	HSMC	HU2L001	Communication Skills Lab.	0	0	4	60	0	40	100	2
6	BSC	CS2L002	Engineering Chemistry Lab	0	0	2	60	0	40	100	1
7	ESC	CS2L003	Engineering Graphics Lab	0	0	4	60	0	40	100	2
8			Societal Internship/ Field	Report submission						50	1
9	ESC	CS2T004	Basic Civil and Mechanical Engineering	2	0	0	10	15	25	50	Audit
				11	**2**	**10**					**17**
				23							

HU2T001	Communication Skills	4 Credit

Course Objectives:

The main objective of the subject is to enhance the employability skills of engineering students as well as communication skills at work place.

The sub-objectives are:

1) To develop students' reading skills and pronunciation.
2) To develop technical communication skills through drafting, letter writing, and précis writing.
3) To develop literary skills through essay writing.
4) To develop public speaking skills of the students.
5) To expose the students to the ethics of English language by teaching grammar

Course Outcomes:

At the end of the course students will be able to

1) Better reading comprehension, pronunciation, and functional English grammar.
2) Write letters and resumes
3) Organize their thoughts for effective presentation and writing.
4) Learn skills to present themselves well in an interview, and handle a Group Discussion

Unit 1: Communication and Communication Processes [06 hrs]

Introduction to Communication, Types and functions of Communication, Barriers to Communication and overcoming them, Role of Communication Skills in Society

Reading: Introduction to Reading, Barriers to Reading, Types of Reading: Skimming, Scanning, Intensive and Extensive, Strategies for Reading Comprehension.

Listening: Importance of Listening, Types of Listening, and Barriers to Listening.

Unit 2: Study of Sounds in English and Vocabulary Building [06 hrs]

Introduction to phonetics, Study of Speech Organs, Study of Phonemic Script, Articulation of Different Sounds in English.

Vocabulary Building: The concept of Word Formation, Root words from foreign languages and their use in English, Use of prefixes and suffixes from foreign languages in English to form derivatives, Synonyms, antonyms, and standard abbreviations

Unit 3: English Grammar **[06 hrs]**

Grammar: Forms of Tenses, Articles, Prepositions, Use of Auxiliaries and Modal Auxiliaries, Sentence Structures, Use of phrases and clauses in sentences, Importance of proper punctuation, Common Errors. Misplaced modifiers

Unit 4: Professional Verbal Communication **[06 hrs]**

Components of an effective talk, Idea of space and time in public speaking, Tone of voice, Body language, Timing and duration of speech, Audio-Visual Aids in speech. Presentation Skills, Group Discussion and Job Interviews

Unit 5: Developing Business Writing Skills, Styles and Practice **[06 hrs]**

Writing Emails, Report Writing: Format, Structure and Types, Letter Writing**:** Types, Parts, Layouts, Writing Job Application Letter and Resume.

Nature and Style of sensible Writing and Practice: Describing, Defining, Classifying, Providing examples or evidence, writing introduction and conclusion, Writing Practices: Comprehension, Précis Writing, Essay Writing

Text book:

Mohd. Ashraf Rizvi, Communication Skills for Engineers, Tata McGraw Hill

Reference Books:

1) Sanjay Kumar, PushpLata, Communication Skills, Oxford University Press, 2016

2) Meenakshi Raman, Sangeeta Sharma, Communication Skills, Oxford University Press, 2017

3) Teri Kwal Gamble, Michael Gamble, Communication Works, Tata McGraw Hill Education, 2010

4) Anderson, Kenneth. Joan Maclean and Tossny Lynch. Study Speaking: A Course in Spoken English for Academic Purposes. Cambridge: CUP, 2004.

5) Aswalthapa, K. Organisational Behaviour, Himalayan Publication, Mumbai (1991).
6) Atreya N and Guha, Effective Credit Management, MMC School of Management, Mumbai (1994).
7) Balan, K.R. and Rayudu C.S., Effective Communication, Beacon New Delhi (1996).
8) Bellare, Nirmala. Reading Strategies. Vols. 1 and 2. New Delhi. Oxford University Press, 1998.
9) Bhasker, W. W. S &Prabhu, N. S.: English through Reading, Vols. 1 and 2. Macmillan, 1975.
10) Black, Sam. Practical Public Relations, E.L.B.S. London (1972).
11) Blass, Laurie, Kathy Block and Hannah Friesan. Creating Meaning. Oxford: OUP, 2007.
12) BoveeCourtland,L and Thrill, John V. Business Communication, Today McGraw Hill, New York, Taxman Publication (1989).

MA2T001	Engineering Mathematics-II	4 Credit

COURSE OBJECTIVES

1. To understand the importance of Mathematics
2. To understand the application of Mathematics in engineering and in real life.
3. To investigate the key concepts of Mathematics.
4. To enable students to analyse a problem

COURSE OUTCOMES

At the end of the course students will be able to

1. Describe concept of complex numbers, integral calculus & multiple integrals, Fourier series & transform, vector differential calculus, vector integral calculus.
2. Illustrate the concept of complex numbers, integral calculus & multiple integrals, Fourier series & transform, vector differential calculus, vector integral calculus by using examples.
3. Apply the knowledge of complex numbers, integral calculus & multiple integrals, Fourier series & transform, vector differential calculus, vector integral calculus to solve the engineering problems.
4. Analyse the problems and results of complex numbers, integral calculus & multiple integrals, Fourier series & transform, vector differential calculus, vector integral calculus to solve the engineering problems.
5. Evaluate the problems by using complex numbers, integral calculus & multiple integrals, Fourier series & transform, vector differential calculus, vector integral calculus to solve the engineering problems.
6. Create the methods or model by using complex numbers, integral calculus & multiple integrals, Fourier series & transform, vector differential calculus, vector integral calculus to solve the engineering problems.

Unit 1: Complex Numbers **[09 Hrs]**

Definition and geometrical representation; De-Moivre's theorem (without proof); Roots of Complex numbers by using De-Moivre's theorem; Circular functions of complex variable – definition; Hyperbolic functions; Relations between circular and hyperbolic functions; Real and

Imaginary parts of circular and hyperbolic functions; Logarithm of Complex quantities.

Unit 2: Integral calculus & Multiple Integrals [09 Hrs]

Beta, Gamma functions; tracing of the curves given in Cartesian, parametric & polar forms. Double integration in Cartesian and polar co-ordinates; Evaluation of double integrals by changing the order of integration and changing to polar form; Triple integral

Unit3: Fourier Series & Transform [09 Hrs]

Fourier Series , Definition and Properties (excluding FFT), Fourier Integral Theorem, Relation with Laplace Transform, Applications of Fourier Transform to Solve Integral Equations.

Unit4: Vector Differential Calculus [09 Hrs]

General rules of vector Differentiation; Scalar and vector fields: Gradient, divergence and curl; Solenoidal and irrotational vector fields; Vector identities

Unit5: Vector Integral Calculus [09 Hrs]

Vector Integration: line integral, surface integral and volume integral; Green's lemma, Gauss' divergence theorem and Stokes' theorem (without proofs).

Text Books

1) Higher Engineering Mathematics by B. S. Grewal, Khanna Publishers, NewDelhi.

2) Advanced Engineering Mathematics by Erwin Kreyszig, John Wiley & Sons, NewYork.

3)A Course in Engineering Mathematics (Vol I) by Dr. B. B. Singh, Synergy Knowledgeware, Mumbai.

4) A Text Book of Applied Mathematics (Vol I & II) by P. N. Wartikar and J. N. Wartikar, Pune Vidyarthi Griha Prakashan, Pune.

5) Higher Engineering Mathematics by H. K. Das and Er. RajnishVerma, S. Chand & CO. Pvt.Ltd., New Delhi.

Reference Books

1) Higher Engineering Mathematics by B. V. Ramana, Tata McGraw-Hill Publications, New Delhi.

2) A Text Book of Engineering Mathematics by Peter O' Neil, Thomson Asia Pte Ltd. , Singapore.

3) Advanced Engineering Mathematics by C. R. Wylie & L. C. Barrett, Tata Mcgraw-Hill Publishing Company Ltd., NewDelhi.

ET2T002	Engineering Chemistry	4 Credit

COURSE OBJECTIVES

1. To understand the importance of Chemistry
2. To understand the application of Chemistry in engineering and in real life.
3. To investigate the key concepts of Chemistry knowledge
4. To enable students to analyse a Chemistry problem so that appropriate problem solving techniques may be applied

COURSE OUTCOMES

At the end of the course students will be able to

1. Describe various properties of water, fuel, transition metal ions and their magnetic properties, Debye-Hückel theory, Quinonoid theory, various electrode, polymer and batteries
2. Illustrate the various types of water, Ostwald's theory of acid-base indicator, polymer, various batteries, and fuel cell.
3. Analyze the question on water characteristics, electrochemistry and various types of instrumental titration, various batteries and fuel cell.
4. Apply the Knowledge of zeolite process, Ion exchange process, Hot Lime –Soda process, acid base concept, fuel cell and batteries..
5. Develop a Modal on softening of water, standardization of acid and base by various instruments, polymers, fuel cell and batteries..
6. Organize water as per quality, and fuel, types of electrodes, polymers and fuel cell and batteries.

Unit-1 **[6 Hrs]**

Water Treatment: Introduction, hard and soft water, softening of water – Zeolite process, Ion exchange process, Hot Lime –Soda process, water characteristics- Hardness, Domestic water treatment

Unit-2 **[6 Hrs]**

Fuels: Introduction, classification of fuel, essential properties of fuel, characteristics of good fuel, solid fuel-Coal, Various types of Coal, Analysis of coal-Proximate and Ultimate analysis, liquid fuel- Refining of Petroleum.

Unit-3 **[8 Hrs]**

Electrochemistry: Introduction-basic concepts, Transport number and its determination by Moving Boundary method, Debye-Hückel theory, Conductometric titrations, Ostwald's theory of acid-base indicator, Quinonoid theory, Electrodes – Glass electrode, Quinhydrone electrode.

Unit-4 **[8 Hrs]**

Advanced Polymeric Materials: Introduction to reactions involving substitution, addition, elimination, cyclization and ring opening. Liquid crystals and liquid crystal polymers (thermotropic and lyotropic), phases of thermotropic polymers: nematic, smectic, cholesteric; advantages, disadvantages and applications

Unit-5Battery Technology: **[6 Hrs]**

Classification of batteries: Primary, Secondary- Electricity storage density, power density, energy efficiency, cycle life, shelf life. Rechargeable alkaline storage batteries, Ni-metal hydride, Lithium ion batteries and H2-O2 Fuel cell.

Text Books:

1. A Text book of Engineering Chemistry, Dr. S. S. Dara, Dr. S. S. Umre, S. Chand and Company Ltd., Twelfth/ 2011
2. Selected Topics in Inorganic Chemistry, Dr. Wahid U. Malik, Dr. G. D. Tuli and Dr. R. D. Madan, S. Chand and Company Ltd., Seventh/2001

Reference Books:

Engineering Chemistry, P. C. Jain and Monika Jain, Dhanpatrai Publishing Company Ltd., 15^{th} Ed/ 2009

Principles of Physical Chemistry, B. R. Puri, L. R. Sharma and Madan S. Pathania, Vishal Publishing Company, First/2002

Chemistry, John E McMurry and Robert C Fay, Pearson, First/2008

ET2T003	Engineering Graphics	3 Credit

COURSE OBJECTIVES

1. To understand the concepts like dimensioning, conventions and standards related to engineering graphics in order to become professionally efficient
2. To understand theory of projection and simple machine parts in first and third angle of projection systems.
3. To understand the key concepts CAD software.
4. To enable students to analyze a 2-dimensional & 3-dimensional problem.

COURSE OUTCOMES:

1. Define various concepts like dimensioning, conventions and standards related to engineering graphics in order to become professionally efficient.
2. Interpret drawings of simple machine component in first and third angle of projection systems
3. Apply theory of projections in projection of lines, projection of planes and projection of solid.
4. Classify solid geometry in different positions.
5. Assess the two dimensional and three dimensional drawing in CAD software.
6. Create the three dimensional engineering objects into two dimensional drawings and vice versa using CAD software

Unit I Introduction to Computer Aided Drawing [03 Hrs]

Theory of CAD software, Demonstration knowledge, layout of the software, standard tool bar/menus and description of most commonly used tools bars, Navigational tools. Creation of 2D/3D environment. Commands and creation of co-ordinate points, lines, axes, polyline, square, rectangle, polygons, splines, circles, ellipse, text, move, copy, offset, mirror, rotate, trim, extend, break, chamfer, fillet, zoom, pan, curves, constraints viz. tangency, parallelism, inclination and perpendicularity. Dimensioning, line conventions, lettering. Line properties, 3D modeling& topology of engineering component.

Unit II Drawing standards & Orthographic Projections: [03 Hrs]

Drawing standard SP: 46, type of lines, lettering, dimensioning. Basic geometrical construction, drawing of regular polygon, Theory of projection, introduction to orthographic projection, drawing of orthographic views of objects from their isometric views by using first angle method of projection.

Unit III Projections of Points & Projections of Straight Lines: [03 Hrs]

Projection of point lying in four quadrants. Projections of lines parallel and perpendicular to one or both planes, projections of lines inclined to one or both reference planes.

Unit IV Projections of Planes & Projections of Solids: [03 Hrs]

Projections of planes parallel and perpendicular to one or both planes, projection of planes inclined to one or both planes.

Types of solids, Projection of solid when axis is perpendicular to one of the reference planes, when axis is inclined to one and parallel to other reference plane, when axis is inclined to both the reference planes

Unit V Isometric Projections [03 Hrs]

Isometric projections: Isometric scale, drawing of isometric projections from given orthographic views.

Text Books:

1. N. D. Bhatt, Engineering Drawing, Charotar Publishing House, 46th Edition, 2003.
2. Dhananjay A. Jolhe, Engineering Drawing with an Introduction to AutoCAD, McGraw Hill Education, 2017

Reference Books:

1. K. V. Natarajan, A text book of Engineering Graphic, Dhanalakshmi Publishers, Chennai, 2006.
2. K. Venugopal and V. Prabhu Raja, Engineering Graphics, New Age International (P) Ltd, 2008.
3. Engineering Drawing, R. K. Dhawan, S. Chand Publication, 1998.
4. Engineering Graphics, A. R. Bapat, Allied Publishers, 2004.
5. Fundamentals of Engineering Drawing, Luzadder& Duff, Eastern Economy, 11^{th} Edition.

HU2L001	**Communication Skills Lab**	**1 Credit**

List of Practical Sessions (Any 10 PR sessions can be conducted):

1) Pronunciation, Intonation, Stress and Rhythm(02 hrs)
2) Introduction to Phonemic symbols (02 hrs)
3) Articulation of sounds in English with proper manner (02 hrs)
4) Practice and exercises on articulation of sounds (02 hrs)
5) Read Pronunciations/transcriptions from the dictionary (02 hrs)
6) Practice and exercises on pronunciations of words (02 hrs)
7) Introduce yourself (02 hrs)
8) Importance of Business Communication with the help of a case study.(02hrs)
9) Listening Skills/ Comprehension(02 hrs)
10) Common Everyday Situations: Conversations and Dialogues(02 hrs)
11) Communication at Workplace(02 hrs)
12) Rapid reading sessions (02 hrs)
13) Draft Email(02 hrs)
14) Resume Writing(02hrs)
15) Drafting Business Letter(02 hrs)
16) Preparing technical paper using IEEE format(02 hrs)
17) Extempore (02 hrs)
18) Elocution (02 hrs)
19) Group discussion (02 hrs)
20) Participating in a debate (02 hrs)
21) Presentation techniques (02 hrs)
22) Interview techniques – Job Interviews, Telephonic Interviews(02hrs)
23) Mock interviews and practice sessions(02 hrs)

EL2L002	**Engineering Chemistry Lab**	**4 Credit**

List of Experiments: (Perform any 8– 10 Experiments)

1. Determination of Hardness of water sample by EDTA method.
2. Determination of flash point by Pensky Martin Apparatus
3. Determination of Dissolve Oxygen by Iodometric method.
4. Determination of percent purity of Bleaching Powder.
5. pH – metric Titration (any one type of Acid Base titration)
6. Conductometric Titration (any one type of Acid Base titration)
7. Surface tension: Determination of relative surface tension of liquid with respect to water using drop number method.
8. Viscosity:Determination of relative viscosity of liquid with respect to water using Ostwald's viscometer method.
9. To determine the normality in Normal term and Strength in gms/lit of HCl solution by titrating with Na_2CO_3 solution.
10. To find out Morality, Normality and Strength of the given $KMnO_4$ solution by titrating against N/10 Mohr's solution.
11. Determination of Acid value of an oil sample.
12. Determination of Saponification value of an oil sample.

Reference Books:

1. Systematic experiments in Chemistry, A. Sethi, New Age International Publication, New Delhi.
2. Practical Inorganic Chemistry, A. I. Vogel, ELBS Pub.
3. Practical in Engineering Chemistry, S. S. Dara.

ET2L003	Engineering Graphics Lab	1 Credit

COURSE OBJECTIVES:

The objective of the course is to enable students to

1. Provide basic foundation in CAD software.
2. Understand the fundamentals used to create and manipulate geometric models.
3. Get acquainted with the basic CAD software for to design geometric modeling.

COURSE OUTCOMES:

1. Define basic structure of CAD workstation, CAD commands, Memory types, input/output devices and display devices to become professionally efficient to operate CAD software.
2. Explain drawing of simple machine component in CAD software.
3. Acquire the knowledge of geometric modeling in CAD software.
4. Analyze the steps required in CAD software for 2-dimensional and 3-dimensional models.
5. Assess the two dimensional and three dimensional drawing in CAD software.
6. Create the three dimensional engineering objects into two dimensional drawings and vice versa using CAD software.

List of Practical:

1. Introduction of CAD software and to study and practice basic draw commands exists in the CAD software.
2. Lines, lettering and dimensioning. (Drafting work)
   Identify the different types of Lines in the given object, draw lettering and give the Required dimensions in the given object.
3. Geometric Construction. (Drafting work)
4. Orthographic projections first sheet. (Using CAD software)
5. Orthographic projections second sheet. (Using CAD software)
6. Projections of straight lines. (Drafting work)
7. Projections of planes & solids. (Drafting work)
8. Isometric Projections first sheet. (Using CAD software)
9. Isometric Projections second sheet. (Using CAD software)
10. Design of basic hardware components using CAD Software.
11. Design of advance hardware components using CAD Software.
12. Design of assembly drawing using CAD Software.

13. Design of assembly drawing with animation and rendering using CAD Software.

ET2T004	**Basic Civil and Mechanical Engineering**	**Audit**

COURSE OBJECTIVES (Basic Mechanical Engineering)

1. To understand the basic stream of Mechanical engineering and Civil Engineering.
2. To understand the concepts of product manufacturing, Energy engineering, design engineering, Automobile engineering, construction technique and civil surveying.
3. To have basic knowledge of Casting, Machining, Designing, Manufacturing, different materials for building construction and surveying.

COURSE OUTCOMES: (Basic Mechanical Engineering)

Students would be able to

1. Define basic stream of Mechanical & Civil Engineering.
2. Explain the concepts of product manufacturing, Energy engineering, design engineering, Automobile engineering, construction technique and civil surveying.
3. Apply Basic knowledge of Casting, Machining, Designing, Manufacturing & Civil Construction technique.
4. Analyzed the different mechanical system and properties of construction & surveying material.
5. Interpret the problem in mechanical system and civil structure.
6. Solve the problem in mechanical system and civil structure.

Part I Basic Civil Engineering

Unit 1: Introduction to civil engineering

Various branches introduction to civil engineer in various construction activities basic engineer properties and various materials: earth bricks timber, stone, sand Aggregate cement motor steel bituminous glass FRP composite material.

Unit 2: Building component and planning material

Foundation and superstructure function of foundation type of shallow and deep foundation suitability in different situation plinth wall lintels beam column slab roof staircase floor door window and study of building plans ventilation and basic plumbing and sanitation

Unit 3: Surveying

Principal of surveying element of distance angular measurement plotting of area base line and off set introduction of plane table survey introduction to levelling concept of bench mark reduce level and counting

Part II Basic Mechanical Engineering

Unit 1: Introduction to Mechanical Engineering, Introduction to Laws of Thermodynamics with simple examples pertaining to respective branches, IC Engines: Classification, Applications, Basic terminology, 2 and 4 stroke IC engine working principle, Power Plant: Types of Power plant; Gas power plant, Thermal power plant, Nuclear power plant, Automobiles: Basic definitions and objectives

Unit 2: Design Basics, Machine and Mechanisms, Factor of safety, Engineering Materials: types and applications, basics of fasteners, machining and machinability. Introduction to lathe machine, drilling machine, milling machine, basics of machining processes such as turning, drilling and milling. Introduction to casting

Text Books:

1. Anurag Kandya, "Elements of Civil Engineering", Charotar Publishing, Anand
2. M. S. Palani Gamy, "Basic Civil Engineering", Tata Mc-Graw Hill Publication
3. G. K. Hiraskar, "Basic Civil Engineering", DhanpatRai Publications
4. Gopi Satheesh, "Basic Civil Engineering", Pearson Education

Reference Books:

1. M. G. Shah, C. M. Kale, and S. Y. Patki, "Building Drawing", Tata McGraw Hill
2. Sushil Kumar, "Building Construction", Standard Publishers Distributors
3. Kanetkar T. P. and Kulkarni S. V., "Surveying and Levelling", Vols. I, II and III, Vidyarthi
4. Gruh Prakashan, Pune
5. B. C. Punmia, "Surveying", Vol.- I, Vol.-II, Vol.-III, Laxmi Publications
6. P. K. Nag "Engineering Thermodynamics", Tata McGraw Hill, New Delhi 3rd ed. 2005
7. A. Ghosh, A K Malik, "Theory of Mechanisms and Machines", Affiliated East West Press Pvt. Ltd. New Delhi.

8. Serope Kalpakaji and Steven R Schimd “A manufacturing Engineering and Technology” Addison WsleyLaongman India 6th Edition 200
9. V. B. Bhandari, “Design of Machine Elements”, Tata McGraw Hill Publications, New Delhi.

Curriculum for Semester- III [Second Year]

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				Credit
				L	T	P	CA	MSE	ESE	Total	Credit
1	HSMC	IT3T001	Organization Behavior	2	0	0	20	20	60	100	2
2	BSC	IT3T002	Mathematics-III	3	1	0	20	20	60	100	4
3	ESC	IT3T003	Digital Electronics & Fundamentals of Microprocessor	3	0	0	20	20	60	100	3
4	PCC	IT3T004	Computer Arhcitecture & Organsization	3	0	0	20	20	60	100	3
5	PCC	IT3T005	Data structure using OOPs	2	1	0	20	20	60	100	3
6	PCC	IT3T006	Computer Graphics	3	0	0	20	20	60	100	3
7	PCC	IT3L007	Data structure using OOPs(Lab)	0	0	2	60	0	40	100	1
8	ESC	IT3T008	Digital Electronics & Fundamentals of Microprocessor (Lab)	0	0	2	60	0	40	100	1
9	PCC	IT3L009	Computer Graphics (Lab)	0	0	2	60	0	40	100	1
10	HSMC	IT3T010	Universal Human Values	2	1	0	20	20	60	100	3
				18	3	6	320	140	540	1000	24

IT3T001	Organizational Behaviour	2 Credit

Course Objectives:

1. To help the students to develop cognizance of the importance of human behaviour.

2. To enable students to describe how people behave under different conditions and understand why people behave as they do.

3. To provide the students to analyze specific strategic human resources demands for future action.

4. To enable students to synthesize related information and evaluate options for the most logical and optimal solution such that they would be able to predict and control human behaviour and improve results.

Course outcomes:

Students will be able to:

1. Outline the applicability of the concept of organizational behaviour to understand the behaviour of people in the organization.

2. Categorizing the applicability of analyzing the complexities associated with management of individual behaviour in the organization.

3. Analyze the complexities associated with management of the group behaviour in the organization

4. Validate how the organizational behaviour can integrate in understanding the motivation (why) behind behaviour of people in the organization

Course Contents:

Unit 1:Introduction to organization Behaviour [4Hrs]

Meaning, Fundamental concepts, Definition, Approaches to OB, Characteristics and limitations of OB, Challenges and Opportunities of OB, Models of OB, Impact of technology on organizational behaviour.

Organization Culture: Meaning and dimensions, Role of founders' values and vision in creating and sustaining culture, Types of organizational cultures, Impact of culture on image and performance of the organization.

Unit 2: Organizational Design, Change And Innovation [4 Hrs]

Designing an organizational structure, Division of labour, Delegation of authority, Departmental biases, Span of control, Dimensions of structure, Organizational design models, Multinational Structure and Design, Virtual Organizations.

Communication: The importance of communication, The communication process, Communicating within organizations, Information richness, How technology affects communication, Interpersonal communication, Multicultural communication, Barriers to effective communication, Improving Communication in organizations, Promoting ethical communications

Technical Report Writing : Characteristics of Technical Communication, Types of Technical Documents, Establishing Goals in Technical Writing, Technical Writing Process: Prewriting, writing, rewriting, Examples of Industries user manuals.

Unit3: Personality [4 Hrs]

Meaning of personality, Nature and Determinants of Personality, Personality Traits - Big Five, Locus of Control, Self-esteem, Type A/ Type B Personality, Risk Taking, Machiavellianism, Self-Monitoring, Personality and OB.

Attitude: Attributes of personality- Transactional Analysis – Ego states – Johari window - Nature and dimensions of attitude – Developing the right attitude, ABC model of Attitude, Managerial Implications of Attitude

Unit 4: Groups and Organizations [4 Hrs]

Groups and Teams, Group Dynamics - Groups versus teams, Nature and types of groups and teams, five stages of group/team development, Determinants of group behaviour, Typical teams in organizations.

Leadership: Leadership as a concept and its essence, Leaders versus managers, Blake and Mouton's managerial grid, Hersey and Blanchard's situational leadership, Transactional versus Transformational leadership, Women as leaders, Leadership in entrepreneurial and family business, organizations.

Unit 5: Motivation [4 Hrs]

Power and purpose of motivation, Theories of motivation - Locke's goal setting theory, Vroom's expectancy theory, Porter and Lawler's model, Adam's equity theory, McClelland's theory of needs, Motivational Techniques – Job design/enlargement /enrichment / rotation, Managing rewards - Job status based rewards, Competency based rewards, performance based rewards, Empowerment and Self Managed Teams.

Power and Politics: The concept of power, Sources of power, Interdepartmental power, Illusion of power, Political strategies and tactics, Ethics, power and politics, using power to manage effectively.

Empowerment and Participation: The nature of empowerment and participation, How participation works, Programs for participation, Important considerations in participation.

Unit 6: Conflict Management [4 Hrs]

Definition. Traditional vs Modern view of conflict – Types of conflict – Intrapersonal, Interpersonal, and Organizational, Constructive and Destructive conflict, Conflict management

Stress and Counselling: What is stress? Stress model, Work stressors, Stress outcomes, Stress moderators, Stress prevention and management, Employee counselling, Types of counselling

Text Books:

1. Franklin Kuo, "Network Analysis & Synthesis", Wiley International.
2. Govind Daryanani, "Analysis and Synthesis of Filters".

Reference Books:

1. Kendall Su, "Analog Filters", Kluwer Academic Publisher, 2nd Edition, 2002.

2. John O’ Malley, “Basic Circuit Analysis”, Schaum’s series.

3. Van Valkenberg, “Network Analysis”, Pearson Education.

IT3T002	**Mathematics-III**	**4 Credit**

COURSE OBJECTIVES:

1. To understand the concept of Laplace Transform , Fourier transform, complex variables Numerical Linear algebra, Stochastic calculus, Computational graph theory.
2. To understand the application of Mathematics in engineering and in real life.
3. To enable students to apply mathematical tool to solve problems in real life.
4. To enable students to apply mathematical tool to analyze problems in real life

COURSE OUTCOMES:

1. Describe the concept of Laplace Transform, Fourier transform, complex variables, Numerical Linear Algebra, Stochastic calculus, Computational graph theory
2. Illustrate the concept of Laplace Transform, Fourier transform, complex variables, Numerical Linear Algebra, Stochastic calculus, Computational graph theory by using examples.
3. Apply the concept of Laplace Transform, Fourier transform, complex variables, Numerical Linear Algebra, Stochastic calculus, Computational graph theory to solve the problem.
4. Analyze the problem by using the concept of Laplace Transform, Fourier transform, complex variables, Numerical Linear Algebra, Stochastic calculus, Computational graph theory.
5. Evaluate the problem base on the concept of Laplace Transform, Fourier transform, complex variables, Numerical Linear Algebra, Stochastic calculus, Computational graph theory.
6. Create the new concept by using the theory of Laplace Transform, Fourier transform, complex variables, Numerical Linear Algebra, Stochastic calculus, Computational graph theory.

Unit1 **[6Hrs]**

Laplace transform: Definition ;Transforms of elementary functions; Properties of Laplace transform; Inverse Laplace transform; Convolution Theorem for finding inverse Laplace transforms ; Applications of Laplace transform to find the solutions differential equations. Introduction to Latex. Calculation of Laplace transform by using software.

Unit2 **[6Hrs]**

Fourier transform: Definitions – Fourier transforms ; Properties of Fourier transforms ; Fourier sine and cosine transforms ; Properties of Fourier transforms ; Parseval's identity for Fourier Transforms; Finite Fourier transform.

Unit3

[6Hrs]

Functions of complex variables : Analytic functions; Harmonic functions in Cartesian form; fundamental theorem of algebra; Cauchy's integral theorem; Cauchy's integral formula; Residues; Cauchy's residue theorem.

Unit4

[6Hrs]

Numerical linear algebra: Introduction to linear algebra; condition number of a matrix; sensitivity analysis; Norm ; stability of numerical algorithms; stability of nonlinear system; SVD; Power method; Google page rank algorithm.

Introduction about meta-heuristic method; Nature-inspired method : ant colony optimization .

Unit5

[6Hrs]

Stochastic calculus: Stochastic Processes: Definition and classification of random processes; Discrete-time Markov chains; Poisson process; Continuous-time Markov chains; Stochastic integration, Itôintegral , Itôformula. Stochastic differential equations. Application of stochastic calculus in computer science.

Unit6

[6Hrs]

Computational graph theory : Basic terminology in graph theory; Invariant of a graph; Adjacency matrix of a graph; Laplacian matrix of a graph; Algebraic connectivity of a graph;

Properties of eigenvalues and eigenvectors of an adjacency matrix and Laplacian matrix of a graph.

Text Books:

1. Higher Engineering Mathematics by B. S. Grewal, Khanna Publishers, New Delhi.

2. Advanced Engineering Mathematics by Erwin Kreyszig, John Wiley & Sons, New York.

3. A Course in Engineering Mathematics (Vol III) by Dr. B. B. Singh, Synergy Knowledgeware, Mumbai.

4. A Text Book of Applied Mathematics (Vol I & II) by P. N. Wartikar and J. N. Wartikar, Pune Vidyarthi Griha Prakashan, Pune.

5. Higher Engineering Mathematics by H. K. Das and Er. Rajnish Verma, S. Chand & Co.Pvt. Ltd., New Delhi.

6. D. S. Watkins, Fundamentals of Matrix Computations, John Wiley, 1991.

7. G. H. Golub and C. F. Van Loan, Matrix Computations, 3rd Edition, John Hopkins University Press, 1996.

8. S.M. Ross, Stochastic Processes, 2nd Edition, Wiley, 1996.

9. J. Medhi, Stochastic Processes, New Age International, 1994.

10. J. A. Bondy and U. S. R. Murty. Graph Theory with Applications.North-Holland, 1976.

11. J. M. Aldous. Graphs and Applications. Springer, LPE, 2007.

12. D. M. Cvetkovic, M. Doob and H. Sachs, Spectra of Graphs: Theory and Applications, Academic Press, 1980.

13. C. Godsil and G. Royale, Algebraic Graph Theory, Graduate Texts in Mathematics 207, Springer, 2001.

14. R. B. Bapat, Graphs and Matrices, Texts and Readings in Mathematics, Hindustan Book Agency, New Delhi, 2010.

Reference Books:

1. Higher Engineering Mathematics by B. V. Ramana, Tata McGraw-Hill Publications, NewDelhi.

2. A Text Book of Engineering Mathematics by Peter O' Neil, Thomson Asia Pte Ltd.,Singapore.

3. Advanced Engineering Mathematics by C. R. Wylie & L. C. Barrett, Tata Mcgraw-Hill Publishing Company Ltd., New Delhi.

4. Integral Transforms and Their Engineering Applications by Dr. B. B. Singh, Synergy .Knowledge ware, Mumbai.

5. Integral Transforms by I. N. Sneddon, Tata McGraw-Hill, New York.

6. L. N. Trefethen and D. Bau III, Numerical Linear Algebra, SIAM, 1997.

7. J. W. Demmel, Applied Numerical Linear Algebra, SIAM, 1997.

8. S. Shreve, Stochastic Calculus for Finance, Vol. 2, Springer, 2004.

9. J. M. Steele, Stochastic Calculus and Financial Applications, Springer, 2001

10. R. M. Patne, G. R. Avachar, note on an adjacency matrix of a graph G, Advances in Mathematics: Scientific Journal, volume 9(3), 1281–1291,2020

11. D. Lamberton and B. Lapeyre, Introduction to Stochastic Calculus Applied to Finance, Chapmans & Hall/CRC, 2000.

12. M. Baxter and A. Rennie, Financial Calculus, Cambridge University Press, 1996.

13. F. Harary: graph theory, addison-wesley reading, Massachusetts, 1996.

IT3T003	Digital Electronics & Fundamentals of Microprocessor	3 Credit

Course Objectives:

1. Understanding basic knowledge of Boolean algebra and automaton theory as a core of computer science.
2. Theoretical and practical knowledge about synthesis of combinational and sequential circuits, and programmable structures.

Course Outcomes:

Students will be able to:

1. Define basic logical circuits, Boolean algebra, minimization methods, methods for writing Boolean functions, combinational and sequential circuits, flip-flops, digital automaton, and programmable structures.
2. Describe operation methods of combinational and sequential circuits, similarities and differences of writing the Boolean functions and minimizations.
3. Select appropriate methods for realization and circuit minimization.
4. Pattern recognition for specific circuit realization and error discovery during circuit design process.
5. Synthesis of appropriate combinational and sequential logic circuits.
6. Evaluation of own solutions and error discovery.

Course Contents:

Unit 1: Logic Simplification [6 Hrs]

Digital signals, digital circuits, AND, OR, NOT, NAND, NOR and Exclusive-OR operations, Boolean algebra, examples of IC gates, Number Systems: binary, signed binary, octal hexadecimal number, binary arithmetic, one's and two's complements arithmetic, codes, error detecting and correcting codes.

Unit 2: Combinational Digital Circuits [6 Hrs]

Standard representation for logic functions, K-map representation, and simplification of logic functions using K-map, minimization of logical functions. Don't care conditions, Multiplexer, De-Multiplexer/Decoders, Adders, Subtractors, BCD arithmetic, carry look ahead adder, serial adder, ALU, elementary ALU design, parity checker / generator

Unit3: Sequential circuits and systems **6 Hrs**

A 1-bit memory, the circuit properties of Bi-stable latch, the clocked SR flip flop, J- K - T and D-types flip flops, applications of flip flops, shift registers, applications of shift registers, serial to parallel converter, parallel to serial converter, ring counter, sequence generator, ripple(Asynchronous) counters, synchronous counters, counters design using flip flops, special counter IC's, asynchronous sequential counters, applications of counters.

Unit4: Fundamentals of Microprocessors **[6 Hrs]**

Fundamentals of Microprocessor, Comparison of 8-bit, (8085) 16-bit (8086), and 32-bitmicroprocessors (80386). The 8086 Architecture: Internal Block Diagram, CPU, ALU, address, data and control bus, Working registers, SFRs, Clock and RESET circuits, Stack and Stack Pointer, Program Counter, I/O ports, Memory Structures, Data and Program Memory, Timing diagrams and Execution Cycles.

Unit 5: Memory Interfacing **[6 Hrs]**

Memory Interfacing. I/O Interfacing. Direct Memory Access. (DMA). Interrupts in 8086.

Unit 6: 8086 Instruction Set and Programming **[6 Hrs]**

Addressing modes: Introduction, Instruction syntax, Data types, Subroutines Immediate addressing, Register addressing, Direct addressing, Indirect addressing, Relative addressing, Indexed addressing, Bit inherent addressing, bit direct addressing. Instruction timings. Data transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Subroutine instructions, Bit manipulation instruction. Assembly language programs, C language programs. Assemblers and compilers. Programming and debugging tools.

Text Books:

1.R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009.
2.M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016.
3.A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.
4.Douglas Hall, Microprocessors and Interfacing, McGraw-Hill Publications

Reference Books:

1. An approach to digital Design: Morris Mano, Pearson Publications.
2. Microprocessor Architecture, Programming and Applications with the 8085:Ramesh Gaonkar, Penram International Publications.
3. Engineering Approach to Digital Design: W. Fletcher, PHI Publications.

IT3T004	Computer Architecture & Organization	3 Credit

Course Objectives:

1. To understand the relationship between instruction set architecture, micro architecture, and system architecture and their roles in the development of the computer.

2. Be aware of the various classes of instruction: data movement, arithmetic, logical and flow control. Explain how interrupts are used to implement I/O control and data transfers.

3. Identify various types of buses in Computer systems.

4. Understand memory hierarchy.

5. Understand various peripheral devices.

Course Outcomes:

At the end of this course, the students should be able to,

1. Outcome- Interpret the functional architecture of computing systems. (Understanding) Classify and compute the performance of machines.

2. Explain addressing modes, instruction formats and program control statements.

3. Relate to arithmetic for ALU implementation. Understand the basics of hardwired and micro-programmed control of the CPU.

4. Build large memories using small memories for better performance. Write ISA level code for RISC and CISC machines.

5. Identify, compare and assess issues related to ISA, memory, control and I/O functions. (Applying, Analyzing, Evaluating)

6. Appreciate advancements to architecture like pipelining and superscalar operation

Course Contents:

Unit 1: Basic Structure of Computers [6 Hrs]

Basic Structure of Computers: Functional Units, Basic Operational Concepts, Bus Structures, Software, Multiprocessors and Multicomputer

Machine Instructions: Instruction Sets: Machine Instruction Characteristics, Types of Operands, Intel x86 and ARM Data Types, Types of Operations, Intel x86 and ARM Operation Type, Memory Locations and Addresses, Memory Operations, Machine program sequencing, addressing modes and encoding of information, Assembly Language, Stacks, Queues and Subroutine.

Unit 2: Instruction Sets [6 Hrs]

Addressing, x86 and ARM Addressing modes, Instruction Formats, x86 and ARM Instruction Formats, Assembly language.

Unit3: Micro-programmed Control **[6 Hrs]**

Control Unit Operation: Micro-operations, Control of the Processor, Hardwired Implementation, and Micro-programmed control, Basic Concepts, Microinstruction Sequencing & Execution, Microinstructions, grouping of control signals, Micro program sequencing, Micro Instructions with next Address field, Perfecting microinstruction, Emulation, Bit Slices, Introduction to Microprogramming, Macro Processor.

Unit 4: Arithmetic **[6Hrs]**

Number Representation, Addition of Positive numbers, Logic Design for fast adders, Addition and Subtraction, Arithmetic and Branching conditions, Multiplication of positive numbers, Signed Operand multiplication, fast Multiplication, Booth's Algorithm, Integer Division, Floating point numbers and operations. Reduced Instruction Set Computers (RISCs): Instruction Execution Characteristics, the Use of Large Register File, Compiler-Based Register Optimization, RISC Architecture, RISC Pipelining, RISC versus CISC

Unit 5: The Memory System **[6 Hrs]**

Some Basic Concepts, Semiconductor RAM Memories, Memory system considerations, Semiconductor ROM Memories, Memory interleaving, Cache Memory, Mapping techniques, Virtual memory, Memory Management requirements.

Unit 6: Computer Peripherals **[6 Hrs]**

I/O Devices, DMA, Interrupt handling, online storage, File services, Processors: Families of microprocessors Chips, Introduction to RISC & CISC Processors, Introduction to Pipelining. Parallel Processing: The Use of Multiple Processors, Symmetric Multiprocessors, Multithreading and Chip Multiprocessors, Clusters, Multicore Organization, Intel x 86 Multi-Core Organization

Text Books:

1. Computer Organization 4 th Edition, 2001 V. Carl Hamacher, McGraw Hill

2. William Stallings: "Computer Organization and Architecture", (8/e) Pearson Education.

Reference Books:

1. Behrooz Parhami: “Computer Architecture”, Oxford University Press

2. J. P. Hayes: “Computer Architecture and Organization” , McGraw Hill

3. D. A. Patterson, J. L. Hennessy: “Computer Architecture” Morgan Kauffmann, 2002

4. Hwang and Briggs: “Computer Architecture and Parallel Processing” McGraw-Hill

IT3T005	Data structure & OOP’s	4 Credit

Prerequisites: Basic knowledge of ‘C’ Language.

Course Objectives:

1. To understand the concepts of ADTs.

2. To learn linear data structures – lists, stacks, and queues

3. To understand sorting, searching and hashing algorithms.
4. To apply Tree and Graph structures.

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Understand the concept of ADT.
2. Identify data structures suitable to solve problems.
3. Develop and analyze algorithms for stacks, queues.
4. Develop algorithms for binary trees and graphs.
5. Implement sorting and searching algorithms.
6. Implement symbol table using hashing techniques

Course Contents:

Unit 1 **[6 Hrs]**

Complexity Analysis: Time and Space complexity of algorithms, asymptotic analysis, big O and other notations, importance of efficient algorithms, program performance measurement, data structures and algorithms.

Hashing: Implementation of Dictionaries, Hash Function, Collisions in Hashing, Separate Chaining, Open Addressing, Analysis of Search Operations

Unit 2 **[6 Hrs]**

ADT Array-Searching and sorting on arrays: Linear search, binary search on a sorted arrays. Bubble sort, Insertion sort, merge sort and analysis; Emphasis on the comparison based sorting model, Counting sort, Radix sort, and bucket sort

Unit 3 **[6 Hrs]**

Stacks and Queues: Abstract data types, sequential and linked implementations, exception handling in classes, representative applications such as parenthesis matching, towers of Hanoi, wire routing in a circuit, finding path in a maze, simulation of queuing systems, equivalence problem.

Unit 4 **[6 Hrs]**

Linked Lists: Abstract data type, sequential and linked representations, comparison of insertion, deletion and search operations for sequential and linked lists, list and chain classes, exception and iterator classes for lists, doubly linked lists, circular lists, linked lists through simulated pointers, lists in STL, skip lists, applications of lists in bin sort, radix sort, sparse tables.

Unit 5 **[6 Hrs]**

Trees: Binary trees and their properties, terminology, sequential and linked implementations, tree traversal methods and algorithms, heaps as priority queues, heap implementation, insertion and deletion operations, heap sort, heaps in Huffman coding, leftist trees, tournament trees, use of winner trees in merge sort as an external sorting algorithm, bin packing.

Unit 6 **[6 Hrs]**

Graphs: Graph Algorithms: Graphs and their Representations, Graph Traversal Techniques: Breadth First Search (BFS) and Depth First Search (DFS), Applications of BFS and DFS, Minimum Spanning Trees (MST), Prim's and Kruskal's algorithms for MST, Connected Components, Dijkstra's Algorithm for Single Source Shortest Paths, Warshall's Algorithm for finding Transitive Closure of a Graph, Floydd's Algorithm for All-Pairs Shortest Paths Problem.

Text Books:

1. Mark Allen Weiss, ―Data Structures and Algorithm Analysis in C, 2nd Edition, Pearson Education,1997.
2. Reema Thareja, ―Data Structures Using C, Second Edition, Oxford University Press, 2011.

Reference Books.

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest, Clifford Stein, "Introduction to Algorithms", Second Edition, Mcgraw Hill, 2002.
2. Aho, Hopcroft and Ullman, Data Structures and Algorithms‖, Pearson Education,1983.
3. Stephen G. Kochan, :Programming in C‖, 3rd edition, Pearson Education.

4. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, ―Fundamentals of Data Structures in C, Second Edition, University Press, 2008.

IT3T006	Computer Graphics	3 Credit

Course Objective:

1. To introduce the use of the components of a graphics system and become familiar with building approach of graphics system components and algorithms related with them.
2. To learn the basic principles of 3- dimensional computer graphics.

3. Provide an understanding of how to scan convert the basic geometrical primitives, how to transform the shapes to fit them as per the picture definition.
4. Provide an understanding of mapping from a world coordinates to device coordinates, clipping, and projections.

Course outcomes:

Students will be able to:

1. Understand the scope of computer graphics and also identified the field related to computer Graphics
2. Demonstrate on the concepts on transforms including translation, rotation, scaling, shearing and reflection.
3. Design algorithms for different geometric shapes, lines , circle, ellipse.

Course Contents:

Unit -1: Introduction to Computer Graphics [6 Hrs]

Overview of Computer Graphics, Computer Graphics Application and Software, Graphics Areas, Graphics Pipeline, Graphics API's, Numerical issues, Efficiency Display and Hardcopy Technologies, Display Technologies – Raster scan Display System, Video Controller – Vector scan display system, Random Scan Display Processor, Input Devices for Operator Interaction, Image Scanners.

Unit -2: Basic Raster Graphics [6 Hrs]

Algorithms for Drawing 2D primitives, aliasing and ant aliasing, Polygon filling methods: Scan Conversion Algorithms: Simple Ordered edge list, Edge Fill, Fence fill and Edge Flag Algorithm, Seed fill Algorithms: Simple and Scan Line Seed Fill Algorithm, Halftoning techniques.

Unit -3: Graphics Programming using OPENGL [6 Hrs]

Why OpenGL, Features in OpenGL, OpenGL operations, Abstractions in OpenGL – GL, GLU & GLUT, 3D viewing pipeline, viewing matrix specifications, a few examples and demos of OpenGL programs, Animations in open GL.

Unit -4:**2-D geometric transformations** **[6 Hrs]**

Basic transformations, matrix representations, composite transformations, other transformations, transformations between coordinate systems, affine transformations, transformation functions, Raster methods for transformations. Two- Dimensional viewing : viewing coordinates, Window-to viewport coordinate transformation, viewing functions, clipping : point, line, polygon, curve, text, exterior.

Unit -5: **Normalized Device Coordinates and Viewing Transformations** **[6 Hrs]**

3D System Basics and 3D Transformations, 3D graphics projections, parallel, perspective, viewing transformations.3D graphics hidden surfaces and line removal, painter's algorithm, Z -buffers, Warnock's algorithm.

Animations & Realism 10 Animation Graphics: Design of Animation sequences – animation function – raster animation – key frame systems – motion specification –morphing – tweening.

Unit -6: Light sources: **[6 Hrs]**

basic illumination models , halftone patterns and dithering techniques; Properties of light, Standard primaries and chromaticity diagram; Intuitive colour concepts, RGB colour model, YIQ colour model, CMY colour model, HSV colour model, HLS colour model; Colour selection.

Text Books:

1. Fundamentals of Computer Graphics, Peter Shirley and Steve Marschner, Third Edition. (A.K.Peters Publication house)
2. Procedural Elements of Computer Graphics III Edition, Rogers, McGraw Hill.
3. Computer Graphics - Principles and Practice, J. D. Foley, A. Van Dam, S. K. Feiner and J. F. Hughes, Second Edition in C, Pearson Education.

Reference Books:

1. Computer Graphics with OpenGL, Donald D. Hearn, M. Pauline Baker, Warren Carithers, Fourth

Edition, Pearson Education.

2.Computer Graphics, Hearn and Baker, PHI, India.

IT3L007	Data Structure using OOP's (Lab)	2 Credit

Course Objectives:

1. To impart the basic concepts of data structures and algorithms

2. To understand concepts about searching and sorting techniques

3. To Understand basic concepts about stacks, queues, lists, trees and graphs

4. To understanding about writing algorithms and step by step approach in solving problems with the help of fundamental data structures**.**

Course Objectives:

1. Ability to analyze algorithms and algorithm correctness.

2. Ability to summarize searching and sorting techniques.

3. Ability to describe stack, queue and linked list operation.

4. Ability to have knowledge of tree and graphs concepts.

List of Experiments:

1. Write a program to implement stack using arrays.
2. Write a program to evaluate a given postfix expression using stacks.
3. Write a program to convert a given infix expression to postfix form using stacks.
4. Write a program to implement circular queue using arrays.
5. Write a program to implement double ended queue (de queue) using arrays.
6. Write a program to implement a stack using two queues such that the push operation runs in constant time and the pop operation runs in linear time.
7. Write a program to implement a stack using two queues such that the push operation runs in linear time and the pop operation runs in constant time.
8. Write a program to implement a queue using two stacks such that the enqueue operation runs in constant time and the dequeue operation runs in linear time.
9. Write a program to implement a queue using two stacks such that the enqueue operation runs in linear time and the dequeue operation runs in constant time.
10. Write programs to implement the following data structures: (a) Single linked list (b) Double linked list
11. Write a program to implement a stack using a linked list such that the push and pop operations of stack still take O(1) time.
12. Write a program to implement a queue using a linked list such that the enqueue and dequeue operations of queue take O(1) time.
13. Case Study:-

Example (01): Simulation Case Study

Problem definition:

In this case study, consider the situation in which you are waiting in line for a service at a bank. In general, the more clerks there are, the faster the line moves. The bank manager wants to keep his customers happy by reducing their waiting time but at the same time he does not want to employ any more service clerks than he has to. Being able to simulate the effect of adding more clerks during peak business hours allows the manager to plan more effectively.

Example (02): Binary Tree Search ƒ

Problem definition:

a. Write a function binary Tree Search.

b. Attempt to locate a specified value in a binary search tree.
c. Input: a pointer to the root node of the binary tree and a search key to be located
d. Output: a pointer to that node (if found) or NULL (not found)

IT3L008	Digital Electronics & Fundamentals of Microprocessor (Lab)	1 Credit

Course Objectives:

1. Provide hands-on experience in digital circuits, which can be constructed by using standard integrated circuits (ICs). Investigate the operation of several digital circuits combinational and sequential.
2. To understand architecture and features of typical Microprocessors.
3. To learn interfacing of real world input and output devices.

Course Outcomes:

Students will be able to:

1. Describe and explain the operation of fundamental digital gates.
2. Analyze the operation of medium complexity standard combinational circuits like the encoder, decoder, multiplexer, de-multiplexer, and adder.
3. Analyze the operation of a flip-flop and examine relevant timing diagrams.
4. Learn importance of Microprocessors in designing real time applications.

5. Describe the 8085, 8086 & 80386 Microprocessors architectures and its feature.
6. Develop interfacing to real world devices.

List of Experiments:

1. .Simplification, realization of Boolean expressions using logic gates/universal gates.
2. Realization of half/full adder & half/full subtractors using logic gates.
3. Realization of parallel adder/subtractors using 7483 chip, BCD to Excess-3codeconversion & vice versa.
4. Realization of binary to gray code conversion & vice versa.
5. MUX/DEMUX – use of 74153, 74139 for arithmetic circuits & code converter.
6. Realization of one/two bit comparator and study of 7485 magnitude comparator.
7. Use of a) Decoder chip to drive LED display & b) Priority encoder.
8. Truth table verification of flip-flops: i) JK Master Slave ii) T type iii) D type.
9. Realization of 3-bit counters as a sequential circuit & MOD-N counter design(7476, 7490, 74192, 74193).
10. Writing& testing of sequence generator.
11. Design of FSM: Moore machine, Mealy machine

IT3L009	Computer Graphics (Lab)	1 Credit

Course Objective:

1. To introduce the use of the components of a graphics system and become familiar with building approach of graphics system components and algorithms related with them.
2. To learn the basic principles of 3- dimensional computer graphics.
3. Provide an understanding of how to scan convert the basic geometrical primitives, how to transform the shapes to fit them as per the picture definition.
4. Provide an understanding of mapping from a world coordinates to device coordinates, clipping, and projections.
5. To be able to discuss the application of computer graphics concepts in the development of computer games, information visualization, and business applications.

Course Outcomes:

At the end of the laboratory work, students will demonstrate the ability to:

1. To list the basic concepts used in computer graphics.
2. To implement various algorithms to scan, convert the basic geometrical primitives, transformations, Area filling, clipping.
3. To describe the importance of viewing and projections.
4. To understand a typical graphics pipeline.

List of Experiments:

1. Write a program to draw a rectangle using line function.
2. Write a program to draw a line using DDA's line drawing algorithm.
3. Write a program to draw a line using Bresenham'sline drawing algorithm.
4. Write a program to draw a circle using equation of circle.
5. Write a program to draw a circle using Bresenham's circle drawing algorithm.
6. Write a program to draw a line using Cohen Sutherland algorithm.
7. Write a program to translate triangle about origin.
8. Write a program to fill a circle using flood fill algorithm.
9. To design poster using photoshop software.
10. To create animated video using photoshop software.

IT3T010	**Universal Human Values**	**3Credit**

Course Objective:

The objective of the course is four fold:

1. Development of a holistic perspective based on self-exploration about themselves (humanbeing), family, society and nature/existence.
2. Understanding (or developing clarity) of the harmony in the human being, family, society andnature/existence
3. Strengthening of self-reflection.
4. Development of commitment and courage to act.

Course Contents:

Module 1: Course Introduction - Need, Basic Guidelines, Content and Process for ValueEducation

1. Purpose and motivation for the course, recapitulation from Universal Human Values-I
2. Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and ExperientialValidation- as the process for self-exploration
3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
4. Right understanding, Relationship and Physical Facility- the basic requirements for fulfillmentof aspirations of every human being with their correct priority
5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
6. Method to fulfill the above human aspirations: understanding and living in harmony at variouslevels.

Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking

Module 2: Understanding Harmony in the Human Being - Harmony in Myself!

7. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
8. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility
9. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
10. Understanding the characteristics and activities of 'I' and harmony in 'I'
11. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal ofPhysical needs, meaning of Prosperity in detail
12. Programs to ensure Sanyam and Health. Include practice sessions to discuss the role othershave played in making material goods available to me.

Identifying from one's own life. Differentiate between prosperity and accumulation. Discussprogram for ensuring health vs dealing with disease

Module 3: Understanding Harmony in the Family and Society- Harmony in Human-HumanRelationship

13. Understanding values in human-human relationship; meaning of Justice (nine universal valuesin relationships) and program for its fulfillment to ensure mutual happiness; Trust and Respect as the foundational values of relationship
14. Understanding the meaning of Trust; Difference between intention and competence

15. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship

16. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals

17. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives

Module 4: Understanding Harmony in the Nature and Existence - Whole existence as Coexistence

18. Understanding the harmony in the Nature

19. Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self regulation in nature

20. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space

21. Holistic perception of harmony at all levels of existence. Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

Module 5: Implications of the above Holistic Understanding of Harmony on Professional Ethics

22. Natural acceptance of human values

23. Definitiveness of Ethical Human Conduct

24. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order

25. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.

26. Case studies of typical holistic technologies, management models and production systems

27. Strategy for transition from the present state to Universal Human Order: a. At the level of

individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations

28. Sum up. Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. to discuss the conduct as an engineer or scientist etc.

Text Books:

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books,New Delhi, 2010

Reference Books:

1. JeevanVidya: EkParichaya, ANagaraj, JeevanVidyaPrakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj - PanditSunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

Curriculum for Semester- IV [Second Year]

Sr. No.	Category of	Course Code	Course Name	Tea chin			Evalu ation				
				L	T	P	CA	MSE	ESE	Total	Credit
1	PCC	IT4T001	Theory of Computation	3	1	0	20	20	60	100	4
2	PCC	IT4T002	Java Programming	3	0	0	20	20	60	100	3
3	PCC	IT4T003	Operating System	3	0	0	20	20	60	100	3
4	PCC	IT4T004	Computer Networks	2	1	0	20	20	60	100	3
5	PCC	IT4T005	DBMS	3	0	0	20	20	60	100	3
6	PCC	IT4T006	Discrete Mathematics & Graph Theory	3	0	0	20	20	60	100	3
7	PCC	IT4L007	DBMS(Lab)	0	0	2	60	0	40	100	1
8	PCC	IT4L008	Computer Networks(Lab)	0	0	2	60	0	40	100	1
9	PCC	IT4L009	Java Programming(Lab)	0	0	2	60	0	40	100	1
10	MC	IT4L010	Consumer Affairs	2	0	0	15	10	25	50	Audit
				19	2	6	300	120	530	950	22

IT4T001	Theory of Computation	4 Credit

Course Objective:

1. To introduce students to the mathematical foundations of computation including automata theory; the theory of formal languages and grammars; the notions of algorithm, decidability, complexity, and computability.
2. To Enhance/develop students' ability to understand and conduct mathematical proofs for computation and algorithms

Course outcomes:

Students will be able to:

1. Students shall able to define the mathematical principles behind theoretical computer science.
2. Students shall able to Differentiate and give examples for the different types of automata like finite automata, push down automata, linear bounded automata and turing machine.
3. Students shall able to correlate the different types of automata to real world applications.
4. Students shall able to Choose and design appropriate automata for the different requirements outlined by theoretical computer science.

5. Students shall able to identify the different computational problems and their associated complexity.

Unit 1
[10Hrs]

Fundamentals : Strings, Alphabet, Language, Operations, Finite state machine, definitions, finite automaton model, acceptance of strings, and languages, deterministic finite automaton and nondeterministic finite automaton, transition diagrams and Language recognizers.

Finite Automata: Introduction to Finite Automata, Structural Representations, Automata and Complexity, Central Concepts of Automata Theory, DFA, NFA, and NFA & epsilon Machine. Conversions and Equivalence: Equivalence between NFA with and without epsilon transitions, NFA to DFA conversion, minimization of FSM, equivalence between two FSM's, Finite Automata with output- Moore and Melay machines.

Unit 2 **[10Hrs]**

Regular Languages : Regular Expressions, Finite Automata and Regular Expressions, Applications of Regular Expressions, Algebraic Laws for Regular Expressions, Properties of Regular Languages, Constructing finite Automata for a given regular expressions, Conversion of Finite Automata to Regular expressions, Pumping Lemma for Regular Languages, Applications of the Pumping Lemma, Closure Properties of Regular Languages, Decision Properties of Regular Languages.

Grammar Formalism: Regular grammars-right linear and left linear grammars, equivalence between regular linear grammar and FA, inter conversion, Context free grammar, derivation trees, sentential forms, Right most and leftmost derivation of strings.

Unit 3 **[10Hrs]**

Context Free Grammars: Context-Free Grammars: Definition of Context-Free Grammars, Derivations Using a Grammar, Leftmost and Rightmost Derivations, the Language of a Grammar, Sentential Forms, Parse Tress, Applications of Context-Free Grammars, Ambiguity in Grammars and Languages.

Push-Down Automata: Push down automata, definition, model, acceptance of CFL, Acceptance by final state and acceptance by empty state and its equivalence, Equivalence of CFL and PDA, interconversion, Introduction to DCFL and DPDA.

Unit 4: Turing Machine **[9Hrs]**

Definition of Recursive and Recursively Enumerable , Church's Hypothesis , Computable Functions , Methods for Turing Machine Construction, Modifications of the Basic Turing Machine Model, Multiple Tape , Multiple Tracks, Non-determinism, etc. Equivalence of the different TM Models and the Basic TM Model.

Unit 5: Computability Theory **[9 Hrs]**

Chomsky hierarchy of languages, linear bounded automata and context sensitive language, LR(0) grammar, decidability of, problems, Universal Turing Machine, undecidability, Posts Correspondence problem, Turing reducibility, Definition of P and NP problems, NP complete and NP hard problems.

TEXT BOOKS:

1. "Introduction to Automata Theory Languages and Computation". Hopcroft H. E. and Ullman J. D. Pearson Education.
2. Introduction to Theory of Computation – Sipser 2nd edition Thomson.

REFERENCES BOOKS:

1. Introduction to Formal languages Automata Theory and Computation Kamala Krithivasan Rama R.
2. Introduction to Computer Theory, Daniel I.A. Cohen, John Wiley.
3. Theory of Computation: A Problem - Solving Approach, Kavi Mahesh, Wiley India Pvt. Ltd.
4. Elements of Theory of Computation, Lewis H.P. & Papadimition C.H. Pearson /PHI.
5. Theory of Computer Science – Automata languages and computation -Mishra and Chandrashekaran, 2nd edition, PHI.

IT4T002	JAVA Programming	3 Credits

COURSE OBJECTIVES

1	To learn the Advanced concepts in J2SE
2	To understand Web Application Development, Database Connectivity and itsImplementation using Servlets, JSP and JDBC
3	To introduce advanced Java frameworks for improving the web application design.

COURSE OUTCOMES

1	Student shall be able to Understand and implement advanced Java concepts.
2	Student shall be able to Develop Java based Web applications using Servlets and JSP
3	Student shall be able toIncorporate cutting-edge frameworks in web application development.

Syllabus

[Unit 1] **6 Hrs**

Basics of OOP: Abstraction, Inheritance, Encapsulation, Classes, subclasses and super classes, Polymorphism and Overloading, message communication Procedure-Oriented vs. Object-Oriented Programming concept

Introduction to Java Programming : Basics of Java, Background/History of Java, Java and the Internet, Advantages of Java , Java Virtual Machine & Byte Code , Java Environment Setup ,Java Program Structure

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[Unit 2] 6 Hrs

Primitive Data Types : Integers, Floating Point type, Characters, Booleans , User Defined Data Type , Identifiers & Literals , Declarations of constants & variables , Type Conversion and Casting , Scope of variables & default values of variables declared , Wrapper classes , Comment Syntax , Garbage Collection

Arrays of Primitive Data Types: Types of Arrays, Creation, concatenation and conversion of a string, Decision & Control Statements, Different Operators

[Unit 3] 6 Hrs

Class : Defining classes, fields and methods, creating objects, accessing rules, this keyword, static keyword, method overloading, final keyword

Constructor: Constructors: Default constructors, Parameterized constructors, Copy constructors, Passing object as a parameter, constructor overloading

[Unit 4] 6 Hrs

Basics of Inheritance: Inheritance, Types of inheritance: single, multiple, multilevel, hierarchical and hybrid inheritance, concepts of method overriding, extending class, super class, Abstract Class

Package : Creating package, importing package, access rules for packages, class hiding rules in a package, Defining interface, inheritance on interfaces, implementing interface, multiple inheritance using interface

[Unit 5] 6 Hrs

Exception Handling : Introduction, Built in classes for Exception Handling, Mechanism of Exception Handling in Java, Error Handling Exception Classes

Multithreading : Creating thread, extending Thread class, implementing Runnable interface, life cycle of a thread, Thread priority & thread synchronization, exception handing in threads

[Unit 6] **6 Hrs**

Java Applets Programming : local and remote applets, difference between applet and application, applet life cycle, developing executable applet code

Web Page Design : applet tag, adding applet to HTML file, running the applet, passing parameter to applet, various methods and component classes to develop basic applet

Textbook:

1) Herbert Schildt, The Complete Reference-Java, Tata Mcgraw-Hill Edition, Eighth Edition, 2014.
2) Nicholas S. Williams, Professional Java for Web Applications, Wrox Press, 2014.
3) Complete Reference J2EE by James Keogh mcgraw publication.

Reference Books:

1) Black Book " Java server programming" J2EE, 1st ed., Dream Tech Publishers, 2008. 3. Kathy walrath .
2) Core Java, Volume II: Advanced Features by Cay Horstmann and Gary Cornell Pearson Publication.
3) Spring in Action 3rd edition , Craig walls, Manning Publication.
4) Hibernate 2nd edition, Jeff Linwood and Dave Minter, Beginning Après publication

IT4T003	Operating Systems	3 Credit

Course Objectives:

1. To understand the services provided by and the design of an operating system.

2. To understand the structure and organization of the file system.

3. To understand what a process is and how processes are synchronized and scheduled.

4. To understand different approaches to memory management.

5. Students should be able to use system calls for managing processes, memory and the file system.

6. Students should understand the data structures and algorithms used to implement an OS.

Course outcomes:

Students will be able to:

1. Identify the significance of operating system in computing devices.
2. Exemplify the communication between application programs and hardware devices through system calls.
3. Compare and illustrate various process scheduling algorithms.
4. Apply appropriate memory and file management schemes.
5. Illustrate various disk scheduling algorithms.
6. Understand the need of access control and protection in an operating system.

Course Contents:

Unit 1: Evolution of operating systems [6 Hrs]

Evolution of operating systems, Types of operating systems. The process concept, system programmer's view of processes, operating system's views of processes, operating system services for process management.

Unit 2: Processes and Threads [6Hrs]

Process Concept, Process Scheduling, Operations on Processes, Cooperating Processes, Inter process Communication, Communication in Client – Server Systems, Multithreading Models, Threading Issues.

Unit -3: CPU Scheduling [6 Hrs]

Scheduling concepts, scheduling algorithms, algorithm evaluation, multiple processor scheduling, real time scheduling.

Unit -4: Memory Management [6 Hrs]

Memory Management, Contiguous allocation, static-swapping, overlays, dynamic partitioned memory allocation, demand paging, page replacement, segmentation. Non-contiguous allocation, paging, Hardware support, Virtual Memory.

Unit -5: File Systems **[6Hrs]**

A Simple file system, General model of a file system, Symbolic file system, Access control verification, Logical file system, Physical file system, Allocation strategy module, Device strategy module, I/O initiators, Device handlers, Disk scheduling

Unit -6: Networks, Security and Design Principles **[6 Hrs]**

Network operating system, distributed operating system, external security, operational security, password protection, access control, security kernels, hardware security, layered approach, design principle.

Text Books:

1. J.L. Peterson and A. Silberchatz, "Operating System Concepts", Addison Wesley.
2. Harvey M. Dietel, "An Introduction to Operating System", Addison Wesley.
3. C. Crowley, "Operating Systems - A Design Oriented Approach", Irwin Publishing

Reference Books:

1. W. Stallings, "Operating systems", Prentice Hall.
2. A.S. Tannenbaum, "Modern Operating system", PHI

IT4T004	Computer Network	3 Credit

Prerequisites:

1. Basic Idea of Transform and its mathematical descriptions (Laplace, Fourier and ZTransform)
2. Differential equations and Integrals (advanced level)
3. Ordinary differential equations
4. Series and expansions
5. Fourier analysis and complex Fourier Series/transform
6. Applications of Fourier series, Fourier Transform to circuits.

Course Objectives:

1. Discuss the physical and logical as well as the electrical characteristics of digital signals and the basic methods of data transmission.
2. Identify the importance of the ISO 7-layer reference model.
3. Identify and requirements hosted in communication protocols and give an overview of data communication standards, how these standards were developed and under which assumptions they were adopted.
4. Establish a solid knowledge of the layered approach that makes design, implementation, and operation of extensive networks possible.
5. Acquire the knowledge of the basic protocols involved in wired/wireless communication process.

Course Outcomes:

At the end of the course the student will be able to:

1. Defining, using and implementing Computer Networks and the basic components of a Network system, explain the importance of data communications, how communication works in data networks.
2. Evaluate data communication link considering elementary concepts of data link layer protocols for error detection and correction.
3. Apply various network layer techniques for designing subnets and supernets and analyse packet flow on basis of routing protocols
4. Estimate the congestion control mechanism to improve quality of service of networking application.
5. Analyze the features and operations of various application layer protocols such as Http, DNS, Telnet, FTP and SMTP.
6. Apply the knowledge for finding security threats and solutions

Course Contents:

Unit-1: Basics of Digital Communications **[6 Hrs]**

Signals, noise, Nyquist's rate, Fourier transform of signals, harmonics. Baseband and broadband transmission: Modulation techniques fundamentals of modems local loop implementation, Introduction, history and development of computer networks, networks topologies. Layering and protocols.

Physical Layer: Different types of transmission media, errors in transmission: attenuation, noise. Repeaters. Encoding (NRZ, NRZI, Manchester, 4B/5B, etc.).

Unit -2: Data Link Layer and Logical Link Control (LLC) sub-layer [6 Hrs]

Framing; Error control including Bit-parity , CRC and Hamming Codes; Reliable transmission and Automatic Repeat Request (ARQ) protocols including Stop-and-Wait, Go-back-N, and Selective Repeat. Performance analysis of ARQ protocols. Example protocols such as HDLC and PPP.

Medium Access Control (MAC) sub-layer: Shared media systems; Bus, Star and Ring topologies; TDMA, FDMA, CSMA, CSMA/CD, Ethernet and IEEE 802.3; IEEE 802.11 including CSMA/CA protocols; Performance analysis; Shared and Switched Ethernet; Related protocols such as ICMP, NAT, ARP and RARP.

Unit -3: Network Layer [6 Hrs]

Design issues, store and forward packet switching connection less and connection oriented networks-routing algorithms-optimality principle, shortest path, flooding, Distance Vector Routing, Control to Infinity Problem, Hierarchical Routing, Congestion control algorithms.

Unit -4: Transport Layer [6 Hrs]

Reliable end-to-end transmission protocols; UDP header; Details of TCP header and operation including options headers, Connection establishment and termination, sliding window revisited, flow and congestion control, timers, retransmission, TCP extensions, etc.

Unit -5: Application Layer [6 Hrs]

Application protocols for email, ftp, web, DNS

Unit -6: Advanced Networking [6 Hrs]

overview to network management systems; security threats and solutions – Firewalls, Access Control Lists, IPSec, IDS

Text Books:

1. Data Communications and Networking - Behrouz A. Forouzan, Fifth Edition TMH, 2013.
2. Computer Networks - Andrew S Tanenbaum, 4th Edition, Pearson Education.
3. Kurose and Ross, "Computer Networking - A top-down approach", Seventh Edition, Pearson, 2017.
4. Peterson and Davie, "Computer Networks, A Systems Approach", 5th ed., Elsevier, 2011

Reference Books:

1. An Engineering Approach to Computer Networks - S. Keshav, 2nd Edition, Pearson Education.
2. Understanding communications and Networks, 3rd Edition, W. A. Shay, Cengage Learning

IT4T005	Database Management Systems	3 Credit

Course Objectives:

1. To learn and understand fundamentals of database management system 2. To analyze and interpret MOSFET circuits for small signal.
2. To exhibit the query development knowledge.
3. To learn modeling and normalization of databases.
4. To learn query processing and exhibit file organization.
5. To exhibit the knowledge of transaction and concurrency control.
6. To learn and understand Big Data and Hadoop.

Course Outcomes:

At the end of this course students will demonstrate the ability to:

1. Learn and understand fundamentals of database management system.
2. Exhibit the query development knowledge.
3. Learn modeling and normalization of databases.
4. Learn query processing and file organization.
5. Exhibit the knowledge of transaction and concurrency control.

6. Learn Big Data and Hadoop.

Course Contents:

Unit-1: Introduction to Database Systems **[6Hrs]**

Significance and advantages, Types of Databases, Limitations of File processing system, the DBMS Environment, Data Abstraction, Data Independence, Data Definition Language (DDL), Data Manipulation Language (DML).

Data models: Evolution of Data Models, Entity-relationship model, Relational integrity constraints, data manipulation operations.

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Unit-2: Relational query languages **[6 Hrs]**

Relational algebra, Tuple and domain relational calculus, SQL3, DDL and DML constructs, Open source and Commercial DBMS – MYSQL, ORACLE, DB2, SQL server.

Unit -3 Relational database design **[6 Hrs]**

Normalization of Database Tables: Need and Significance, Domain and data dependency, Armstrong's axioms, Normal forms, Dependency preservation, Lossless design.

Unit -4: Query processing **[6 Hrs]**

Evaluation of relational algebra expressions, Query equivalence, Join strategies.

File Organization and Indexing: Indices, B-trees, hashing

Unit -5: Transaction processing **[6Hrs]**

Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp based schedulers, Multi-version and optimistic Concurrency Control schemes, Database recovery.

Unit -6: Big Data and Hadoop **[6 Hrs]**

The rise of Big Data, What is Big Data, Big Data and it’s Challenges, Hadoop as a solution, What is Hadoop, Components of Hadoop, Use case of Hadoop

Text Books:

1. Henry Korth, Abraham Silberschatz & S. Sudarshan, *Database System Concepts*, McGraw-Hill Publication, 6th Edition, 2011.
2. Bipin Desai, An Introduction to Database System, West Publishing Company, College & School Division, 1990.
3. Raghu Ramakrishnan, Johannes Gehrke, *Database Management Systems*, McGraw-Hill Publication, 3rd Edition, 2003.
4. Big Data Simplified, Sourabh Mukherjee, Pearson India

Reference Books:

1. Joel Murach, *Murach's Oracle SQL and PL/SQL for Developers*, Mike Murach & Associates, 2nd Edition, 2014.
2. Wiederhold, *Database Design*, McGraw-Hill Publication, 2nd Edition, 1983.
3. Navathe, *Fundamentals of Database System*, Addison-Wesley Publication, 6th Edition, 2012.
4. J. D. Ullman, "Principles of Database and Knowledge – Base Systems", Vol 1, Computer Science Press.

IT4T006	Discrete Mathematics & Graph Structures	Credit-3

Course Objective:

1.To develop logical thinking and its application to computer science

2. The subject enhances one's ability to reason and ability to present a coherent and mathematically accurate argument

Course Outcomes:

1.Be able to construct simple mathematical proofs and possess the ability to verify them ABET

2. Acquire ability to describe computer programs (e.g. recursive functions) in a formal mathematical manner

3. Be able to apply basic counting techniques to solve combinatorial problems

Course Contents:

Unit 1 **[6 hrs]**

Fundamental Structures and Basic Logic: Sets, Venn diagram, Cartesian product, Power sets, Cardinality and countability, Propositional logic, Logical connectives, Truth tables, Normal forms, Validity, Predicate logic, Limitations of predicate logic, Universal and existential quantification, First order logic.

Principles of Mathematical Induction: The Well-Ordering Principle, Recursive definition, The Division algorithm: Prime Numbers, The Greatest Common Divisor: Euclidean Algorithm, The Fundamental Theorem of Arithmetic.

Unit 2 **[6 hrs]**

Functions and Relations: Subjective, Injective, Bijective and inverse functions, Composition of function, Reflexivity, Symmetry, Transitivity and equivalence relations.

Unit 3 **[6 hrs]**

Combinatorics: Counting, Recurrence relations, generating functions.

Unit 4 **[6 hrs]**

Graph Theory: Basic terminology, Multi graphs and weighted graphs, Paths and circuits, Shortest

path problems, Euler and Hamiltonian paths, Representation of graph, Isomorphic graphs, Planar graphs, Connectivity, Matching Coloring.

Unit 5 **[6 hrs]**

Trees: Rooted trees, Path length in rooted tree, Binary search trees, Spanning trees and cut set, Minimal spanning trees, Kruskal′s and Prim′s algorithms for minimal spanning tree.

Unit 6 **[6 hrs]**

Algebraic Structures and Morphism: Algebraic Structures with one Binary Operation, Semi Groups, Monoids, Groups, Congruence Relation and Quotient79 Structures, Free and Cyclic Monoids and Groups, Permutation Groups, Substructures, Normal Subgroups, Algebraic Structures with two Binary Operation, Rings, Integral Domain and Fields. Boolean Algebra and Boolean Ring, Identities of Boolean Algebra, Duality, Representation of Boolean Function, Disjunctive and Conjunctive Normal Form

Reference Books:

1. Lipschutz, Discrete Mathematics, McGraw-Hill Publication, 3rd Edition, 2009.

2. V. K. Balakrishnan, Schaum's Outline of Graph Theory, McGraw-Hill Publication, 1st Edition, 1997.

3. Eric Gossett, Discrete Mathematics with Proof, Wiley Publication, 2nd Edition, 2009.

Text Books:

1. C. L. Liu, Elements of Discrete Mathematics, McGraw-Hill Publication, 3rd Edition, 2008.

2. Kenneth H. Rosen, Discrete Mathematics and its Applications, McGraw-Hill Publication, 6th Edition, 2010.

3. Y. N. Singh, Discrete Mathematical Structures, Wiley Publication, 1st Edition, 2010.

4. Dr. Sukhendu Dey, Graph Theory with Applications, SPD Publication, 1st Edition, 2012.

IT4L007	Database Management Systems (Lab)	1 Credit

Course Objectives:

1. To explain basic database concepts, applications, data models, schemas and instances.
2. To demonstrate the use of constraints and relational algebra operations. I
3. Describe the basics of SQL and construct queries using SQL.
4. To emphasize the importance of normalization in databases.
5. To facilitate students in Database design.
6. To familiarize issues of concurrency control and transaction management.

Course Outcomes:

The students will be able to

1. Apply the basic concepts of Database Systems and Applications.
2. Use the basics of SQL and construct queries using SQL in database creation and interaction.
3. Design a commercial relational database system (Oracle, MySQL) by writing SQL using the system.
4. Analyze and Select storage and recovery techniques of database system.

List of Experiments:

1. Defining schema for applications.

2. Creating tables, Renaming tables, Data constraints (Primary key, Foreign key, Not Null), Data insertion into a table.
3. Grouping data, aggregate functions, Oracle functions (mathematical, character functions).
4. Sub-queries, Set operations, Joins.
5. Creation of databases, writing SQL and PL/SQL queries to retrieve information from the databases.
6. Assignment on Triggers & Cursors.
7. Normal Forms: First, Second, Third and Boyce Codd Normal Forms.
8. Assignment in Design and Implementation of Database systems or packages for applications such as office automation, hotel management, hospital management.
9. Deployment of Forms, Reports Normalization, Query Processing Algorithms in the above application project.
10. Large objects – CLOB, NCLOB, BLOB and BFILE.
    Distributed data base Management, creating web-page interfaces for database applications using servlet.

IT4L008	Computer Networks (Lab)	1 Credit

Course Objectives:

1. To understand the working principle of various communication protocols.
2. To analyze the various routing algorithms.
3. To know the concept of data transfer between nodes.

Course Outcomes:

Students will be able to:

1. Understand fundamental underlying principles of computer networking.
2. Understand details and functionality of layered network architecture.
3. Apply mathematical foundations to solve computational problems in computer networking.
4. Analyze performance of various communication protocols.
5. Compare routing algorithms.
6. Practice packet /file transmission between nodes.

List of Experiments:

1. Implement three nodes point – to – point network with duplex links between them. Set the queue size, vary the bandwidth and find the number of packets dropped using NS.
2. Implement transmission of ping messages/trace route over a network topology consisting of 6 nodes and find the number of packets dropped due to congestion using NS.

3. Implement an Ethernet LAN using n nodes and set multiple traffic nodes and plot congestion window for different source / destination using NS.
4. Implement and study the performance of CDMA on NS2/NS3 (Using stack called Call net) or equivalent environment using NS.
5. Write a Program for ERROR detecting code using CRC-CCITT (16bit).
6. Write a program to find the shortest path between vertices using bellman-ford algorithm.
7. Study of Network simulator (NS) and simulation of Congestion Control Algorithms using NS.
8. Configure Host IP, Subnet Mask and Default Gateway in a System in LAN (TCP/IP Configuration).

IT4L009	JAVA Programming (Lab)	1 Credit

Course Objective:

1. Gain knowledge about basic Java language syntax and semantics to write Java programs and use concepts such as variables, conditional and iterative execution methods etc.
2. Understand the fundamentals of object-oriented programming in Java, including defining classes, objects, invoking methods etc and exception handling mechanisms.
3. Understand the principles of inheritance, packages and interfaces.

Course Outcome:

1. Identify classes, objects, members of a class and relationships among them needed for a specific problem
2. Write Java application programs using OOP principles and proper program structuring
3. Demonstrate the concepts of polymorphism and inheritance.
4. Write Java programs to implement error handling techniques using exception handling

List of Experiments

1. Install JDK, write a simple “Hello World” or similar java program, compilation, debugging, executing using java compiler and interpreter
2. Write a Java program that takes a number as input and prints its multiplication table upto 10.

3. Write a program in Java to find second maximum of n numbers without using arrays.
4. Designed a class that demonstrates the use of constructor and destructor.
5. Write a java program to demonstrate the implementation of abstract class.
6. Write a java program to implement single level inheritance.
7. Write a java program to implement method overriding
8. Create a package, Add the necessary classes and import the package in java class.
9. Write a java program to implement thread life cycle.
10. Develop minimum two basic Applets. Display Output with Applet Viewer and Browser

Course Structure and Syllabus

For

B. Tech. Information Technology Programme

Curriculum for Semester- V [Third Year]

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				
				L	T	P	CA	MSE	ESE	Total	Credit
1	ESC	IT5T001	Embedded System & IoT	3	0	0	20	20	60	100	3
2	PCC	IT5T002	Cyber Security & Cryptography	2	1	0	20	20	60	100	3
3	PCC	IT5T003	Design and Analysis of Algorithm	3	1	0	20	20	60	100	4
4	PCC	IT5O001	Open Elective-1	3	1	0	20	20	60	100	4
5	PEC	IT5TE01	Elective -I	3	0	0	20	20	60	100	3
8	ESC	IT5L004	Embedded System & IoT (Lab)	0	0	2	60	20	40	100	1
9	PCC	IT5L005	Cyber Security & Cryptography (Lab)	0	0	2	60	0	40	100	1
10	PCC	IT5L006	Design and Analysis of Algorithm (Lab)	0	0	2	60	0	40	100	1
6	PROJECT	IT5P007	Internship	0	0	0	0	0	0	0	1
7	MC	IT5T008	Innovation and Enterpreneurship Development	2	0	0	15	10	25	50	Audit
				16	3	6	300	120	450	850	21

COURSE OBJECTIVES:

1. To understand fundamentals of IoT and embedded system including essence, basic design strategy and process modelling.

2. To introduce students a set of advanced topics in embedded IoT and lead them to understand research in network
3. To develop comprehensive approach towards building small low cost embeddedIoT system
4. To understand fundamentals of security in IoT
5. To learn to implement secure infrastructure for IoT
6. To learn real world application scenarios of IoT along with its societal and economic impact using case studies

COURSE OUTCOMES:

CO1 : On completion of the course, student will be able to

CO2: Implement an architectural design for IoT for specified requirement

CO3: Solve the given societal challenge using IoT

CO4: Choose between available technologies and devices for stated IoT challenge

Unit 1 : Introduction to Embedded System and Internet of Things: [6Hrs]

Embedded Systems: Application Domain and Characteristic of Embedded System, Real time systems and Real-time scheduling, Processor basics and System-On-Chip, Introduction to ARM processor and its architecture. **IoT:** Definition and characteristics of IoT, Internet of Things: Vision, Emerging Trends, Economic Significance, Technical Building Blocks, Physical design of IoT, Things of IoT, IoTProtocols,Logical design of IoT, IoT functional blocks, IoT communication models, IoT Communication APIs, IoT enabling technologies, IoT levels and deployment templates, IoT Issues and Challenges, Applications

Unit 2 :EmbeddedIoT Platform Design Methodology [6 Hrs]

Purpose and requirement specification, Process specification, Domain model specification, information model specification, Service specifications, IoT level specification, Functional view specification, Operational view specification,Device and component integration, o Application development

Unit 3 :**Pillars of Embedded IoT and Physical Devices [6 Hrs]**

Horizontal, verticals and four pillars of IoT, M2M: The internet of devices, RFID: The internet of objects, WSN: The internet of transducer, SCADA: The internet of controllers, DCM: Device, Connect and Manage, Device: Things that talk, Connect: Pervasive Network, IoT Physical Devices and Endpoints: Basic building blocks of and IoT device, Exemplary device: Raspberry

Pi, Raspberry Pi interfaces, Programming Raspberry Pi with Python, Beagle board and Other IoT Devices.

Unit 4 :IoT Protocols and Security **[6Hrs]**

Protocol Standardization for IoT, M2M and WSN Protocols, SCADA and RFID Protocols, Issues with IoT Standardization, Unified Data Standards, Protocols – IEEE 802.15.4, BACNet Protocol, Modbus, KNX, Zigbee Architecture, Network layer, APS layer. IoT Security: Vulnerabilities of IoT, Security Requirements, Challenges for Secure IoT, Threat Modeling, Key elements of IoT Security: Identity establishment, Access control, Data and message security, Non-repudiation and availability, Security model for Io

Unit 5 :Web of Things and Cloud of Things **[6Hrs]**

Web of Things and Cloud of Things ▪ Web of Things versus Internet of Things, Two Pillars of the Web, ▪ Architecture Standardization for WoT, Platform Middleware for WoT, Unified Multitier WoT Architecture, WoT Portals and Business Intelligence. Cloud of Things: Grid/SOA and Cloud Computing, Cloud Middleware, Cloud Standards – Cloud Providers and Systems, Mobile Cloud Computing, ▪ The Cloud of Things Architecture.

Unit 6 :Cloud Offerings and IoT Case Studies **[6Hrs]**

IoT Physical Servers, Introduction to Cloud Storage Models, Communication API, WAMP: Autobahn for IoT, Xively Cloud for IoT, Python Web Application Framework: Django, Amazon Web Services for IoT, SkynetIoT Messaging Platform. Case Studies: Home Intrusion Detection, WeatherMonitoring System, Air Pollution Monitoring, Smart Irrigation.

Text Books:

1. Embedded System: Architecture, Programming and Design by Rajkamal,2nd edition,2010,Tata McGraw Hill

2. MSP430 Microcontroller Basics by John H. Davies Elsevier; First edition (2010)

3. Computer as Components: Principles of Embedded Computing System Design, Wayne Wolf,2nd edition,2008, Morgan Kaufmann Publication

Reference Books:

1. Wayne Wolf, “Computer as Components – Principles of Embedded Computing System Design”, Gulf Professional Publishing, 2nd Edition, 2008.
2. David E Simon, “An Embedded Software Primer”, Addison Wesley Publication, 2004.

IT5T002	Cyber Security & Cryptography	4 Credit

COURSE OBJECTIVES:

1. To understand basics of Cryptography and Network Security.

2. To be able to secure a message over insecure channel by various means.

3. To learn about how to maintain the Confidentiality, Integrity and Availability of a data.

4. To understand various protocols for network security to protect against the threats in the networks..

COURSE OUTCOMES:

CO1. Analyze and resolve security issues in networks and computer systems to secure an IT infrastructure.

CO2. Develop policies and procedures to manage enterprise security risks.

CO3. Evaluate and communicate the human role in security systems with an emphasis on ethics, social engineering vulnerabilities and training.

CO4. Interpret and forensically investigate security incidents.

Unit 1: Introduction to Cyber Security& Cryptography [6Hrs]

Overview of Cyber Security, Internet Governance – Challenges and Constraints, Cyber Threats:- Cyber Warfare-Cyber Crime-Cyber terrorism-Cyber Espionage, Need for a Comprehensive Cyber Security Policy, Need for a Nodal Authority,International convention on Cyberspace, Cyber Security Regulations, Roles of International Law.

Overview of Cryptography:Public versus private key cryptography, Stream Ciphers, Digital Signatures, Applications of Cryptography.

Unit 2:Cryptography and Network Security [6Hrs]

Cryptography, Stream Ciphers–One-time Pad(OTP),Perfect secrecy,Pesudo-Random Generators,Attacks on stream ciphers and OTP,Public key cryptosystems: RSA, ElGamal, Rabin,Ellipticcurve cryptosystemsPKC, key exchange, IBE, Lattice based cryptosystem.Authentication and signature protocols,Kerberos.Overview of Firewalls-Types of

Firewalls, Security Protocols: Security at the Application Layer- PGP and S/MIME, Security at Transport Layer- SSL and TLS,PEM and S/MIME, PGP, Security at Network Layer-IPSec,

Unit 3: Cyber Security Vulnerabilities and Cyber Security Safeguards [6Hrs]

Cyber Security Vulnerabilities-Overview, vulnerabilities in software, System administration, Complex Network Architectures, Open Access to Organizational Data, Weak Authentication, Unprotected Broadband communications, Poor Cyber Security Awareness. Cyber Security Safeguards- Overview, Access control, Audit, Authentication, Biometrics, Cryptography, Deception, Ethical Hacking, Threats in network, Security policy, Threat Management

Unit 4: Securing Web Application, Services and Servers [6Hrs]

Introduction, Basic security for HTTP Applications and Services, Basic Security for SOAP Services, Identity Management and Web Services, Authorization Patterns, Security Considerations, Challenges.

Unit 5: Intrusion Detection and Prevention [6Hrs]

Intrusion, Physical Theft, Abuse of Privileges, Unauthorized Access by Outsider, Malware infection, Intrusion detection and Prevention Techniques, Anti-Malware software, Network based Intrusion detection Systems, Network based Intrusion Prevention Systems, Host based Intrusion prevention Systems, Security Information Management, Network Session Analysis, System Integrity Validation.Honeypots, password management.

Unit 6: Cyber Forensics [6Hrs]

Introduction to Cyber Forensics, Handling Preliminary Investigations, Controlling an Investigation, Conducting disk-based analysis, Investigating Information-hiding, Scrutinizing E-mail, Validating E-mail header information, Tracing Internet access, Tracing memory in real-time.

RESOURCES:

Video Lectures

1. http://nptel.ac.in/courses/106105031/lecture by Dr.DebdeepMukhopadhyayIITKharagpur
2.https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-033-computer-system engineering-spring-2009/video-lectures/ lecture by Prof. Robert Morris and Prof. Samuel Madden MIT.

Text Books

1. William Stallings, “Crpyptography and Network security Principles and Practices”, Pearson/PHI.
2. Wade Trappe, Lawrence C Washington, “ Introduction to Cryptography with coding theory”, Pearson.

3.J. Katz and Y. Lindell, Introduction to Modern Cryptography, CRC press, 2008.

Reference Books
1. Charles P. Pfleeger, Shari Lawrence Pfleeger – Security in computing – Prentice Hall of India.
2.Golreich O, Foundations of Cryptography, Vol.1.2, Cambridge University Press, 2004
3.Menezes, et.al, Handbook of Applied Cryptography, CRC Press, 2004.

IT5T003	Design and Analysis of Algorithm	4 Credit

COURSE OBJECTIVES:

1. To learn fundamentals of algorithms design techniques.
2. To understand basic knowledge of computational complexity, approximation and randomized algorithms, selection of the best algorithm to solve a problem.
3. To analyze the performance of algorithms, to compare algorithms with respect to time and space complexity.
4. To develop proficiency in problem solving and programming.

COURSE OUTCOMES:

After learning the course the students should be able:

CO1. Develop efficient algorithms for simple computational tasks.

CO2 Gain understanding of concepts of time and space complexity, worst case, average case and best case complexities and the big-O notation.

CO3.Design standard algorithms such as sorting, searching, and problems involving graphs

CO4.Compute complexity measures of algorithms, including recursive algorithms using recurrence relations

Course Contents:

Unit 1 : [6 Hrs]

Introduction to Algorithm, Iterative Algorithm Design and Issue, Use of Loops, Efficiency of Algorithm, Estimating & Specifying Execution Time and Space, Order Notation (O, Θ, Ω Notations), Algorithm Strategies, Mathematical Analysis for Recursive and Non-Recursive algorithm.

Unit 2]6 Hrs]

Introduction to Divide and Conquer, Binary Search, Merge Sort, Quick Sort, Strassen's Matrix Multiplication, Finding median, Closest Pair, Convex Hulls Problem.

Unit 3 [6 Hrs]

Greedy Methods, Fractional Knapsack Problem, Job Sequencing with Deadlines, Optimal Merge Pattern, Huffman Coding, Minimum Spanning Tree – Kruskal's and Prim's Algorithm, Dijkstra's Shortest Path Algorithm.

Unit 4 [6 Hrs]

Introduction to Dynamic Programming, Elements of Dynamic Programming, Multistage Graphs, Traveling Salesman Problem, Matrix-chain multiplication, Optimal Polygon Triangulation, Longest common subsequence, Floyd-Warshall algorithm

Unit 5 [6 Hrs]

Introduction to Backtracking, N-Queen Problem, Combinational Search, Backtracking Strategies, Search & Traversal Techniques – BFS, DFS, Sum of Subsets, Graph coloring, Hamiltonian Circuit Problem, Tower of Hanoi Problem, State Space Tree, Branch & Bound, Least cost (LC) Search, Control Abstractions for LC search, FIFO Branch & Bound..

Unit 6 [6 Hrs]

Efficiency of Algorithms: Polynomial Time & Non-Polynomial Time Algorithms, NP-Complete, NP-Hard, Limitation of Algorithm, Worst and Average Case Behavior, Efficiency of Recursion, Complexity Calculation for Various Sorting Algorithms, Approximation of Algorithms, Time-Space Trade off in algorithms research.

Text Books:

1. Thomas H. Cormen, Charles E Leiserson, Introduction to Algorithms, PHI Publication, 3rd Edition.
2. Parag Dave, Himanshu Dave, Design and Analysis of Algorithm, Pearson Education India, 2nd Edition.
3. S. Sridhar, Design and Analysis of Algorithms, Oxford University Press, India.

Reference Books:

1. Aho, Ullman, Data Structure and Algorithms, Addison-Wesley Publication, 1st Edition, 1983.
2. Michel Goodrich, Roberto Tamassia, Algorithm Design - Foundation, Analysis & Internet Examples, Wiley Publication, 2nd Edition, 2006.
3. George T. Heineman, Gary Pollice, Stanley Selkow, Algorithms in a Nutshell, A Practical Guide, O'Reilly Media, 2nd Edition, 2016.

IT5O001	**Open Elective-1 Web Development & Design**	**4 Credit**

COURSE OBJECTIVES:

1. Students will able to understand and illustrate HTML.
2. Students will be able to understand about CSS Properties.
3. Student will able to understand basic of Java Script
4. Student will able to design website

COURSE OUTCOMES: Student will able to

CO1. Remember the basic tags of HTML, CSS, and JavaScript

CO2. Understand thebasic tags of HTML, CSS, and JavaScript

CO3: Execute the different Syntax and Tags present in HTML, CSS, and JavaScript

CO4. Analyze difference between various web design Languages

CO5. Evaluate the design of Different Forms

CO6. Design the web site form

Course Contents:

Unit 1 - Introduction [8Hrs]

Introduction to Internet, World Wide Web Communication& Markup Language, HTTP Request / Response, The HTTP Request Circle.

Unit 2 -HTML Basic Tags [8Hrs]

HTML Basic Examples, HTML Editors, HTML Elements, HTML Attributes, HTML Documents, HTML Document Structure, HTML Headings, HTML Paragraphs, HTML Styles, HTML Text Formatting, HTML Quotation and Citation Elements, HTML Comments

Unit 3 -HTML Table [8 hrs]

HTML Colors, HTML Links, HTML Images, HTML Tables, HTML List, HTML frames, HTML Layout Elements and Techniques

Unit 4 - HTML form & Media [8Hrs]

HTML Form, Attribute, Element, Input Type, Input Attribute, Input Form Attribute

Unit 5 - CSS Introduction [8Hrs]

Concept of CSS: Introduction, Syntax, CSS Border, Background, CSS Text, Font, Link, Table, list ,Align, Creating Style Sheet, CSS Properties, CSS Styling(Background, Text Format, Controlling Fonts)

Unit 6 -Java Script Introduction **[8Hrs]**

JAVAScript Implementation, SyntaxBasics and Variable Types: History of a java script, java script Implementation, The language syntax, The character set, Data Types,

Reference Books:

1. Reference Book: Web Developer's Reference Guide. By: Joshua Johanan, Talha Khan, RicardoZea.

Reference Website:

2. Reference Website: W3 School web Developemt: https://www.w3schools.com/whatis/whatis_icons.asp

COURSE OBJECTIVES :

1. To Understand the concepts of Web Science, semantics of knowledge and resource, ontology.
2. To Describe logic semantics and inference with OWL.
3. To Use ontology engineering approaches in semantic applications
4. To enable students build a applications based on semantic web

COURSE OUTCOMES:

CO1: Understand the fundamentals of Semantic web

CO2: Creating structured web documents in XML

CO3:Apply ontology engineering to various problems.

CO4:Understand Semantic Web query languages (SPARQL)

CO5:Program semantic applications with Java and Jena API.

Unit I: Semantic Web Vision: [6 Hrs]

Todays' web, Examples of semantic web from today's web, Semantic web technologies, layered approach

Structured web documents in XML: The XML language, Structuring, Namespaces, Querying and Addressing XML documents, Processing

Unit II: Describing Web Resources: [6Hrs]

Introduction, RDF: Basic Ideas,RDF: XML-Based Syntax,RDF serialization, RDF Schema: Basic Ideas,RDF Schema: The Language ,RDF and RDF Schema,Querying RQL.Logic and Inference Rules:

Introduction, Monotonic Rules syntax, semantics & examples, Nonmonotonic rules – syntax & examples, Encoding in XML

Unit III: Ontology Engineering: [6 Hrs]

Introduction, Manual construction of Ontology, Reusing existing ontology, using Semi-automatic methods, Knowledge semantic web architecture

Unit IV: SPARQL: [6 Hrs]

SPARQL simple Graph Patterns, Complex Graph Patterns, Group Patterns, Queries with Data Values, Filters OWL Formal Semantics,Emerging Semantic Web Ontology Languages using Protege tool.

Unit V: SchemaWeb Ontology Language: [6 Hrs]

SchemaWeb Ontology Language: Introduction, OWL language, Examples, OWL in OWL, Future extensions.

Unit VI: Trust and Applications: **[6 Hrs]**

Digital Signatures and Web of Trust, Applications in E-Commerce and Bio-Informatics, e-Learning, Web Services, Other Scenarios,Linked Open Data Cloud,Research in Semantic Web Mining.

Text Books

1. A Semantic Web Primer: Grigoris Antoniou and Frank Van Hermelen , MIT Press
2. Foundations of Semantic Web Technologies, Pascal Hitzler, Markus Krötzsch, Sebastian Rudolph, CRC Press
3. John Davies, Dieter Fensel and Frank Van Harmelen, "Towards the Semantic Web: Ontology-Driven Knowledge Management", John Wiley and Sons, 2003.
4. Linked Data:Evolving the Web into a Global Data space by Tom Heath, Christian Bizer , Morgan & Claypool publication

Reference Books

1. Michael C. Daconta, Leo J. Obrst, and Kevin T. Smith, "The Semantic Web: A Guide to the Futureof XML, Web Services, and Knowledge Management", Fourth Edition, Wiley Publishing, 2003.
2. John Davies, Rudi Studer, and Paul Warren John, "Semantic Web Technologies: Trends and Research in Ontology-based Systems", Wiley and Son's, 2006.

IT5TE02B	Quantum Computing	3 Credits

COURSE OBJECTIVES:

1. The objective of this course is to provide the students an introduction to quantum computation.
2. Much of the background material related to the algebra of complex vector spaces and quantum mechanics is covered within the course.
3. Analyze the behaviour of basic quantum algorithms.
4. Implement simple quantum algorithms and information channels in the quantum circuit model.
5. Simulate a simple quantum error-correcting code.
6. Prove basic facts about quantum information channels.

COURSE OUTCOMES:

CO1. The basic principles of quantum computing.

CO2. The fundamental differences between conventional computing and quantum computing.

CO3. Several basic quantum computing algorithms.

Co4. The classes of problems that can be expected to be solved well by quantum computers.

CO5.Quantum mechanics as applied in Quantum computing.

CO6. Understand how quantum parallelism is used in the simplest quantum algorithms such as Deutsch, period finding and quantum Fourier transform

Course Contents:

Unit 1 **[6Hrs]**

Introduction to Quantum Computation: Quantum bits, B loch sphere representation of a qubit, multiple qubits.

Unit 2 **[6Hrs]**

Background Mathematics and Physics: Hilber space, Probabilities and measurements, entanglement, density operators and correlation, basics of quantum mechanics, Measurements in bases other than computational basis.

Unit 3 **[6 Hrs]**

Quantum mechanics, Measurements in bases other than computational basis. 083 Quantum Circuits: single qubit gates, multiple qubit gates, design of quantum circuits.

Unit 4 **[6 Hrs]**

Quantum Information and Cryptography: Comparison between classical and quantum information theory. Bell states, Quantum teleportation. Quantum Cryptography, no cloning theorem.

Unit 5 **[6Hrs]**

Quantum Algorithms: Classical computation on quantum computers. Relationship between quantum and classical complexity classes. Deutsch's algorithm, Deutsch's-Jozsa algorithm, Shor factorization, Grover search.

Unit 6 **[6Hrs]**

Noise and error correction: Graph states and codes, Quantum error correction, fault-tolerant computation.

Text Books:

1. Nielsen M. A ., Quantum Computation and Quantum Information, Cambridge University Press.2002
2. Benenti G., Casati G. and Strini G., Principles of Quantum Computation and Information, Vol.I : Basic Concepts, Vol I I: Basic Tools an d Special Topics, World Scientific.2004
3. Pittenger A. O., An Introduction to Quantum Computing Algorithms.2000

Reference Books:

1. Quantum computing explained, David McMahon, Wiley-interscience, John Wiley & Sons, Inc. Publication 2008

2. Quantum computation and quantum information, Michael A. Nielsen and Isaac L. Chuang, Cambridge University Press 2010
3. Introduction to Quantum Mechanics, 2nd Edition, David J. Griffiths, Prentice Hall New Jersey 1995

IT5TE03C	Biomedical Informatics	3 Credit

COURSE OBJECTIVES:

1.Driven by efforts to improvehuman health and healthcare systems, this course will cover relevant topics at the intersection of people, health information, and technology.
2. Specifically, we will survey the field of biomedical informatics that studies the effective uses of biomedical data, information, and knowledge fromindividuals(patients), populations, biomolecules, and cellular processes,forscientific inquiry,problemsolving, and decision making.
3. We will explore foundations and methods from both biomedical and computing perspectives, including hands-on experiences with systems, tools, andtechnologies in the healthcareecosystem.

COURSE OUTCOMES:

CO1. Understand the different sub-disciplines of biomedical informatics (BMI)and identity an area of interestfor further study, research, and/or practice

CO2.Comprehend how to acquire, store and maintain, retrieve, analyse, and meaningfully use biomedical data

CO3.Apply biomedical and computational tools and technologies to solve problems in biomedicine and healthcare

CO4.Understand how technology, including health information systemsand medical devices, can improve or limit the ability to provide clinical care.

CO5.Critically think and develop own perspectives on ethical and legal considerations in use of contemporary technology and informatics in health care.

Course Contents:

Unit 1 [6 Hrs]

The Science and Pragmatics of Biomedical Informatics,Acquisition, Storage, and Use of biomedical data (including “big data”),Introduction Categories of Biological Databases, Microarray Technology: A Boon to Biological Sciences Introduction to Microarray Microarray Technique

Unit 2 [6Hrs]

Standards in Biomedical Informatics,Biomedical Decision Making,Natural Language Processing in Health care and Biomedicine.

Unit 3 [6Hrs]

Sequence alignment,Multiple Sequence Alignment methods (MSA), Scoring of a MSA, Progressive (CLUSTALW and PILEUP), Iterative (Genetic) and Hidden Markov Model (HMM) methods of MSA, Local MSA (Profile and BLOCK analysis, and Pattern searching, and Expectation Maximization (EM) Algorithm (MEME),Ethics in Biomedical and Health Informatics: Users, Standards, and Outcomes

Unit 4 [6 Hrs]

Markov Chains and HMM Frequent words in DNA, Consensus word analysis, Transaction and emission matrix, Development of training set, CpG island prediction using HMM, Application of HMM in gene finding, and Multiple sequence alignment by HMM method. Introduction to Methodologies in Biomedical Informatics

IT5L004	Embedded System and IOT-Lab	1 Credit

Unit 5 **[6 Hrs]**

Introduction to Biopython, sequence objects, sequence record objects. Sequence input and output:-parsing sequences, parsing sequences from the net, sequence files as dictionaries, writing sequence files. Multiple Sequence Alignment objects,BLAST using Biopython

Unit 6 **[6 Hrs]**

Phylogenetic analysis: Definition and description of phylogenetic trees, a primer on computational phylogenetic analysis. Computational gene prediction methods, analysis of codon usage bias, computational prediction and analysis of regulatory sites,Human Genome Project Genome Sequenced in the Public (HGP) and Private.

Text Books:

1. Biomedical Informatics: Computer Applications in Health Care and Biomedicine (Health Informatics),
2. Shortliffe EH, Cimino JJ. Fourth edition, 2014.
3. M.J. Bishop and C.J. Rawlings (editors), DNA and Protein Sequence Analysis---A Practical Approach IRL Press at Oxford University Press, ISBN 0 19 963464 7 (Pbk)
4. J. Pevsner (2002) Bioinformatics and Functional Genomics; Cold Spring Harbor Laboratory
   Press, Cold Spring Harbor, New York.
5. Jeff Chang, Brad Chapman, Iddo Friedberg, Thomas Hamelryck, BiopythonTutorial and Cookbook", http://biopython.org/DIST/docs/tutorial/Tutorial.html,2013

Reference Books:

1. Shortliffe, E. H., &Cimino, J. J. (2013). Biomedical Informatics: Computer Applications in Health Care and Biomedicine. Springer Science & Business Media, (4thEdition).
2. Selected readings from peer-reviewed literature in biomedical informatics, translational medicine, and healthcare systems engineering.
3. Lesk, A.M. 2005, 2nd edition, Introduction to Bioinformatics. Oxford University Press

COURSE OBJECTIVES :

To create an environment for research, design, development and testing of IoT solutions, in the field of energy management, communication systems, distributed sensor devices and advanced user interfaces

COURSE OUTCOMES:

Investigate a variety of emerging devices and technologies such as smart sensing, pervasive connectivity, virtual interfaces & ubiquitous computing and their potential applications in consumer, retail, healthcare and industrial contexts

List of Experiments:

1. Study of Raspberry-Pi, Beagle board, Arduino and other micro controller (History& Elevation)

2. Study of different operating systems for Raspberry-Pi /Beagle board. Understanding the process of OS installation on Raspberry-Pi /Beagle board

3. Study of Connectivity and configuration of Raspberry-Pi /Beagle board circuit with basic peripherals, LEDS. Understanding GPIO and its use in program.

4. Understanding the connectivity of Raspberry-Pi /Beagle board circuit with temperature sensor. Write an application to read the environment temperature. If temperature crosses a threshold value, the application indicated user using LEDSs

5) Understanding the connectivity of Raspberry-Pi /Beagle board circuit with IR sensor. Write an application to detect obstacle and notify user using LEDs.

6. Understanding and connectivity of Raspberry-Pi /Beagle board with camera. Write an application to capture and store the image.

7. Understanding and connectivity of Raspberry-Pi /Beagle board with a Zigbee module. Write a network application for communication between two devices using Zigbee.

8. Study of different CPU frequency governors. Write an application to change CPU frequency of Raspberry-Pi /Beagle board

9. Write an application using Raspberry-Pi /Beagle board to control the operation of stepper motor.

10. Write an application using Raspberry-Pi /Beagle board to control the operation of a hardwaresimulated traffic signal.

11. Write an application using Raspberry-Pi /Beagle board to control the operation of a hardwaresimulated lift elevator

12. Write a server application to be deployed on Raspberry-Pi /Beagle board. Write client applications to get services from the server application.

IT5L006	Design and Analysis of Algorithm Lab	1 Credit

COURSE OBJECTIVES :

1. To analyze the running time of asymptotic algorithm.
2. To develop algorithms for sorting, searching, insertion and matching.
3. To identify and apply the concept of computational intractability.
4. To acquire knowledge in NP Hard and complete problem

COURSE OUTCOMES:

CO1. To design new algorithms, prove them correct, and analyze their asymptotic and absolute runtime and memory demands.

CO2.To find an algorithm to solve the problem (create) and prove that the algorithm solves the problem correctly (validate) .

CO3.To apply classical sorting, searching, optimization and graph algorithms Apply classical sorting, searching, optimization and graph algorithms

CO4. To understand basic techniques for designing algorithms, including the techniques of recursion, divide-and-conquer, and greedy.

CO6.To explain NP-Completeness and deal with NP-complete problems.

CO7 To synthesize efficient algorithms in common engineering design situations.

List of Experiments:

1. Introduction of Algorithm (Order Notation , Time & Space Complexity)
2. Write a program to implement Binary Search Algorithm
3. Write a program to implement Merge sort Algorithm

4. Write a program to implement Knapsack problem using greedy method
5. Write a program to implement Prim's Algorithm
6. Write a program to implement Kruskals Algorithm
7. Write a program to implement Dijkstras's algorithm
8. Write a program to implement Travelling Salesman Problem
9. Write a program to implement Tower of Hanoi problem for n number of disks.
10. Write a program to implement Warshall's algorithm.
11. Write a program to implement Quick Sort Algorithm
12. Write a program to implement Depth first Search Algorithm

13. Write a program to implement Spanning tree.
14. Write a program to implement Breath First Search Algorithm
15. Write a program to implement Selection Sort Algorithm
16. Write a program to implement Longest Common Subsequence Algorithm
17. Write a program to implement Bubble Sort algorithm.
18. Write a program to implement Insertion Sort Algorithm
19. Write a Program to Search a number from the given list of numbers using Linear Search
20. Write a program to implement Hamilton Algorithm

IT5T008	**Innovation and Enterpreneurship Development**	**1 Credit**

COURSE OBJECTIVES

1. To understand the importance of Innovation and Idea Generation
2. To understand the concept of entrepreneurship.

COURSE OUTCOMES

At the end of the course students will be able to

1. Identify and validate of ideas.
2. Remember Patent registration of Innovation.
3. Understand roles and responsibilities of Entrepreneurship.

Unit 1: Innovation **[06 Hours]**

Concept of creativity, innovation, invention, discovery. Methods for development of creativity, convergent & divergent thinking etc. Introduction to Intellectual Property Rights (IPR), Patent and laws related to patents.

Unit 2: Entrepreneurship **[06 Hours]**

Concept of entrepreneurship, its relations in economic developments, Eventuation of concept of entrepreneur, characteristics of an Entrepreneur, Types of entrepreneurs, Qualities of entrepreneur, Factors affecting growth of entrepreneurship.

Unit 3: Role of Entrepreneurial Bodies **[06 Hours]**

Theory of achievement, motivation, Medelland’s. experiment, Women entrepreneurship, Role of SSI,
it’s advantages & limitations, policies governing small scale industries, Procedure to set up small
scale industrial unit, Advantages and limitations of SSI.

Unit 4: Role of Entrepreneurial Support **[06 Hours]**

Factors governing project selection, Market survey, Preparation of project report. Financial, technical
& market analysis of project. Entrepreneurial support systems, Role of consultancy organization like,District Industrial Centre, State Industrial Development Corporation, Financial institution, Latest SSI schemes of DIC (to be confirmed from DIC from time to time.

Text Book

1) Entrepreneurship Development, S. S. Khanka, S. Chand Publishers.

Reference Book

1) Creativity Innovation & Entrepreneurship, Zechariah James Blanchard, Needle Rat Business
Publishers.

Course Structure and Syllabus

For

B. Tech. Information Technology Programme

Curriculum for Semester- VI [Third Year]

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				
				L	T	P	CA	MSE	ESE	Total	Credit
1	ESC	IT6T001	Adhoc Wireless Networks	3	0	0	20	20	60	100	3
2	PCC	IT6T002	Machine Learning	2	1	0	20	20	60	100	3
3	PEC	IT6TE02	Elective -II	3	0	0	20	20	60	100	3
4	PEC	IT6TE03	Elective-III	3	0	0	20	20	60	100	3
5	OEC	IT6O002	OPEN Elective 2	3	1	0	20	20	60	100	4
6	ESC	IT6L003	Adhoc Wireless Networks (Lab)	0	0	2	60	0	40	100	1
7	PCC	IT6L004	Machine Learning (Lab)	0	0	2	60	0	40	100	1
8	PCC	IT6L005	Multimedia (Lab)	0	0	2	60	0	40	100	1
9	PROJECT	IT6P006	Mini Project	0	0	4	25	0	25	50	3
10	MC	IT6T007	Intellectual Property Rights	2	0	0	15	10	25	50	Audit
11	PROJECT	IT6P007	CRT(Campus Recruitment Training)	0	0	2	60	0	40	100	1
				16	2	10	320	110	470	900	23

IT6T001	Adhoc Wireless Network	3 Credit

COURSE OBJECTIVES:

1. Explain fundamental principles of Ad-hoc Networks

2. Discuss a comprehensive understanding of Ad-hoc network protocols
3. Outline current and emerging trends in Ad-hoc Wireless Networks.
4. Analyze energy management in ad-hoc wireless networks.

COURSE OUTCOMES:

CO1. Design their own wireless network

CO2. Evaluate the existing network and improve its quality of service

CO3. Choose appropriate protocol for various applications

CO4. Examine security measures present at different level

CO5. Analyze energy consumption and management

Course Contents:

Unit 1 **[10 Hrs]**

Teaching Hours Ad-hoc Wireless Networks Introduction, Issues in Ad-hoc Wireless Networks, Ad-hoc Wireless Internet; MAC Protocols for Ad-hoc Wireless Networks: Introduction, Issues in Designing a MAC Protocol, Design Goals of MAC Protocols, Classification of MAC protocols, Contention-Based Protocols, Contention-Based Protocols with Reservation Mechanisms, Contention-Based Protocols with Scheduling Mechanisms, MAC Protocols that Use Directional Antennas.

Unit 2 **[8 Hrs]**

Routing Protocols for Ad-hoc Wireless Networks Introduction, Issues in Designing a Routing Protocol for Ad-hoc Wireless Networks; Classification of Routing Protocols; Table Driven Routing Protocols; On-Demand Routing Protocols, Hybrid Routing Protocols, Hierarchical Routing Protocols and Power-Aware Routing Protocols.

Unit 3 **[9 Hrs]**

Multicast Routing in Ad-hoc Wireless Networks Introduction, Issues in Designing a Multicast Routing Protocol, Operation of Multicast Routing Protocols, An Architecture Reference Model for Multicast Routing Protocols, Classifications of Multicast Routing Protocols, Tree-Based Multicast Routing Protocols and Mesh-Based Multicast Routing Protocols.

Unit 4 **[9Hrs]**

Transport Layer and Security Protocols for Ad-hoc Networks: Introduction, Issues in Designing a Transport Layer Protocol; Design Goals of a Transport Layer Protocol; Classification of Transport Layer Solutions; TCP over Transport Layer Solutions; Other Transport Layer Protocols for Ad-hoc Networks; Security in Ad-hoc Wireless Networks, Issues and Challenges in Security Provisioning, Network Security Attacks, Key Management and Secure Touting Ad-hoc Wireless Networks.

Unit 5 **[9 Hrs]**

Quality of Service and Energy Management in Ad-hoc Wireless Networks: Introduction, Issues and Challenges in Providing QoS in Ad-hoc Wireless Networks, Classification of QoS Solutions, MAC Layer Solutions, Network Layer Solutions; Energy Management in Ad-hoc Wireless Networks: Introduction, Need for Energy Management in Ad-hoc Wireless Networks, Classification of Energy Management Schemes, Battery Management Schemes, Transmission Management Schemes, System Power Management Schemes.

Text Books:

1. C. Siva Ram Murthy & B. S. Manoj: Ad-hoc Wireless Networks, 2nd Edition, Pearson Education, 2011

Reference Books:

1. Ozan K. Tonguz and Gianguigi Ferrari: Ad-hoc Wireless Networks, John Wiley, 2007.

2. Xiuzhen Cheng, Xiao Hung, Ding-Zhu Du: Ad-hoc Wireless Networking, Kluwer Academic Publishers, 2004.

IT6T002	Machine Learning	4 Credit

COURSE OBJECTIVES:

1. To understand the basic concepts and methods of machine learning.

2. To make use of some elementary machine learning techniques in the design of computer systems.

3. To develop a broad perspective about the applicability of ML algorithms in different fields.

4. To understand the major machine learning algorithms, the problem settings and assumptionsthat underlies them.

5. To possess insights, concerning the relative strengths and weaknesses of various commonmachine learning methods.

COURSE OUTCOMES:

After learning the course the student will be able:

CO1. To demonstrate knowledge of the machine learning literature.

CO2. To describe how and why machine learning methods work.

CO3. To demonstrate results of parameter selection.

CO5. To select and apply appropriate machine learning methods to a selected problem.

CO6. Toimplement machine learning algorithms on real datasets.

Course Contents:

Unit 1 **[6 Hrs]**

Introduction: Well-posed learning problems, Designing a Learning System, Perspectives and Issues in Machine learning, Concept Learning and General-to-specific Ordering: A concept learning task, Concept learning as Search, Finding a maximally specific hypothesis, Version Spaces and Candidate elimination algorithm, Inductive Bias.

Unit 2 **[6 Hrs]**

Decision Tree Learning: Decision tree learning algorithm, Hypothesis space search in decision tree Evaluating Hypothesis: Estimating Hypothesis accuracy, Basics of sampling theory, Deriving confidence intervals, Hypothesis testing, comparing learning algorithms.

Unit 3 **[6 Hrs]**

Bayesian Learning: Bayes theorem and concept learning, Maximum likelihood and least square error hypotheses, Minimum description length principle, Bayes optimal classifier, Gibbs algorithm, Naive Bayes classifier, Computational Learning Theory: Probably learning an approximately correct hypothesis, PAC learnability, The VC dimension, the mistake bound model for learning.

Unit 4 **[6 Hrs]**

Linear Models for Regression: Linear basis function models, The Bias-Variance decomposition, Bayesian Linear Regression, Bayesian Model comparison, Kernel Methods: Constructing kernels, Radial basis function networks, Gaussian Processes, Ensemble Learning: Bagging, boosting, and DECORATE. Active learning with ensembles.

Unit 5 **[6 Hrs]**

Unsupervised Learning: Clustering:Learning from unclassified data, Hierarchical Aglomerative Clustering, k-means partitional clustering, Batchler and Wilkin's algorithm.

Reinforcement Learning: The learning task, Q learning, Non-deterministic rewards and action, Temporal difference learning, Generalizing from examples.

Text Books:

1. Mitchell, Tom. M., “Machine Learning”, McGraw-Hill Education, 1st Edition, May 2013.
2. Segaran, Toby. “Programming Collective Intelligence- Building Smart Web 2.0 Applications”, O’Reilly Media, August 2007.

Reference Books:

1. Miroslav, Kubat. “An Introduction to Machine Learning”, Springer Publishing.
2. Bishop, C. M., “Pattern Recognition and Machine Learning”, Springer Publishing.
3. Conway, Drew and White, John Myles, “Machine Learning for Hackers”, O'Reilly Media, February 2012.

IT6TE02A	**Elective II- Cloud Computing and Storage Management Semester**	**Credit:3**

Course Objectives:

1. To learn the concept of cloud computing.
2. To understand the trade-off between deploying applications in the cloud over local infrastructure.
3. To identify different storage virtualization technologies and their benefits.
4. To understand and articulate business continuity solutions including backup and recovery technologies, local and remote replication solutions.

Course Outcomes:

After learning the course, the student will be able:

1. To understand the key dimensions of the challenge of Cloud Computing.
2. To assess the economics, financial and technological implications for selecting cloud Computing for organization.
3. To describe and apply storage technologies.
4. To identify leading storage technologies that provide cost-effective IT solutions for medium to large scale businesses and data centres.
5. To describe important storage technology features such as availability, replication,

scalability and performance.

Course Content:

UNIT I

Introduction: Distributed Computing and Enabling Technologies, Cloud Fundamentals: Cloud Definition, Evolution, Architecture, Applications, Deployment models and service models.

UNIT II

Virtualization: Issues with virtualization, Virtualization technologies and architectures, Internals of virtual machine monitors/hypervisors, Virtualization of data centres and Issues with Multi-tenancy.

UNIT III

Implementation: Study of Cloud computing Systems like Amazon EC2 and S3, Google App Engine and Microsoft Azure, Build Private/Hybrid Cloud using open source tools, Deployment of Web Services from inside and outside a Cloud Architecture, MapReduce and its extensions to Cloud Computing, HDFS and GFS.

UNIT IV

Storage virtualization: Fixed Content and Archives, Types, Features, Benefits, CAS Architecture, Object storage and retrieval, Examples: Storage Virtualization-forms of virtualization, SNIA Taxonomy – Storage virtualization configurations,Challenges, Types of storage virtualization - Business Continuity- Overview of emerging technologies such as Cloud storage, Virtual provisioning, Unified Storage, FCOE, FAST.

UNIT V

Business Continuity and Recovery: Information Availability, BC Terminology, Life cycle, Failure analysis: Backup and Recovery- Backup purpose, considerations, Backup Granularity, Recovery considerations- Backup methods, Process, backup
and restore operations, Overview of emerging technologies: Duplication, Off site backup.

UNIT VI

Storage security and Management: Storage security framework, Securing the Storage infrastructure, Risk triad: Managing the storage infrastructure, Monitoring the storage infrastructure, identify key parameters and components to monitor in a storage infrastructure, List key management activities and examples, Define storage management standards and initiative-Industry trend

Text Books:

1. RajkumarBuyya, James Broberg, AndrzejGoscinski, “Cloud Computing Principles and Paradigms”, Wiley Publishers, 2011.

2. Barrie Sosinsky, “Cloud Computing Bible”, Wiley Publishers 2010.

3. Tim Mather, SubraKumaraswamy, ShahedLatif, “Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance”, O’Reilly 2010.

4. EMC Corporation, “Information Storage and Management”, 1st Edition, Wiley India 2009.

Reference Books:

1. RajkumarBuyya, Christian Vacchiola, S ThamaraiSelvi, “Mastering Cloud Computing”, McGraw Hill, 2013

2. Michael Miller, “Cloud Computing : Web-based Applications that change the way you work and collaborate online”, Pearson Education, 2008

3. IBM, “Introduction to Storage Area Networks and System Networking”, 5th Edition, November 2012.

4. Robert Spalding, “Storage Networks: The Complete Reference”, Tata McGraw Hill, Osborne, 6th reprint 2003.

5. Marc Farley, “Building Storage Networks”, Tata McGraw Hill, Osborne, 1st Edition, 2001.

IT6TE02B	Expert Systems	3 Credit

COURSE OBJECTIVES:

1. Students will be introduced to what is an Expert System.
2. Students will be able to understand First and Second Generation Expert Systems.
3. Students will study Artificial Intelligence.
4. Students will study Artificial Intelligence.
5. Students will study Different approaches to gain knowledge with different perspectives.

6. Students will study about Machine Learning and its importance.

COURSE OUTCOMES:

CO1. Students will be able to understand Knowledge Representation.

CO2. Students will be able to understand what is Machine Learning.

CO3. Students will be able to analyse a Hybrid Expert System for Insurance Policy.

CO4. Students will illustrate the Frame Problem.

CO5. Students will be Understand what is Neural Network

CO6. Students will be introduced with Machine learning concepts.

Course Contents:

Unit 1 **[6 Hrs]**

Introduction to Expert System: Artificial Intelligence, Basic expert System concepts, Knowledge Engineering, First and second Generation Expert Systems, Advantages and disadvantages of Expert Systems, Expert System applications.

Unit 2 **[6 Hrs]**

Theoretical Foundations : Introduction, Propositional Logic, First order predicate calculus and Predicate Logic, Inference, Proof by Refutation Resolution, Green's Answer Terms, Knowledge Acquisition Bottleneck, Search Strategies, Non Monotonic Reasoning, Forward Backward Chaining.

Knowledge Representation: Presentation of Knowledge, Rules, Semantic Networks, Frames, Object Oriented Systems, Hybrid Representation, The Frame problem, Semantic Primitives..

Unit 3 **[6 Hrs]**

Knowledge Acquisition, Verification and Validation: The Expert System Development Process, Knowledge Elicitation, The Knowledge Level, Explanation in Second Generation Expert System, The Problem Solving Methods and Generic Tasks Approach, Verification and Validation.

Unit 4 **[6 Hrs]**

Uncertainty: Uncertainty in Expert Systems, The Bayesian Approach, Certainty Factors, Dempster Shafer Theory of Evidence, Fuzzy Sets and Fuzzy Logic, Bayesian Belief Networks.

Machine Learning: Introduction, Decision Trees and The ID3 Algorithm, Learning From Noisy Data, Version Space Search and Conceptual Clustering, Case Based Reasoning, Evolutionary Machine Learning.

Unit 5 **[6 Hrs]**

Neural Networks: Introduction, Artificial Neural Network, Perceptron, Hidden Layers, Multi layerPerceptrons, Hopfield Networks, Multilayered Nets AndBackpropagation.

Unit 6 **[6 Hrs]**

Hybrid Expert System: Introduction, Macie: A Connectionist Expert System, Generating Rules from Neural Nets, A Hybrid expert system for Investment Advising, A Hybrid Expert System for Insurance Policy.

Reference Book:

1. Nikolopoulos "Expert Systems" 1997

2. J. Giarratano and G. Riley, "Expert Systems -- Principles and Programming". 4th Edition, PWS Publishing Company, 2004

3. Peter J. Lucas "Principles of Expert Systems" January 1991

4. Joseph C. Giarratano "Expert systems"

IT5TE01A	Blockchain	3 Credit

COURSE OBJECTIVES:

1. To understand the concepts of blockchain
2. To understand various cryptocurrency and their working
3. To Use various algorithms for distributed consensus
4. To enable students build a applications based on blockchain technology

COURSE OUTCOMES:

CO1: Understand emerging abstract models for Blockchain Technology.

CO2: Identify major research challenges and technical gaps existing between theory and practice in crypto currency domain.

CO3: It provides conceptual understanding of the function of Blockchain as a method of securing distributed ledgers, how consensus on their contents is achieved, and the new applications that they enable.

CO4: Apply hyperledger Fabric and Etherum platform to implement the Block chain Application

Unit I: Introduction : [6 Hrs]

Blockchain-History,Myths,Benefits,Limitations and Challenges of Blockchain, Structure of Blocks, Miners,Working of Blockchain,Types of Blockchain,Blockchain as Public Ledgers-Bitcoin, Blockchain 2.0, Smart Contracts, Transactions-Distributed Consensus, The Chain and the Longest Chain -Cryptocurrency to Blockchain 2.0 - Permissioned Model of Blockchain,

Unit II: Blockchain Architecture and Cryptographic**:** **[6Hrs]**

Crypto Primitives, Permissioned Blockchain,Consensusmechanism **,**Cryptographic -Hash Function,Properties of a hash function-pointer and Merkle tree. Public key cryptosystems, private vs public blockchain. Introduction to cryptographic concepts required,Hashing, public key cryptosystems, private vs public blockchain and use cases,

Unit III: Bitcoin Consensus: [6 Hrs]

Introduction to BitcoinBlockchain,Transactions,Bitcoin limitations, Bitcoin Consensus, Proof of Work (PoW)- HashcashPoW , BitcoinPoW, Attacks on PoW ,monopoly problem- Proof of Stake- Proof of Burn - Proof of Elapsed Time - Bitcoin Miner, Mining Difficulty, Mining Pool-Permissioned model and use cases.

Unit IV:Cryptocurrency and Smart Contracts **[6 Hrs]**

Introduction, Ethereumblockchain, Elements of the Ethereumblockchain, IOTA,Namecoin.Legal Aspects Cryptocurrency Exchange, Black Market and Global Economy.Smart Contracts: Definition, DAO,Ricardian contracts,Precompiled contracts.

Unit V: HyperledgerFabric: [6 Hrs]

Architecture of Hyperledger fabric v1.1-Introduction to hyperledger fabric v1.1, chain code- Ethereum:Ethereum network, EVM, Transaction fee, Mist Browser, Ether, Gas, Solidity, TruffleDesign and issue Crypto currency, Mining, DApps, DAO

Unit VI: BlockchainApplications : [6 Hrs]

Uses of Blockchain in E-Governance, Land Registration, Medical Information Systems, Finance, and others

Text Books

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016

2. Draft version of "S. Shukla, M. Dhawan, S. Sharma, S. Venkatesan, 'Blockchain Technology: Cryptocurrency and Applications', Oxford University Press, 2019.

3. Josh Thompson, 'Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming', Create Space Independent Publishing Platform, 2017.

Reference Books

1. Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popularBlockchain frameworks by Bashir, Imran,2017.
2. Joseph Bonneau et al, SoK: Research perspectives and challenges for Bitcoinandcryptocurrency, IEEE Symposium on security and Privacy, 2015.

IT6TE02D	Big Data Analytic Technique	3 Credit

COURSE OBJECTIVES:

1. Design applications using R, HADOOP.
2. Design applications using RHADOOP
3. Develop analytic applications for data Streams.
4. Develop Pig scripts for Big data applications.
5. Design Big data applications schema

COURSE OUTCOMES:

CO1. Understand basic concepts and techniques of Hadoop ecosystem and Big data.

CO2.Design different component of Hadoop ecosystem.

CO3. Understand the domain of data science and analysis of big data.

Course Contents:

Unit 1 : [6 Hrs]

What is big data, why big data, convergence of key trends, unstructured data, industry examples of big data, web analytics, big data and marketing, fraud and big data, risk and big data, credit risk management, big data and algorithmic trading, big data and healthcare, big data in medicine, advertising and big data, big data technologies.

Unit 2 : [7 Hrs]

Introduction to NoSQL, aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schemaless databases, materialized views, distribution models, master-slave replication, peer-peer replication, consistency, relaxing consistency, version stamps, map-reduce, partitioning andcombining, composing map-reduce calculations.

Unit 3 : **[7 Hrs]**

Data format, analyzing data with Hadoop, scaling out, Hadoop streaming, Hadoop pipes, design of Hadoop distributed file system (HDFS), HDFS concepts, Java interface, data flow, Hadoop I/O, data integrity, compression, serialization, Avro, file-based data structures

Unit 4 : **[7 Hrs]**

Map Reduce workflows, unit tests with MR Unit, test data and local tests, anatomy of Map Reduce job run, classic Map-reduce, YARN, failures in classic Map-reduce and YARN, job scheduling, shuffle and sort, task execution, Map Reduce types, input formats, output formats.

Unit 5 : **[7 Hrs]**

H base, data model and implementations, H base clients, H base examples, praxis. Cassandra, Cassandra data model, Cassandra examples, Cassandra clients, Hadoop integration, Hive, data types and file formats, HiveQL data definition, Hive QL data manipulation, HiveQL queries.

Unit 6 : **[6Hrs]**

Big Data Issues: Privacy, Visualization, Compliance and Security,Structuredvs Unstructured Data.

Text Books:

1. Big Data Analytics, Introduction to Hadoop, Spark, and Machine-Learning, Raj kamal, PreetiSaxena, McGraw Hill, 2018.
2. Big Data, Big Analytics: Emerging Business intelligence and Analytic trends for Today's Business, Michael Minelli, Michelle Chambers, and AmbigaDhiraj, John Wiley & Sons, 2013

Reference Books:

1. Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013
2. Hadoop: The Definitive Guide, Tom White ,Third Edition, O'Reilley, 2012.
3. Hadoop Operations, Eric Sammer, O'Reilley, 2012.
4. Programming Hive, E. Capriolo, D. Wampler, and J. Rutherglen, O'Reilley, 2012.
5. H Base: The Definitive Guide, Lars George, O'Reilley, 2011.
6. Cassandra: The Definitive Guide, Eben Hewitt, O'Reilley, 2010.

IT6TE03A	Graph Analytic for Big data	3 Credit

COURSE OBJECTIVES:

1.To understand the concept of Big Data

2.To learn Big Data file systems and their storage methods

3.To understand the algorithms and

4.To learn to process Big Data information for analytics

5.To discuss and understand Big Data implementations within large corporations like Google and Facebook

COURSE OUTCOMES:

CO1.To model and implement efficient big data solutions for various application areas using appropriately selected algorithms and data structures.

CO2.To analyze methods and algorithms, to compare and evaluate them with respect to time and space requirements, and make appropriate design choices when solving real-world problems.

CO3.To explain trade-offs in big data processing technique design and analysis in written and oral form.

CO4.To explain the Big Data Fundamentals, including the evolution of Big Data, the characteristics of Big Data and the challenges introduced.

CO5.To apply non-relational databases, the techniques for storing and processing large volumes of structured and unstructured data, as well as streaming data.

Course Contents:

Unit 1 **[6 Hrs]**

What is big data?, the four V's of big data, Distributed File System, functional programming vsobject oriented programming, advantages of scala, spark streaming

Unit 2 **[7 Hrs]**

Introduction, Parallel processing using Pig, Pig Architecture, Grunt, Pig Data Model-scalar and complex types. Pig Latin-Input and output, Relational operators, User defined functions. Working with scripts

Unit 3 **[7 Hrs]**

Big Data Storage Models: Distributed Hash-table, Key-Value Storage Model (Amazon's Dynamo), Document Storage Model(Facebook's Cassandra), Graph storage models

Unit 4 **[7 Hrs]**

Scalable Algorithms: Mining large graphs, with focus on social networks and web graphs. Centrality, similarity, all-distances sketches, community detection, link analysis, spectral techniques. Map-reduce, Pig Latin, and No SQL, Algorithms for detecting similaritems, Recommendation systems, Data stream analysis algorithms, Clustering algorithms, Detecting frequent items.

Unit 5 **[7 Hrs]**

Big Data Applications: Advertising on the Web, Web Page Quality Ranking, Mining Social-Networking Group, Human Interaction with Big-Data. Recommendation systems with case studies of Amazon's Item-to-Item recommendation and Net fix Prize, Link Analysis with case studies of the PageRank algorithm and the Spam farm analysis, Crowd Sourcing

Unit 6 **[6 Hrs]**

Big graph Analytic Approaches: In memory big graph analytics, SSD-based big graph analytics, Disk based big graph analytics, centrality analysis: Degree, eignvectorkatz, page rank.

Text Books:

1. Big Data Analytics, Introduction to Hadoop, Spark, and Machine-Learning, Raj kamal, PreetiSaxena, McGraw Hill, 2018.
2. Big Data, Big Analytics: Emerging Business intelligence and Analytic trends for Today's Business, Michael Minelli, Michelle Chambers, and AmbigaDhiraj, John Wiley & Sons, 2013**.**

Reference Books:

1. An Introduction to Information Retrieval, Christopher D. Manning, PrabhakarRaghavan, HinrichSchütze
2. Data-Intensive Text Processing with Map Reduce, Jimmy Lin and Chris Dyer.

IT6TE03B	Smart Sensors for Robotics	3 Credit

COURSE OBJECTIVES:

1. To understand the different sesnsors used in robotics
2. To learn kinematics of robotics
3. To understand sensors used in industries

COURSE OUTCOMES:

CO1.Student shall be able to differentiate sensors uses..
CO2.Student shall be able to apply the knowledge of different sensors in different area of robotics.
CO3.Students shall able to understand the robotics assembly

Course Contents:

UNIT I: Introduction **[6 Hrs]**

An Introduction to sensors and Transducers, History and definitions, Smart Sensing, AI sensing, Need of sensors in Robotics.

UNIT II: Sensors In Robotics [**7 Hrs]**

Position sensors -optical, non-optical, Velocitysensors, Accelerometers, Proximity Sensors - Contact, non-contact, Range Sensing, touch and Slip Sensors, Force and Torque Sensors

UNIT III: Miscellaneous Sensors In Robotics [**8Hrs]**

Different sensing variables -smell, Heat or Temperature, Humidity, Light, Speech or Voice recognition Systems, Telepresence and related technologies. Range detectors, assembly aid devices,force and torque sensors, machine vision, ranging, laser, acoustic, magnetic, fiberopticand tactile sensors.

UNIT IV: Vision Sensors InRobtics [**6Hrs]**

Robot Control through Vision sensors, Robot vision locating position, Robot guidance with vision system, End effector camera Sensor

UNIT V: Multisensor Controlled Robot Assembly

[**7Hrs]**

Control Computer, Vision Sensor modules, Software Structure, Vision Sensor software, Robot programming, Handling, Gripper and Gripping methods, accuracy .

UNIT VI: Case Study [**6Hrs]**

Case Studies: Multiple robots, machine interface, robots in manufacturing and non-manufacturing applications, robot cell design, selection of robot.

Text Books:

1.Mikell P. Weiss G.M., Nagel R.N., Odraj N.G., "Industrial Robotics", McGraw-Hill, Singapore, 1996.
2.Ghosh, "Control in Robotics and Automation: Sensor Based Integration", Allied Publishers, Chennai, 1998.
3.Paul W Chapman, "Smart Sensors", an Independent Learning Module Series, 1996
4.Richard D. Klafer, Thomas a. Chmielewski; Michael Negin, "Robotic Engineering -An integrated approach", Prentice Hall of India Private Limited, 1989

Reference Books:

1.K.S. Fu, R.C. Gonzalez, C.S.G. Lee, "Robotics -Control Sensing, Vision and Intelligence", McGraw Hill InternationalEditions, 1987
2.Mikell P. Groover, Mitchell Weiss, Roger N Nagel, Nicholas G. Odrey, "Industrial Robotics - Technology, Programming and Applications", McGraw Hill, International Editions, 1986
3.SabricSoloman, "Sensors and Control Systems in Manufacturing", McGraw Hill, International Editions, 1994
4.Julian W Gardner, Micro Sensor MEMS and Smart Devices, John Wiley & Sons, 2001
5.Bijay K. Ghosh, Ning Xi, T.J. Tarn, Control in Robtics and Automation Sensor -Based integration, Academic Press, 1999
6.K.S. Fu, R.C. Gonzalez, C.S.G. Lee, Robotics Control, Sensing Vision and Intelligence, McGraw Hill Book Company, 1987

IT6TE03C	Human Computing Interface	3 Credit

COURSE OBJECTIVES

The student should be made to:

1. Learn the foundations of Human Computer Interaction
2. Be familiar with the design technologies for individuals and persons with disabilities
3. Gain an understanding and articulate the fundamental design concepts and practices associated with the design of human-computer interactions.

4. Analyze human factors such as cognition, affect and behaviour as they relate to the human-computer interaction and apply them in the development of human-computer interactions.
5. Evaluate the impact of new and emerging technology trends on human computer interactions and the user experience.
6. Synthesize sound (solid) design principles and aesthetics as they apply to the design of innovative interfaces.

COURSE OUTCOMES

Upon completion of the course, the student should be able to:

CO1. Design effective dialog for HCI.
CO2.Design effective HCI for individuals and persons with disabilities.
CO3.Assess the importance of user feedback.
CO4 Explain the HCI implications for designing multimedia/ ecommerce/ e-learning Web sites.
CO5 Develop meaningful user interface.

Unit 1: FOUNDATIONS OF HCI [6 Hrs]

The Human: I/O channels – Memory – Reasoning and problem solving; The computer: Devices – Memory – processing and networks.

Unit 2 :INTERACTIVE SYSTEM DESIGN [6 Hrs]

Interaction: Models – frameworks – Ergonomics – styles – elements – interactivity- Paradigms.

Interactive Design basics – process – scenarios – navigation – screen design – Iteration and prototyping. HCI in software process – software life cycle – usability engineering .

Unit 3 : MODELS AND THEORIES [6 Hrs]

Cognitive models –Socio-Organizational issues and stake holder requirements –Communication and collaboration models-Hypertext, Multimedia and WWW.

Unit 4: MODEL BASED DESIGN AND EVALUATION [6 Hrs]

Basic idea, introduction to different types of models, GOMS family of models (KLM and CMN-GOMS), Fitts' law and HickHyman's law.

Unit 5: GUIDELINES IN HCI [6 Hrs]

Shneiderman's eight golden rules, Norman's seven principles, Norman's model of interaction, Nielsen's ten heuristics with example of its use, Heuristic evaluation, Cognitive walkthrough.

Unit 6: TASK MODELING AND ANALYSIS [6 Hrs]

Hierarchical task analysis (HTA), Engineering task models and Concur Task Tree (CTT), Introduction to formalism in dialog design, design using FSM (finite state machines), State charts and (classical) Petri Nets in dialog design.

TEXTBOOK:

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, "Human Computer Interaction", 3rd Edition, Pearson Education, 2004 (UNIT I , II & III)
2. Brian Fling, "Mobile Design and Development", First Edition , O"Reilly Media Inc., 2009 (UNIT –IV)
3. Bill Scott and Theresa Neil, "Designing Web Interfaces", First Edition, O"Reilly, 2009.(UNIT-V)

REFERENCE BOOK:

1. Preece J., Rogers Y.,Sharp H.,Baniyon D., Holland S. and Carey T. Human Computer Interaction,Addison-Wesley, 1994.
2. B.Shneiderman; Designing the User Interface,Addison Wesley 2000 (Indian Reprint).

IT6TE03D	Machine Learning with Big Data	3 Credits

COURSE OBJECTIVES:

1. Understand the Big Data Platform and its Use cases.
2. Apply analytics on Structured, Unstructured Data.
3. Acquire a sharp understanding of how big data can be applied to concrete environments/sectors.
4. Approach dissemination actions targeting different stakeholders.
5. The student will learn to use tools to develop systems using machine-learning algorithms in big data.
6. The student will learn about problems and industrial challenges through domain-based case studies.

COURSE OUTCOMES:

CO1. Ability to identify the characteristics of datasets and compare the trivial data and big data for various applications.

CO2. Ability to select and implement machine learning techniques and computing environment that are suitable for the applications under consideration.

CO3. Ability to solve problems associated with batch learning and online learning, and the big data characteristics such as high dimensionality, dynamically growing data and in particular scalability issues.

CO4. Ability to understand and apply scaling up machine learning techniques and associated computing techniques and technologies.

CO5. Ability to recognize and implement various ways of selecting suitable model parameters for different machine learning techniques.

CO6. Ability to integrate machine learning libraries and mathematical and statistical tools with modern technologies like hadoop and mapreduce.

Course Contents:

Unit 1 **[6 Hrs]**

Introduction: Types of Machine Learning , Machine Learning process, preliminaries, testing Machine Learning algorithms, turning data into probabilities, and Statistics for Machine Learning, Probability theory ,Probability Distributions ,Decision Theory.

Unit 2 **[6 Hrs]**

Supervised Learning: Linear Models for Regression , Classification, Discriminant Functions, Probabilistic Generative Models, Probabilistic Discriminative Models , Decision Tree Learning , Bayesian Learning, Naïve Bayes , Ensemble Methods, Bagging, Boosting, Neural Networks , Multilayer Perception, Feed-forward Network, Error Back propagation ,Support Vector Machines.

Unit 3 **[6 Hrs]**

Unsupervised Learning: Clustering-K-means , EM Algorithm, Mixtures of Gaussians , Dimensionality Reduction, Linear Discriminant Analysis, Factor Analysis, Principal Components Analysis, Independent Components Analysis.

Unit 4 **[6 Hrs]**

Discriminative Models: Least Square Regression, Gradient Descent Algorithm, Univariate and Multivariate Linear Regression, Prediction Model, probabilistic interpretation, Regularization, Logistic regression, multi class classification, Support Vector Machines- Large margin classifiers, Nonlinear SVM, kernel functions, SMO algorithm.

Unit 5 **[6 Hrs]**

Introduction to Big Data Analytics: Big Data Overview, State of the Practice in Analytics, Data Analytics Lifecycle, data analytics problems. Understanding features of R language, Understanding different Hadoop modes, Understanding Hadoop features, The HDFS and MapReduce architecture.

Unit 6 **[6 Hrs]**

Understanding the basics of MapReduce, The HadoopMapReduce, The HadoopMapReduce fundamentals, writing a HadoopMapReduce example, learning the different ways to write MapReduce in R. Integrating R and Hadoop – the RHIPE architecture and RHadoop.

Text Books:

1. Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2016.
2. EthemAlpaydin, "Introduction to Machine Learning", MIT Press, Third Edition, 2014.
3. Tom Mitchell, "Machine Learning", McGraw-Hill, 1997.
4. Big Data Analytics with R and Hadoop, VigneshPrajapati, PACKT Publishing, 2013.
5. Fundamentals of Business Analytics, R N Prasad and S Acharya, Wiley India, 2011

Reference Books:

1. Christopher Bishop, "Pattern Recognition and Machine Learning" Springer, 2007.
2. Stephen Marsland, "Machine Learning –An Algorithmic Perspective", Chapman andHall, CRC Press, Second Edition, 2014.
3. Randal S, "Python Machine Learning, PACKT Publishing, 2016

IT6L003	AD-HOC WIRELESS NETWORKS LAB	Credit 1

1. To be able to understand importance of ad-hoc network, NS3 and assembly programming languages.

2. To be able to understand about importance of various Interfaces.

List of Experiments:

1. Program in NS 3 to connect WIFI TO BUS(CSMA)

2. Program in NS 3 to create WIFI SIMPLE INFRASTUCTURE MODE 3. Program in NS

3 To create WIFI SIMPLE ADHOC MODE

4. Program in NS 3 to connect WIFI TO WIRED BRIDGING

5. Program in NS 3 to create WIFI TO LTE(4G) CONNECTION

6. Create a simple dumbbell topology, two client Node1 and Node2 on the left side of the dumbbell and server nodes Node3 and Node4 on the right side of the dumbbell. Let Node5 and Node6 form the bridge of the dumbbell. Use point to point links.

7. Program in NS3 for CREATING A SIMPLE WIFI ADHOC GRID

8. Create a wireless mobile ad-hoc network with three nodes Node1, Node2 and Node3. Install the OLSR routing protocol on these nodes

9. Setup a 5x5 wireless adhoc network with a grid. You may use examples/wireless/wifi-simple-adhoc-grid.cc as a base

10. Setup a 2-nodes wireless adhoc network. Place the nodes at a fixed distance in a 3d scenario

IT6L004	Machine Learning Lab	Credit 1

COURSE OBJECTIVES:

1. To understand the basic concepts and methods of machine learning.
2. To make use of some elementary machine learning techniques in the design of computer systems.
3. To develop a broad perspective about the applicability of ML algorithms in different fields.
4. To understand the major machine learning algorithms, the problem settings and assumptions that underlies them.
5. To possess insights, concerning the relative strengths and weaknesses of various common machine learning methods.

COURSE OUTCOMES:

After learning the course the student will be able:

1. To demonstrate knowledge of the machine learning literature.
2. To describe how and why machine learning methods work.

3. To demonstrate results of parameter selection.
4. To explain relative strengths and weaknesses of different machine learning methods.
5. To select and apply appropriate machine learning methods to a selected problem. 6. To implement machine learning algorithms on real datasets.

List of Experiments:

1. Implement and demonstratethe FIND-Salgorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithmto output a description of the set of all hypotheses consistent with the training examples. 3. Write a program to demonstrate the working of the decision tree based ID
3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge toclassify a new sample.
4. Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same.
5. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
6. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.

IT6L005	**Multimedia (Lab)**	**Credit 1**

COURSE OBJECTIVES:

1. Students will Gain an understanding of how to use Multimedia Software’s.

2. Students will Understandhow to create an Animation.

3. Students will study Animation Techniques.

4. Students will Study Animation Software.

COURSE OUTCOMES:

1. Students will be able to understand how to create their own Animations by using different Multimedia software.
2. Students will understand Flash8 software.
3. Students will understand background given techniques while creating Animation.
4. Students will understand how to simulate movement.

List of Practicals:

1. Create an Animation to Represent the Growing Moon.

2. Create an Animation to Indicate a Ball Bouncing on Steps.

3. Create an Animation to Simulate Movement of a Cloud.

4. Create Procedure to Draw the Fan Blades and to Give Proper Animation.

5. Create an Animation to Display the Background Given(Filename: Tulip.jpg) Through Your Name.

6. Create an Animation to Simulate a Ball Hitting Another Ball.

7. Create an Animation to Create an Animated Cursor UsingStartdrag("Ss", True); Mouse.hide();

8. Design a Visiting Card Containing At Least One Graphic and Text Information.

9. Take a Photographic Image. Give a Title for the Image. Put the Border. Write Your Names. Write the Name of Institution and Place.

10. Prepare Cover Page for The book in Your Subject Area. Plan Your Own Design.

11.Software: Flash8, adobe Photoshop 7.0

IT6P006	**Mini Project**	**Credit 1**

Evaluation Criteria: The total term work shall be of 50 marks. The 30 marks shall be distributed over internal assessments / reviews (at least 02 reviews) during the semester by a review

committee. The remaining 5 marks shall be distributed for attendance. The Head of the Department shall constitute the review committee. The student shall make presentation on the progress made before the committee. The 20marks of the practical will be awarded based on
the performance in the practical exam conducted by the University at the end of the semester.
General Suggestions and Expectations / Guidelines

• The project shall be developed in C++/JAVA/PYTHON

• The students may choose the theory concepts they studied in different subjects as project topic.

• Interdisciplinary project proposals and innovative projects are encouraged and more appreciable.

• The project topic can be suggested by the staff member or it can be proposed by the students.

• The project topic shall be approved by the project in-charge.

• The Guides are advised to give projects and suggest project titles focusing more on the current field ofresearch and ensure the level of innovation.

• A project team shall contain a maximum of 2 members.

• The project work should be properly distributed among the team members.

• Students should submit the project documentation at the beginning of the semester consisting of: Title, AbstractModules Split-upDeliverables for each reviewData Model (If Any)Details of Team Members

• Reviews for the project work will be conducted at regular intervals by the panel of examiners formed by theHead of the Department.

• The student failing to attend the project review will be subject to strict action as decided by the Head of theDepartment.

• Throughout the semester at any point of time if students are found to be involved in any of the following:

Using project codes available on the Internet

Using project codes developed by someone elseUsing project work which is already submitted in other institute or university Such students shall bedeclared failed or penalized as decided by the Examiners.

• The students must arrange regular meetings with the guide and present progress of project work.

• A Spiral bound Project report to be prepared as per the guidelines and format given by the Department

• The guides are advised to check for the formatting of the presentation and project report.

- Students must submit a report well before the end of the semester.

IT6T007	Intellectual Property Right (IPR)	1 Credit

Course Objectives :

1. To introduce fundamental aspects of Intellectual property Rights to students who are going to play a major role in development and management of innovative projects in industries.
2. To disseminate knowledge on patents, patent regime in India and abroad and registration aspects
3. To disseminate knowledge on copyrights and its related rights and registration aspects
4. To aware about current trends in IPR and Govt. steps in fostering IPR

Course Outcome :

CO 1: To provide an understanding of the law relating to Intellectual Property and Competition in India.

CO2: To understand the concept of Intellectual Property and Intellectual Property Rights with special reference to India.

CO3:To appreciate the significance of Intellectual Property in modern times, in the light of its international legal regime.

CO4:To study the important Agreements, Treaties and Conventions relating to Intellectual Property Rights.

CO5:To understand the intricacies of grant of Patent, Patentability, Licensing and Revocation at National and International levels.

Course Contents :

UNIT1: Introduction to IPRs, Basic concepts and need for Intellectual Property - Patents, Copyrights, Geographical Indications, IPR in India and Abroad Function of IPR. Public good, Incentive theory, different forms of IPR , Industrial Property, technological Research, Inventions and Innovations – Important examples of IPR.

UNIT 2: Practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad .Introduction to competition Law, Anti-competitive agreements, Abuse of dominance, Regulation of combinations,

UNIT3: International Treaties and Conventions on IPRs, TRIPS Agreement, PCT Agreement, Patent Act of India, Patent Amendment Act, Design Act, Trademark Act, Geographical Indication Act.

UNIT 4: The relationship and Interaction between IPR and competition law The economics of US Anti trustlaw,IP and competition issues,Technology transfer agreements. The EU experience with IP and Competition Law

UNIT5: Market allocation, Horizontal agreements, Vertical agreements, licensing issues.Indian Competition Act and IPR protection. Digital Innovations and Developments as Knowledge Assets – IP Laws, Cyber Law and Digital Content Protection – Unfair Competition – Meaning and Relationship between Unfair Competition and IP Laws – Case Studies.

Text Books :

1. Fundamentals ofIP for Engineers: K.Bansl&P.Bansal

2. Intellectual property right, Deborah, E. BoDcboux, Cengageleam'ng.

3. Inrelletul property right - Unleasbing the knowledgeconomy, PmbuddhaGanguli, Tata MccrawHiU Publishing Company Ltd.

Refrence Books:

1. Eleclronic resource guide ERc published online by the American Society of Intellectual Propery Rights md Develolment Policy: Repod of rhe

2. Commission on InrellectualPrcpertyRidls, London Sepiedber 2002

IT6P007	Campus Recruitment Training	1 Credit

About CRT Training Campus Recruitment training (CRT) at is designed to aid candidates in their preparation for Recruitment through Campuses or outside campuses (i.e On campus or off campus). Students in their final step of graduation looking for placement in reputed organizations can make use of this training to get trained to deliver their best in the selection processes of organizations.

COURSE OBJECTIVES

1. To enhance the problem solving skills, to improve the basic mathematical skills and to help students who are preparing for any type of campus recruitment drive.
2. To groom the students to the corporate level
3. To ensure that all eligible students are employed by the end of the final year of study.

COURSE OUTCOMES

At the end of the course students will be able to

1. Solve the problems easily by using Short-cut method with time management which will be helpful to them to clear the competitive exams for better job opportunity.
2. Analyze the Problems logically and approach the problems in a different manner.
3. Students will be able to apply mathematical analysis of data to make connections, draw conclusions and solve problems.
4. Students will learn a series of techniques through practical activities to develop presenting skills and enhance confidence to expand the potential of the individual.
5. Students can produce a resume that describes their education, skills, experiences and measurable achievements with proper grammar, format and brevity.
6. Students demonstrate an ability to target the resume to the presenting purpose
7. Demonstrate professional behavior(s) including preparedness, professional attire, and respectful presentation during interviews.

PART I: - QUANTITATIVE ABILITY

Unit 1: - 03 hrs

Speed Maths Calculation, Number Systems, Ratio & Proportion, Percentage

Unit 2: - 03 hrs

Profit – Loss & Discount, Simple Interest & Compound Interest, Simple Equation and Age's

Unit 3:- 03 hrs

Averages Mixture & Allegation, Time and work, Time Speed & Distance, Permutation – Combination & Probability

PART II: - REASONING ABILITY

Unit 1: - 03 hrs

Coding Decoding, Blood Relation, Direction sense, Number Series, Analogy

Unit 2: - 03 hrs

Sitting Arrangement, Puzzles.

Unit 3:- 03 hrs

Syllogism, Statement course of action, Statement arguments, Statement Assumptions, Miscellaneous Type of Reasoning

PART III: - Employability Skills

Unit 1: - Presentation Skills (02 hrs)

What is a presentation? Essential characteristics of Good presentation.

Preparation of presentation: Identify the purpose, Analyze the audience, Design and organize the information, Medium of presentation and Visual aids

Delivering Presentation: rehearsal, body Language, Handling questions, Tips to fight stage fear.

Unit 2: - Job Interview Skills (02 hrs)

Types of interviews, Focus of interview, dress code, importance of body language.

Probable interview questions, Telephonic and video interview, Strategies for success at interview.

Unit 3: - Resume Building (02 hrs)

Meaning, Difference among Bio-data, Curriculum vitae and Resume.

CV writing tips, The content of Resume, Structure of Resume

Books

1. Prashant Sharma, SOFT SKILLS PERSONALITY DEVELOPMENT FOR LIFE SUCCESS. BPB Publication.
2. P. D. Chaturvedi & Mukesh Chaturvedi, Business Communication: Concepts, Cases, and Applications 2nd Edition. Pearson Education.
3. Barun Mitra, Personality Development and Soft Skills. Oxford University Press.
4. Dr.K.Alex, *Soft Skills Know yourself and Know the World*. S.ChandPublishing, 2014
5. R.S Agrawal, Quantitative Aptitude.
6. Arun Sharma, How to Prepare for Quantitative Aptitude.
7. R. S Agrawal, Verbal and Non Verbal Reasoning.
8. R.V.Praveen,Quantitative Aptitude and Reasoning, 2nd Revised Edition 2013, Prentice-Hall of India Pvt.Ltd.
9. G. K. Ranganath, C. S. Sampangiram and Y. Rajaram, A text Book of business Mathematics, 2008, Himalaya Publishing House

JAIDEV EDUCATION SOCIETY'S

J D COLLEGE OF ENGINEERING AND MANAGEMENT

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At: Khandala, Post- Valni, Kalmeshwar Road, Nagpur

Department of Information Technology

"Progress Beyond Excellence"

Session: 20220-23

Course Structure and Syllabus (Autonomous)

For

B. Tech. Information Technology Programme

Course Structure and Syllabus

For

B. Tech. Information Technology Programme

Curriculum for Semester- VII [Fourth Year]

7th Semester

Sr. No.	**Category of Subject**	**Course Code**	**Course Name**	**Teaching Scheme**			**Evaluation Scheme**				Credit
				L	T	P	CA	MSE	ESE	Total	
1	ESC	IT7T001	Data Science	2	1	0	20	20	60	100	3
2	PCC	IT7T002	Artificial Intelligence & Cognitive Robotics	3	0	0	20	20	60	100	3
2	PEC	IT7TE04	Elective-IV	2	1	0	20	20	60	100	3
3	PEC	IT7TE05	Elective -V	2	1	0	20	20	60	100	3
5	OEC	IT7O003	OPEN Elective -III	3	0	0	20	20	60	100	4
6	ESC	IT7L002	Data Science using R (Lab)	0	0	2	60	0	40	100	1
7	PEC	IT7L003	Middleware Technolgies(Lab)	0	0	2	60	0	40	100	1
8	PROJECT	IT7P004	Project Phase I	0	0	6	50	0	50	100	3
9	MC	IT7T005	Research Methodology	2	0	0	15	10	25	50	Audit
				14	**3**	**10**	**285**	**110**	**455**	**850**	**21**

Open Elective-3 : Cloud Computing & Storage Management

IT7T001	Data Science	3 Credit

COURSE OBJECTIVES:

1. To Understand the basic concepts used in data Science

2. To Understand data collection and pre-processing

3. To Understand problems solving using data science

4 To Introduce concepts of Data Collection and Data Pre-Processing

5. To develop skills in students to solve applications based problems on Data Science

COURSE OUTCOMES:

After learning the course the student will be able:

1. To build the fundamentals of Data Science.

2. To apply Data Collection and Data Preprocessing Strategies.

3. To compare and choose data visualization method for effective visualization of data

4. To implement regression models, model evaluation and validation

5. To test Multiple Parameters by using Grid Search

Course Contents:

Unit 1 **[7 Hrs]**

Introduction to Data Science : What is Data Science, importance of data science, Big data and data Science, The current Scenario, Industry Perspective Types of Data: Structured vs. Unstructured Data, Quantitative vs. Categorical Data, Big Data vs. Little Data, Data science process, Role Data Scientist.

Unit 2 **[7 Hrs]**

Data Collection and Data Pre-Processing : Data Collection Strategies, Data Pre-Processing Overview, Data Cleaning, Data Integration and Transformation, Data Reduction, Data Discretization.

Unit 3 **[7 Hrs]**

Exploratory Data Analytics : Descriptive Statistics, Mean, Standard Deviation, Skewness and Kurtosis, Box Plots, Pivot Table, Heat Map, Correlation Statistics.

Unit 4 **[8 Hrs]**

Model Development : Simple and Multiple Regression, Model Evaluation using Visualization, Residual Plot, Distribution Plot, Polynomial Regression and Pipelines, Measures for In-sample Evaluation, Prediction and Decision Making, Feature Engineering

Unit 5 **[7 Hrs]**

Model Evaluation : Generalization Error, Out-of-Sample Evaluation Metrics, Cross Validation, Overfitting, Under Fitting and Model Selection, Prediction by using Ridge Regression, Testing Multiple Parameters by using Grid Search

Text Books:

1. JojoMoolayil, “Smarter Decisions: The Intersection of IoT and Data Science”, PACKT, 2016.
2. Cathy O’Neil and Rachel Schutt , “Doing Data Science”, O'Reilly, 2015
3. David Dietrich, Barry Heller, Beibei Yang, “Data Science and Big data Analytics”, EMC 2013
4. Raj, Pethuru, “Handbook of Research on Cloud Infrastructures for Big Data Analytics”, IGI Global.

Reference Books:

1. Cathy O’Neil and Rachel Schutt. Doing Data Science, Straight Talk From The Frontline. O’Reilly.
2. Jure Leskovek, Anand Rajaraman and Jeffrey Ullman. Mining of Massive Datasets. v2.1,Cambridge University Press.
3. Laura Igual and Santi Segui, Introduction to Data Science: A Python Approach to Concepts, Techniques

IT7T002	**Artificial Intelligence and Cognitive Robotics**	**3 Credit**

Course Objective:

1. Learn about knowledge for the design of robotics.
2. Understand robot kinematics and robot programming.
3. Understand application of Robots.
4. Learn about force and torque sensing.
5. To learn about application of robot.

Course Outcomes:

Upon Completion of this course the student will be able to:

1. List the objectives and functions of modern Artificial Intelligence.
2. Categorize an AI problem based on its characteristics and its constraints.
3. Have a glance at machine learning algorithms and extracting knowledge models from data.
4. Learn different logic formalisms and decision taking in planning problems.
5. Learn how to analyze the complexity of a given problem and come with suitable optimizations.

Unit -I: Introduction to Artificial Intelligence ,Features of AI , Agents and Environments, structure of agents, problem solving agents, problem formulation, AI techniques- search knowledge.

[7 Hrs]

Unit- II: Searching- Searching for solutions, uniformed search strategies – Breadth first search, depth first Search. Search with partial information (Heuristic search) Hill climbing, A* ,AO* Algorithms, Problem reduction, Game Playing-Adversial search, Games, mini-max algorithm, optimal decisions in multiplayer games, Problem in Game playing, Alpha-Beta pruning, Evaluation functions.

[7 Hrs]

Unit -III: Knowledge Representation& Learning, Uncertainty, probabilistic reasoning-Bayesian Network, probabilistic reasoning over time-Inference in temporal Model, Hidden Markov models-Kalman filters, Dynamic Bayesian Network, speech recognition **[8 Hrs]**

Unit IV: Learning: Concept of learning, learning automation, genetic algorithm, learning by inductions, neural nets. Programming Language: Introduction to programming Language. Handling Uncertainties: Non-monotonic reasoning, Probabilistic reasoning, use of certainty factors, Fuzzy logic

[7 Hrs]

Unit -V: AI in Cognitive Robotics: Robotic perception, localization, mapping- configuring space, planning uncertain movements, dynamics and control of movement, Ethics and risks of artificial intelligence in robotics. Case study of AI in robotics. **[7 Hrs]**

References:

1. Stuart Russell, Peter Norvig, Artificial Intelligence: A modern approach, Pearson Education, India.

2. Negnevitsky, M, Artificial Intelligence: A guide to Intelligent Systems,. Harlow: Addison-Wesley,2002.

3. E. Rich and K. Knight, “Artificial intelligence”, TMH, 2nd ed..

4. Nilsson, N. J. (1986). Principles of artificial intelligence. Morgan Kaufmann.

5. Craig, J. J. (2009). Introduction to robotics: mechanics and control, 3/E. Pearson Education India.

6. D.W. Patterson, “Introduction to AI and Expert Systems”, PHI, 1992.

7. Peter Jackson, “Introduction to Expert Systems”, AWP, M.A., 1992.

8. R.J. Schalkoff, “Artificial Intelligence - an Engineering Approach”,

IT7TE04A	Computational Intelligence	3 Credit

Course Objectives:

1. Understand the basic techniques, theory and computational models of Fuzzy and Soft computing.

2. Understand several neural network algorithms over real-time problems to get optimized outcome

Course Outcomes: After completing the course, the students will be able to
CO1: To provide a strong foundation on fundamental concepts in Computational Intelligence.
CO2: To enable Problem-solving through various searching techniques.
CO3: To apply these techniques in applications which involve perception, reasoning and learning.
CO4: To apply Computational Intelligence techniques for information retrieval
CO5: To apply Computational Intelligence techniques primarily for machine learning.
CO6: To Apply fuzzy principles and thinking to deal with vulnerability and tackle realtime issues

Unit 1 **[7 Hrs]**

Introduction to Computational Intelligence:
Computational Intelligence Paradigms, Introduction to Fuzzy logic, Fuzzy sets and membership functions, Operations on Fuzzy sets, Fuzzy relations, rules, propositions, implications and inferences, Defuzzification techniques, Fuzzy logic controller design.

Unit 2 **[7 Hrs]**

Artificial Neural Networks:

Artificial Neuron, Supervised Learning Neural Networks, Unsupervised Learning Neural Networks, Performance Issues (Supervised Learning), Performance Measures, Accuracy, Complexity, Convergence.

Unit 3 **[7 Hrs]**

Evolutionary Computation:

Introduction to Evolutionary Computation, Genetic Algorithms: Crossover, mutation, selection, Differential evolution algorithm, Hybrid Differential Evolution Strategies, Differential Evolution for Discrete-Valued Problems.

Unit 4 **[7 Hrs]**

Multi-objective Optimization Problem Solving:

Concept of multi-objective optimization problems (MOOPs) and issues of solving them, MultiObjective Evolutionary Algorithm (MOEA), Non-Pareto approaches to solve MOOPs, Paretobased approaches to solve MOOPs, Some applications with MOEAs.

Unit 5 **[8 Hrs]**

Applications of Computational Intelligent Techniques:

In solving single- objective and multi-objective optimization, scheduling problem, Parameter Estimation for Frequency-Modulated (FM) Sound Waves, Lennard-Jones Potential Problem, Gear Train Problem, Pressure vessel optimization problem, Welded beam design optimization problem

Text Books:

1. A. P. Engelbrecht, Computational Intelligence: An Introduction, John Wiley & Sons, 2007.

2. Fuzzy Logic with Engineering Applications (3rd Edn.), Timothy J. Ross, Willey, 2010.

Reference-Books:

1. NeuralNetworks: A Comprehensive Foundation, SimonHaykin. Prentice Hall

2. Neural Network Design, M. T. Hagan, H. B. Demuth, Mark Beale, Thomson Learning, Vikash Publishing House.

IT7TE04B	Computer Forensics	3 Credit

Course Objectives:

• To study the fundamentals of Computer Forensics

• To learn, analyze and validate Forensics Data

Course Outcomes:

Upon completion of the course students would be able to:

1. Conduct a computer forensics investigation, including the concept of the chain of evidence.
2. Report findings from digital forensic investigations.
3. Perform recovery of digital evidence from various digital devices using a variety of software utilities.
4. To explain the tools and tactics associated with Cyber Forensics

Unit-1 **[7 Hrs]**

Digital forensic Computer forensics and investigations as a profession, Understanding computer forensics, computer forensics versus other related disciplines, History of computer Forensics, Understanding case laws, Developing computer forensics resources, Preparing for computer investigations, Understanding law enforcement agency investigations and legal process, Understanding corporate investigations, Establishing company policies, Displaying warning Banners.

UNIT – 2 **[7 Hrs]**

Windows Systems and artifacts Windows Systems and Artifacts: Introduction, Windows File Systems, File Allocation Table, New Technology File System, File System Summary, Registry, Event Logs, Prefetch Files, Shortcut Files, Windows Executables.

UNIT – 3 **[7 Hrs]**

Linux Systems and artifacts Linux Systems and Artifacts: Introduction, Linux File Systems, File System Layer, File Name Layer , Metadata Layer, Data Unit Layer, Journal Tools, Deleted Data, Linux Logical Volume Manager, Linux Boot Process and Services, System V , BSD, Linux System Organization and

Artifacts, Partitioning, File system Hierarchy, Ownership and Permissions, File Attributes, Hidden Files, User Accounts , Home Directories.

UNIT – 4 **[7 Hrs]**

Current Computer Forensics Tools Evaluating Computer Forensics Tool Needs, Types of Computer Forensics Tools, Tasks Performed by Computer Forensics Tools, Tool Comparisons, Command-Line Forensics Tools, UNIX/Linux Forensics Tools, Other GUI Forensics Tools, Computer Forensics Hardware Tools, Forensic Workstations, Write-Blocker, Cyber forensics tools and case studies.

Unit-5 **[8 Hrs]**

Identification of data: Timekeeping, Forensic Identification and Analysis of Technical Surveillance Devices, Reconstructing Past Events: Digital Detective, Types of File Formats, Converting Files, Investigating Network Intrusions and Cyber Crime, Network Forensics and Investigating logs, Investigating network Traffic, Investigating Web attacks ,Router Forensics.

Text book:

Davis, Philipp, and Cowen, Hacking Exposed: Computer Forensics, McGraw-Hill Education

References:

1. Cory Altheide, Harlan Carvey, Digital Forensics with Open Source Tools, Syngress imprint of Elsevier.

2. Bill Nelson, Amelia Phillips, Christopher Steuart, “Guide to Computer Forensics and Investigations”, Fourth Edition, Course Technology.

3. Angus M.Marshall, “Digital forensics: Digital evidence in criminal investigation”, John – Wiley and Sons, 2008.

IT7TE04C	Robotics & Automation	3 Credit

Course Learning Objectives:

The students will be able to
1. Understand the concepts of robotics and automation.
2. Impart the knowledge of robotic programming and robotic operation control
3. Selection and analysis of robot configuration and kinematics
4. Importance of automation manufacturing techniques and processing industries
5. Development of automation system for manufacturing and processing industries

Course Outcomes:

After completing the course, the students will be able to
CO1: Understand the characteristics and working principle of robots.
CO2: Apply the related mathematical model to formulate the kinematics and trajectory planning of industrial robot.
CO3: Analyse the machine vision for effective Flexible Manufacturing Systems.
CO4: Develop model and integrate drives for industrial robots and automation systems.
CO5: Understand distributed data processing in FSM.
CO6: Work on the robotic automation.

Unit 1 **[6Hrs]**

Introduction:
Basics of kinematics, Anatomy of robot, Robot configuration, Robot joints, Sensors and drive system, Control modes, Specification of robots, Robot programming methods.

Unit 2 **[7Hrs]**

Robot-Kinematics :
Position and orientation of objects, Objects coordinate frame, Rotation matrix, Euler angles roll, pitch and yaw angles coordinate transformations, Joint variables and position of end effector, Homogeneous transformation. D-H parameters and conventions, D-H matrix, Direct kinematic and inverse analysis of planar and 3 DoF robots.

Unit 3 **[8Hrs]**

Trajectory planning:
Introduction, Path versus trajectory, Joint-space versus Cartesian-space descriptions, Basics of trajectory planning, Joint-space trajectory planning, Third-order and Fifth-order polynomial trajectory planning.
Automation in Production Systems - Manufacturing support systems, Automation principles and strategies, Levels of Automation, Production Concepts and Mathematical models, Numericals

Unit 4 **[8Hrs]**

Machine Vision:
Object recognition by features, Basic features used for object identification, Moments, Template matching,Discrete Fourier descriptors, Computed Tomography (CT), Depth measurement with vision systems, Scene analysis versus mapping, Range detection and Depth analysis, Stereo imaging, Scene analysis with shading and sizes, Specialized lighting, Image data compression, Intraframe spatial

domain techniques, Interframe coding, Compression techniques, Colour images, Heuristics, Applications of vision systems.

Unit 5 **[7 Hrs]**

Robotics Hands on :- Design of Robotics Arm in proteus using Arduino programming , Line following robot using Arduino in proteus with Arduino code, Design of robotic car using Proteus.

Text Books:

1 Mohsen Shahinpoor, “A Robot Engineering Textbook”, Harper & Row Publishers, 3rd Edition, New York, ISBN:006045931X

2 John J. Craig, “Introduction to Robotics”, Pearson Education International, 3rd Edition, ISBN:109876543, 1-13-123629-6

Reference-Books:

1. Mikell P Groover, “Automation, Production Systems, and Computer-integrated Manufacturing”, Pearson Publishing, 3rd Edition, 2014, ISBN 978 81 203 3418 2

2. Joseph Talavage, “Flexible Manufacturing Systems in Practice Design: Analysis and Simulation”, CRC Press, 1987, ISBN 9780824777180

IT7TE04D	Natural Language Processing	3 Credit

Course Learning Objectives:

1. To familiarize the concepts and techniques of Natural language Processing for analyzing words based on Morphology and CORPUS.
2. To relate mathematical foundations, Probability theory with Linguistic essentials such as syntactic and semantic analysis of text.
3. To apply the Statistical learning methods and cutting-edge research models from deep learning.

Course Outcomes:
After completing the course, the students will be able to

1. Apply the principles and Process of Human Languages such as English and other Indian Languages using computers.
2. Realize semantics and pragmatics of English language for text processing.
3. Create CORPUS linguistics based on digestive approach (Text Corpus method)
4. Check a current methods for statistical approaches to machine translation.
5. Perform POS tagging for a given natural language and Select a suitable language modelling technique based on the structure of the language.
6. Demonstrate the state-of-the-art algorithms and techniques for text-based processing of natural language with respect to morphology

Unit 1: Introduction to NLP **[7 Hrs]**

Introduction to NLP - Various stages of NLP –The Ambiguity of Language: Why NLP Is DifficultParts of Speech: Nouns and Pronouns, Words: Determiners and adjectives, verbs, Phrase Structure. Statistics Essential Information Theory : Entropy, perplexity, The relation to language, Cross entropy.

Unit 2: Text Preprocessing and Morphology **[7 Hrs]**

Character Encoding, Word Segmentation, Sentence Segmentation, Introduction to Corpora, Corpora Analysis. Inflectional and Derivation Morphology, Morphological analysis and generation using Finite State Automata and Finite State transducer.

Unit 3: Language Modelling **[7 Hrs]**

N gram models, Smoothing, Part of speech tagging, Hidden Markov models, Viterbi algorithm, Forward - backward algorithm, EM training, Models for Named Entity Recognition, Neural Language Models - Recurrent Neural Networks and Long Short term Memory networks

Unit 4: Word Sense Disambiguation **[8 Hrs]**

Methodological Preliminaries, Supervised Disambiguation: Bayesian classification, An informationtheoretic approach, Dictionary-Based Disambiguation: Disambiguation based on sense, Thesaurusbased disambiguation, Disambiguation based on translations in a second-language corpus.

Unit 5: Markov Model and POS Tagging **[7 Hrs]**

Markov Model: Hidden Markov model, Fundamentals, Probability of properties, Parameter estimation, Variants, Multiple input observation. The Information Sources in Tagging: Markov model taggers, Viterbi algorithm, Applying HMMs to POS tagging, Applications of Tagging

Text Books:

1. Christopher D. Manning and Hinrich Schutze, " Foundations of Natural Language Processing" , 6 th Edition, The MIT Press Cambridge, Massachusetts London, England, 2003
2. Daniel Jurafsky and James H. Martin "Speech and Language Processing", 3rd edition, Prentice Hall, 2009.

References:

1. NitinIndurkhya, Fred J. Damerau "Handbook of Natural Language Processing", Second Edition, CRC Press, 2010.
2. James Allen "Natural Language Understanding", Pearson Publication 8th Edition. 2012..
3. Chris Manning and HinrichSchütze, "Foundations of Statistical Natural Language Processing", 2nd edition, MITPress Cambridge, MA, 2003.
4. Hobson lane, Cole Howard, Hannes Hapke, "Natural language processing in action" MANNING Publications, 2019.

IT7TE05A	**Advanced Computer Vision**	**3 Credit**

Course Learning Objectives:

1. To build an understanding on detailed models of image formation.
2. To expose the students to image feature detection and matching.
3. To introduce fundamental algorithms for pattern recognition.
4. To introduce various classification techniques.
5. To expose the students to various structural pattern recognition and feature extraction techniques.

Course Outcomes:

After completing the course, the students will be able to

1. Appreciate the detailed models of image formation.
2. Analyse the techniques for image feature detection and matching.
3. Apply various algorithms for pattern recognition.
4. Examine various clustering algorithms.
5. Analyze structural pattern recognition and feature extraction techniques.
6. Explain various image models

Unit 1 **[6 Hrs]**

Image formation and Image model- Components of a vision system- Cameras- camera model and camera calibration- Radiometry- Light in space- Light in surface - Sources, shadows and shading .

Unit 2 **[7 Hrs]**

Multiple images-The Geometry of multiple views- Stereopsis- Affine structure from motion- Elements of Affine Geometry Affine structure and motion from two images- Affine structure and motion from multiple images- From Affine to Euclidean images.

Unit 3 **[7 Hrs]**

High level vision- Geometric methods- Model based vision- Obtaining hypothesis by pose consistency, pose clustering and using Invariants, Verification.

Unit 4 **[8 Hrs]**

Introduction to pattern and classification, supervised and unsupervised learning, Clustering Vs classification, Bayesian Decision Theory- Minimum error rate classification Classifiers, discriminant functions, decision surfaces- The normal density and discriminant-functions for the Normal density.

Unit 5 **[8 Hrs]**

Linear discriminant based classifiers and tree classifiers

Linear discriminant function based classifiers- Perceptron- Minimum Mean Squared Error (MME) method, Support Vector machine, Decision Trees: CART, ID3.

Text Books:

1. Bernd Jahne and Horst HauBecker, Computer vision and Applications, Academic press, 2000.
2. David A. Forsyth & Jean Ponce, Computer vision – A Modern Approach, Prentice Hall, 2002.

References

1. C. M. Bishop, Pattern Recognition and Machine Learning, Springer, 2006.
2. R. O. Duda, P. E. Hart and D. G. Stork, Pattern Classification, John Wiley, 2001.
3. Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, 2004.
4. S. Theodoridis and K. Koutroumbas, Pattern Recognition, 4th Ed., Academic Press, 2009.

IT7TE05B	AI in Digital Forensic	3 Credit

Course Objective:

On completion of the course, Students will be able to–

1. Understand the basic digital forensics concepts and techniques for conducting the forensic examination on different digital devices.
2. Understand how to examine digital evidences gathered through such as the data acquisition, identification analysis.
3. Understand the basics of Computer forensics and cyber forensics, mobile phone forensics, network forensics, Email forensics and web forensics etc.

Course Outcomes: Student will be able to

1. Describe digital forensics and relate it to an investigative process.
2. Explain the legal issues of preparing for and performing digital forensic analysis based on the investigator's position and duty.
3. Perform basic digital forensics.
4. Demonstrate use of digital forensics tools.
5. Guide a digital forensics exercise.
6. Recognize the state of the practice and the gaps in technology, policy, and legal issues.

Unit I **[7 hrs]**

Basic Definitions and terminology of AI:, Foundation and History of AI, Overview of AI problems, Evolution of AI,- Applications of AI, Classification/Types of AI. Artificial Intelligence vs Machine learning. Intelligent Agent: Types of AI Agent, Concept of Rationality, nature of environment, structure of agents. Turing Test in AI.

Unit II **[7 hrs]**

Search Algorithms in Artificial Intelligence: Terminologies, Properties of search Algorithms, Types of search algorithms: uninformed search and informed search, State Space search Heuristic Search Techniques: Generate-and-Test; Hill Climbing; Properties of A* algorithm, Best-first Search; Problem Reduction. Constraint Satisfaction problem: Interference in CSPs; Back tracking search for CSPs; Local Search for CSPs; structure of CSP Problem.

Unit III **[8 hrs]**

Knowledge-Based Agent in Artificial intelligence: Architecture, Approaches to designing a knowledge- based agent, knowledge representation: Techniques of knowledge representation, Propositional logic, Fundamentals of Digital Forensics Foundations of Digital Forensic: Digital evidence, Awareness, Principles of Digital Forensic, Challenging aspects of digital evidence, Cybertrail. Language of Computer Crime Investigation: Role of Computers in crime, Cybercrime law, offenses, jurisdiction. Traffic analysis, Fraud, IT Act.

Unit IV **[7 hrs]**

Processing Computer Crime : Introduction to Crime Scenes, Seizing and storing digital evidence at scene, Documenting the Scene and the Evidence , Dealing with Live Systems and Dead Systems, Using Hashing to Verify the Integrity of Evidence

Unit V **[7 hrs]**

Data Acquisition and Data Recovery - Understanding storage formats and digital evidence, determining the best acquisition method, acquisition tools, validating data acquisitions, performing RAID data acquisitions, remote network acquisition tools, other forensics acquisitions tools Data Recovery : Data Backup and Recovery, The Role of Backup in Data Recovery, The Data-Recovery Solution Hiding and Recovering Hidden Data , Data Handling tools

Textbooks:

1. Digital Evidence Computer Crime – Forensic science, Computers & The Internet', Eoghan Casey, 3rd edition
2. 'Computer Forensics Computer Crime scene investigation', 2nd edition, Johm R. Vacca
3. Russell, S. and Norvig, P. 2015. Artificial Intelligence - A Modern Approach, 3rd edition, Prentice Hall

Reference Books:

1. 'Computer Forensics Investigating Network Intrusions & Cybercrime', EC–Council press, Cengage Learning
2. Guide to Computer Forensics & Investigations, 4th edition, Bill Nelson, Amelia Phillips & Christopher Steuart, Cengage Learning
3. Introduction to Artificial Intelligence & Expert Systems, Dan W Patterson, PHI., 2010 2. S Kaushik, Artificial Intelligence, Cengage Learning, 1st ed.2011.

IT7TE05C	Brain Machine Interface & Interaction	3 Credit

Course Learning Objectives:
1. Understand the basic concepts of brain computer interface, interface types, EEG signals.
2. Study the state of art in neuroimaging-based approaches and their related applications and Brain Computer Interface system.
3. Analyse the different Non-invasive Electromagnetic Methods.
4. Demonstrate the concept of Data Streaming and Data Processing using suitable tool.
5. Understand the ethical issues pertaining to the development and use of Brain Computer Interface technology.
6. Understand the brain interactive system and techniques.

Course Outcomes: After completing the course, the students will be able to
CO1: Study the utilization of drives system related to the electroencephalogram (EEG) signals for neuro rehabilitation.
CO2: Understand the concept of Brain Computer Interface Systems that can be designed and developed with the overall goal of supporting a wide range of users for a wide range of applications.
CO3: Process multi-channel EEG data using a suitable tool in the computing environment which will be helpful for developing, prototyping and testing Brain Computer Interface approaches.
CO4: Solve the interoperability and standardization issues of Brain Computer Interface software platforms.
CO5: To identify and design new applications of Brain Computer Interface.
CO6: Understand the brain interactive system and techniques.

Unit 1 **[7 Hrs]**

Basics of Brain Computer Interface: Introduction, Brain Anatomy, Brain Computer Interface Types, Types of BCI Signals, Components of Interest, Monitoring Brain Activity Using EEG, BCI System, BCI Monitoring Hardware and Software, Brain Computer Interface applications, BCI Trends.

Unit 2 **[7 Hrs]**

Brain Computer Interface: A Review: Introduction, Neuroimaging-Based Approaches in the BCI, Control Signals in BCI Systems- EEG Signal Processing for BCI, Pre-processing Techniques, Feature Extraction, Classification Methods and Post-processing, Classification Performance Metrics.

Unit 3 **[7 Hrs]**

Non-invasive Electromagnetic Methods for Brain Monitoring: A Technical Review Introduction, Human Brain Anatomy, Brain Diseases, Non-invasive Brain Monitoring, Electromagnetic Brain Monitoring Methods.

Unit 4 **[8 Hrs]**

Tools for BCI Research: Introduction, Data Streaming- Field-Trip, Data-Suite: Data-River and Mat-River, Data River, Mat River, EEG LAB, Online Data Processing-A Minimalistic BCI Script, BCI LAB, Other Classification Tools, Other existing, Paradigms of interaction for BCIs Tools.

Unit 5 **[7 Hrs]**

Applications for Brain-Computer Interfaces: Introduction, BCIs for Assistive Technology, BCIs for Recreation, BCIs for Cognitive Diagnostics and Augmented Cognition, Rehabilitation and Prosthetics.

Text Books:

1. Brain-Machine Interfaces Methods and Perspectives, **Maureen Clerc,Laurent Bougrain, Fabien Lotte**, ISBN: 978-1-848-21826-0, Wiley-ISTE.
2. Brain-Computer Interfaces Current Trends and Applications, Aboul Ella Hassanien, Ahmad Taher Azar,Volume 74, Springer International Publishing2015, ISBN: 978-3-319-10977-0, DOI:10.1007/978-3-319-10978-7
3. Brain Computer Interfaces-Applying Your Minds to Human-Computer Interaction, Desney S. Tan,Anton Nijholt, ISBN: 978-1-84996-271-1, DOI: 10.1007/978-1-84996-272-8

ReferenceBooks:

1.Brain–Computer Interfaces Handbook-Technological and Theoretical Advances, Chang S. Nam,AntonNijholt, Fabien Lotte, Taylor & Francis 2018, ISBN: 13: 978-1-4987-7343-0
2. Brain-Computer Interfacing -an Introduction, Rajesh P.N.Rao,2013, ISBN: 978-0-521-76941-9

IT7TE05D	Virtual Reality	3 Credit

Course Objective:

1. Understand how the design of VR technology relates to human perception and cognition.
2. Discuss applications of VR to the conduct of scientific research, training, and industrial design.
3. Gain first-hand experience with using virtual environment technology, including 3D rendering software, tracking hardware, and input/output functions for capturing user data.
4. Learn the fundamental aspects of designing and implementing rigorous empirical experiments using VR.
5. Learn about multimodal virtual displays for conveying and presenting information and techniques for evaluating good and bad virtual interfaces.

Course Outcomes:

CO1:Describe how VR systems work and list the applications of VR.
CO2:Understand the design and implementation of the hardware that enables VR systems tobe built.
CO3:Understand the system of human vision and its implication on perception and rendering.
CO4: Explain the concepts of motion and tracking in VR systems.
CO5:Describe the importance of interaction and audio in VR systems.

Course Contents:

Unit I: Introduction to Virtual Reality **[8 Hrs]**

Defining Virtual Reality, History of VR, Human Physiology and Perception, Key Elements of Virtual Reality Experience, Virtual Reality System, Interface to the Virtual World-Input & output- Visual, Aural & Haptic Displays, Applications of Virtual Reality.

Unit II:Representing the Virtual World **[7 Hrs]**

Representation of the Virtual World, Visual Representation in VR, Aural Representation in VR and Haptic Representation in VR

Unit III: The Geometry of Virtual Worlds &The Physiology of Human Vision **[7 Hrs]**

Geometric Models, Changing Position and Orientation, Axis-Angle Representations of Rotation, Viewing Transformations, Chaining the Transformations, Human Eye, eye movements & implications for VR.
7

Unit IV: Visual Perception & Rendering **[7 Hrs]**

Visual Perception - Perception of Depth, Perception of Motion, Perception of Color, Combining Sources of Information Visual Rendering -Ray Tracing and Shading Models, Rasterization, Correcting Optical Distortions, Improving Latency and Frame Rates

Unit V:- Motion & Tracking **[7 Hrs]**

Motion in Real and Virtual Worlds- Velocities and Accelerations, The Vestibular System, Physics in the Virtual World, Mismatched Motion and Vection Tracking- Tracking 2D & 3D Orientation, Tracking Position and Orientation, Tracking Attached Bodies

Text Books:

1. Virtual Reality, Steven M. LaValle, Cambridge University Press, 2016
2. Understanding Virtual Reality: Interface, Application and Design, William R Sherman and Alan B Craig, (The Morgan Kaufmann Series in Computer Graphics)". Morgan Kaufmann Publishers, San Francisco, CA, 2002
3. Developing Virtual Reality Applications: Foundations of Effective Design, Alan B Craig, William R Sherman and Jeffrey D Will, Morgan Kaufmann, 2009.

Reference Books:

1. Gerard Jounghyun Kim, "Designing Virtual Systems: The Structured Approach", 2005.
2. Doug A Bowman, Ernest Kuijff, Joseph J LaViola, Jr and Ivan Poupyrev, "3D User Interfaces, Theory and Practice", Addison Wesley, USA, 2005.
3. Oliver Bimber and Ramesh Raskar, "Spatial Augmented Reality: Meging Real and Virtual Worlds", 2005.
4. Burdea, Grigore C and Philippe Coiffet, "Virtual Reality Technology", Wiley Interscience, India, 2003.

IT7O003	Cloud Storage Management-III(Open Elective)	4 Credit

Course Objectives:

1. To learn the concept of cloud Computing and Storage Management.
2. To understand the trade-off between deploying applications in the cloud over local infrastructure.
3. To identify different storage virtualization technologies and their benefits.
4. To understand and articulate business continuity solutions including backup and recovery technologies, local and remote replication solutions.

Course Outcomes:

After learning the course the student will be able:

1. To understand the key dimensions of the challenge of Cloud Computing.
2. To assess the economics, financial and technological implications for selecting Cloud Computing for organization.
3. To describe and apply storage technologies.
4. To identify leading storage technologies that provide cost-effective IT solutions for medium to large scale businesses and data centers.
5. To describe important storage technology features such as availability, replication, scalability and performance.

Course Content:

UNIT I Introduction: [9 Hrs]

Distributed Computing and Enabling Technologies, Cloud Fundamentals: Cloud Definition, Evolution, Architecture, Applications, Deployment models and service models, Cloud Storage Virtualization technologies and architectures, Cloud Storage Virtualization of data centers and Issues with Multi-tenancy.

UNIT II Implementation: [10 Hrs]

Study of Cloud computing Systems like Amazon EC2 and S3, Google App Engine and Microsoft Azure,Build Private/Hybrid Cloud using open source tools, Deployment of Web Services from inside and outside a Cloud Architecture, MapReduce and its extensions to Cloud Computing, HDFS and GFS.

UNIT III Storage Virtualization: [10 Hrs]

Fixed Content and Archives, Types, Features, Benefits, CAS Architecture, Object storage and retrieval, Examples: Storage Virtualization-forms of virtualization, SNIA Taxonomy – Storage virtualization configurations,Challenges, Types of storage virtualization - Business Continuity- Overview of emerging technologies such as Cloud storage, Virtual provisioning, Unified Storage, FCOE, FAST.

UNIT IV Cloud Business Storage Continuity and Recovery: [9 Hrs]

Information Availability, BC Terminology, Life cycle, Failure analysis: Backup and Recovery- Backup purpose, considerations, Backup Granularity, Recovery considerations- Backup methods, Process, backup and restore operations, Overview of emerging technologies: Duplication, Off site backup

UNIT V. Cloud Storage Security and Management: [10 Hrs]

Storage security framework, Securing the Storage infrastructure, Risk triad: Managing the storage infrastructure, Monitoring the storage infrastructure, identify key parameters and components to monitor in a storage infrastructure, List key management activities and examples, Define storage management standards and initiative-Industry trend.

Text Books:

1. Rajkumar Buyya, James Broberg, Andrzej Goscinski, "Cloud Computing Principles and Paradigms", Wiley Publishers, 2011.

2. Barrie Sosinsky, "Cloud Computing Bible", Wiley Publishers 2010.

3. Tim Mather, Subra Kumaraswamy, Shahed Latif, "Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance", O'Reilly 2010.

4. EMC Corporation, "Information Storage and Management", 1st Edition, Wiley India 2009.

Reference Books:

1. Rajkumar Buyya, Christian Vacchiola, S Thamarai Selvi, "Mastering Cloud Computing", McGraw Hill, 2013

2. Michael Miller, "Cloud Computing : Web-based Applications that change the way you work and collaborate online", Pearson Education, 2008

3. IBM, "Introduction to Storage Area Networks and System Networking", 5th Edition, November 2012.

4. Robert Spalding, "Storage Networks: The Complete Reference", Tata McGraw Hill, Osborne, 6th reprint 2003. 5. Marc Farley, "Building Storage Networks", Tata McGraw Hill, Osborne, 1st Edition, 2001

IT7L002	**Data Science using R(Lab)**	**1 Credit**

COURSE OBJECTIVES:

The course should enable the students to:

1. Understand the R Programming Language.

2. Exposure on Solving of data science problems.

3.. Understand The classification and Regression Model.

COURSE OUTCOMES:

After learning the course the student will be able:

1. To Apply Data Collection and Data Preprocessing Strategies.

2.To Compare and choose data visualization method for effective visualization of data

3. To Implement regression models, model evaluation and validation

List of Experiments:

1. R AS CALCULATOR APPLICATION

a. Using with and without R objects on console

b. Using mathematical functions on console

c. Write an R script, to create R objects for calculator application and save in a specified location in disk

2. DESCRIPTIVE STATISTICS IN R

a. Write an R script to find basic descriptive statistics using summary, str, quartile function on mtcars& cars datasets.

b. Write an R script to find subset of dataset by using subset (), aggregate () functions on iris dataset.

3. READING AND WRITING DIFFERENT TYPES OF DATASETS

a. Reading different types of data sets (.txt, .csv) from Web and disk and writing in file in specific disk location.

b. Reading Excel data sheet in R.

4. VISUALIZATIONS

a. Find the data distributions using box and scatter plot.

b. Find the outliers using plot.

c. Plot the histogram, bar chart and pie chart on sample data.

5. REGRESSION MODEL

Import a data from web storage. Name the dataset and now do Logistic Regression to find out relation between variables that are affecting the admission of a student in a institute based on his or her GRE score, GPA obtained and rank of the student. Also check the model is fit or not. Require (foreign), require (MASS).

6. MULTIPLE REGRESSION MODEL

Apply multiple regressions, if data have a continuous independent variable. Apply on above dataset.

Reference Books:

Yanchang Zhao, "R and Data Mining: Examples and Case Studies", Elsevier, 1st Edition, 2012

Web References:

1.http://www.r-bloggers.com/how-to-perform-a-logistic-regression-in-r/

2.http://www.ats.ucla.edu/stat/r/dae/rreg.htm

3.http://www.coastal.edu/kingw/statistics/R-tutorials/logistic.html

4. http://www.ats.ucla.edu/stat/r/data/binary.csv

SOFTWARE: R Software , R Studio Software

IT7L003	**Middleware Technolgies(Lab)**	**1 Credit**

Course Outcomes:

1. To study how to create distributed server
2. To understand how to create a Java Bean.
3. To understand how to develop an enterprise.
4. To study how to develop a component.
5. To understand how to create a control.

Syllabus:

Program 1: Create a distributed name server (like DNS) RMI.

Program 2: Create a Java Bean to draw various graphical shapes and display it using or without using BDK.

Program 3: Develop an Enterprise Java Bean for student Information System.

Program 4: Develop an Enterprise Java Bean for Library operations.

Program 5: Create an Active-X control for Timetable.

Program 6: Develop a component for converting the currency values using COM / .NET

Program 7: Develop a component for browsing CD catalogue using COM / .NET

Program 8: Develop a component for retrieving information from message box using DCOM/.NET

Program 9: Develop a middleware component for retrieving Stock Market Exchange information using CORBA

Program 10: Develop a middleware component for retrieving Bank Balance using CORBA.

IT7P004	Project Phase I	3 Credit

The project should enable the students to combine the theoretical and practical concepts studied in his/her academics. The project work should enable the students to exhibit their ability to work in a team, develop planning and execute skills and perform analyzing and trouble shooting of their respective problem chosen for the project. The students should be able to write technical report, understand the importance of teamwork and group task. The students will get knowledge about literature survey, problem definition, its solution, and method of calculation, trouble shooting, costing, application and scope for future development.

Project work

The project work is an implementation of learned technology. The knowledge gained by studying various subjects separately supposed to utilize as a single task. A group of 03/04 students will have to work on assigned work. The topic could be a product design, specific equipment, live industrial problem etc. The project work involves experimental/theoretical/computational work. It is expected to do necessary literature survey by referring current journals belonging to Information Technology reference books and internet. After finalization of project, requisites like equipments, data, tools etc. should be arranged.

Project Activity

The project groups should interact with guide, who in turn advises the group to carry various activities regarding project work on individual and group basis. The group should discuss the progress every week in the project hours and follow further advice of the guide to continue progress. Guide should closely monitor the work and help the students from time to time. The guide should also maintain a record of continuous assessment of project work progress on weekly basis.

Phase I

1. Submission of project/problem abstract containing problem in brief, requirements, broad area, applications, approximate expenditure if required etc.
2. Problem definition in detail.
3. Literature survey.
4. Requirement analysis.
5. System analysis (Draw DFD up to level 2, at least).
6. System design, Coding/Implementation (20 to 30%).

IT7T005	Research Methodology	Audit

Course Objectives:

1. To know the basic data collection methods with emphasis on secondary and survey research.
2. To understand the format of primary data collection instruments.
3. To understand and use basic data analysis techniques.
4. To familiar with ethical issues in educational research, including those issues that arise in using quantitative and qualitative research.
5. To identify the overall process of designing a research study from its inception to its report.

Course Outcomes:

1. Identify a research problem stated in a study
2. Obtain skills to identify a business problem/ need, translate it into a research question, and design an appropriate way to answer it.
3. Develop skills to design a research project and collect data.
4. Develop skills to critically evaluate the quality of other researchers' findings and the process used to obtain them.
5. Identify the overall process of designing a research study from its inception to its report.

Unit-I Fundamentals of research;

Meaning, Objectives, Research process, Methods and Methodology, Criteria of good research, Review of literatures: Primary source, Secondary source, Identifying gap areas from literature review, Searching e- resources, using search engines, Searching data base.

Unit-II

Types of Research; Pure research, applied research, Exploratory Research, Descriptive research, Diagnostic research, Quantitative and Qualitative research etc.

Unit-III

Research Sampling and Design: Sampling of data: Concept of sampling, Probability sampling techniques , Non probability sampling techniques , Sampling error, Research Design: Meaning, Need, Types of research design-Exploratory Research Design, components of research design and features of good research design,

Unit-IV

Methods, Collection and Analysis of Data: Types of data, Methods of data collection- Interview Method, Mailing Method, Observation Method, Survey Method etc.; Primary and secondary sources of data, Sampling- meaning and methods, Classification and Tabulation, Graphical presentation, Application of computer in research data analysis.

Unit-V

Presentation of Research: Citation Styles- APA, MLA etc., Research ethics and Plagiarism, Indexing of journal and research output, Report writing steps in report writing, layout of report writing, reference and bibliography.

Text Books:

1. Research Methodology, Methods and Techniques by C.R Kothari, 2nd Edition.
2. Sinha, S.C. and Dhiman, A.K., 2002. Research Methodology, Ess Ess Publications. 2 volumes. 4. Trochim, W.M.K., 2005. Research Methods: the concise knowledge base, Atomic Dog Publishing. 270p.

Reference Books:

3. The Science of Education Research, Eurasia Publishing House, New Delhi by George J. (1964),
4. Advanced focus Group Research, Sage Publication, India Ltd, New Delhi by Fern Edward F. (2001)
5. Research Methodology in Management, Himalaya Publishing House, New Delhi by Michael V.P.

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Course Structure and Syllabus

For

B. Tech. Information Technology Programme

Curriculum for Semester- VIII [Fourth Year]

8th Semester

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				Credit
				L	T	P	CA	MSE	ESE	Total	
1	PEC	IT8TE06	Elective –VI	3	0	0	20	20	60	100	3
2	OEC	IT8O004	OPEN Elective - IV	3	1	0	60	20	40	100	4
3	PROJECT	IT8P001	Project Phase II	0	0	6	75	0	75	150	5
4	PCC	IT8T002	NPTEL Courses	0	0	0					2
				6	**1**	**6**	**155**	**40**	**175**	**350**	**14**

Open Elective-4 : Big Data Analytics

IT8TE06A	BITCOIN AND CRYPTOCURRENCY	3 Credit

Course Objectives:

1. To Understand the concepts of blockchain
2. Understand the core functionality and utility of Bitcoin and Cryptocurrency technologies.
3. To Understand various cryptocurrency and their working
4. To use various algorithms for distributed consensus
5. To Build a applications based on blockchain technology

Course Outcomes:

1. Understand how Bitcoin and Cryptocurrency work,
2. Understand how securely interact with them,
3. Design, build, and deploy smart contracts and distributed applications
4. Identify major research challenges and technical gaps existing between theory and practice in crypto currency domain.
5. Analyze the conceptual understanding of the function of Blockchain as a method of securing distributed ledgers.

UNIT I- **[7 Hrs]**

INTRODUCTION Basic of Blockchain Architecture – Challenges – Applications – Block chain Design Principles -The Blockchain Ecosystem - The consensus problem - Asynchronous Byzantine Agreement - AAP protocol and its analysis - Nakamoto Consensus on permission-less, nameless, peer-to-peer network - Proof of Work (PoW) - Proof of Stake (PoS) based Chains - Hybrid models (PoW + PoS), Proof of Burn, Difficulty Level, Sybil Attack.

UNIT II- **[7 Hrs]**

BITCOIN MECHANICS: Cryptographic basics for crypto currency - a short overview of Hashing, cryptographic algorithm – SHA 256,signature schemes, encryption schemes and elliptic curve cryptography- Introduction to Hyperledger- Hyperledger framework - Public and Private Ledgers.

UNIT III- **[7 Hrs]**

BIT COIN: How Does Bitcoin Work,Bitcoin’s Ecosystem,Bitcoin in Practice

Bitcoin’s Predecessors, Bitcoin’s Early History, Bitcoin’s Price, Storing Bitcoins:

Software Wallets, Hardware Wallets,Buying and Selling Bitcoins Exchanges,Merkley Tree - hardness of mining - transaction verifiability - anonymity - forks - double spending - mathematical analysis of properties of Bit coin. Bitcoin blockchain, the challenges, and solutions, alternatives to Bitcoin consensus, Bitcoin scripting language and their uses.

UNIT IV- **[8 Hrs]**

Cryptocurrency: History, Distributed Ledger, Bitcoin protocols - Mining strategy and rewards, Ethereum - Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Sidechain, Namecoin, Cryptocurrency Regulation: Stakeholders, Roots of Bit coin, Legal Aspects-Crypto currency Exchange, Black Market and Global Economy

UNIT V- **[7 Hrs]**

ETHEREUM Ethereum - Ethereum Virtual Machine (EVM) - Wallets for Ethereum - Solidity - Smart Contracts - some attacks on smart contracts. Ethereum and Smart Contracts- The Turing Completeness of Smart Contract Languages and verification challenges- comparing Bitcoin scripting vs. Ethereum Smart Contracts

Text Books:

1. Melanie Swan, “Block Chain: Blueprint for a New Economy”, O‟Reilly, first edition – 2015.

2. Daniel Drescher, “Block Chain Basics”, Apress; 1stedition, 2017

3. Anshul Kaushik, “Block Chain and Crypto Currencies”, Khanna Publishing House, Delhi.

4. Imran Bashir, “Mastering Block Chain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained”, Packt Publishing, first edition – 2012.

Websites:

1. https://developer.ibm.com/patterns/create-and-deploy-block chain-network-usingfabric-sdk-java/

2.https://docs.docker.com/get-started/https:/console.ng.bluemix.net/docs/services/block%2520chain/index. html

IT8TE06B	Full Stack Development	3 Credit

Course Learning Objectives:

1. Use their learned skills, knowledge and abilities to develop web sites for the internet.
2. Apply basic design principles to present ideas, information, products, and services on Websites.
3. Apply basic programming principles to the construction of websites.
4. Effectively manage website projects using available resources.
5. Create visualizations in accordance with UI/UX theories.
6. Develop a fully functioning website and deploy on a web server.

Course Outcomes: After completing the course, the students will be able to

CO1: Understand the formalistic (aesthetic) aspects of design and visual communication.

CO2: Develope cross-platform (web, mobile, broadcast, print) storytelling skills.

CO3: Become familiar with graphic design and/or game theory and be able to apply this theory to real world projects.

CO4:Develop and understand information design and usability as it applies to interactive media projects.

CO5: Utilize coding and software tools to analyze and present data in a professional manner that could be translated to web-based or app-based media.

Unit 1 **[7 Hrs]**

Basic HTML, Advanced HTML :

HTML-Introduction , HTML-Basic Formatting Tags , HTML-Grouping Using Div Span, HTML-Lists , HTML-Images , HTML-Hyperlink , HTML-Table, HTML-Iframe , HTML-Form, Adding audio, Drag & drop, User location: geolocation, Saving ,information - localStorage, Saving information - sessionStorage.

Unit 2 **[8 Hrs]**

CSS

What Is CSS? How to write CSS: syntax, Using style sheets, Using external style sheets, Identities and classes, Style entire elements, CSS Comments, Change background colors, Setting background images, Change text color, Text formatting using CSS, Font Properties, Text Properties, Styling hyperlinks using CSS, Styling lists using CSS, Setting element width and height, Adding borders, Spacing: margin & padding, Change the mouse type: cursor, Hide, show and display elements,

What to do with overflowing content.

CSS Advanced: Grouping & Nesting, Maximum & Minimum Dimensions, Move an element from its default position, Relative location & layering, Floating, Clear, Pseudos, Alignment Sprites: the most efficient way to load images, Make elements translucent: opacity, Different media types, Style elements based on their attributes, Browser prefixes.

Unit 3 **[7 Hrs]**

Javascript Basics

JavaScript Essentials, What is JavaScript?, JavaScript: Internal vs. External, JavaScript comments, document.write(); Display info from the browser: alert & confirm, Prompting the user for Information, Programming fundamentals: Variables, Add two sentences together: concatenation, Basic math in JavaScript, Redirecting users and opening ne6w windows, creating empty hyperlinks, String Manipulation, Comparing variables and values, Programming fundamentals: If...Else Statements, Else...If Statements, Switch Statements, Functions; JavaScript Events, Selecting HTML Elements using getElementById(), Escaping content, Programming fundamentals: Arrays, For Loops, While Loops, Breaking Out Of Loops, Skipping A Loop Cycle.

Unit 4 **[7 Hrs]**

ReactJS

Introduction , Templating using JSX ,Components, State and Props , Lifecycle of Components ,Components, State and Props , Lifecycle of Components ,Rendering List and Portals ,Error Handling ,Routers , Redux and Redux Saga , Immutable.js , Service Side Rendering ,Unit Testing , Webpack .

Unit 5 **[7 Hrs]**

PHP

Overview Of PHP, Basic Scripting and Looping Constructs Conditional Constructs, Modularity through Include Files, PHP Operators, PHP Functions, New Features, Arrays in PHP,Basic OOP in PHP,Writing OOP PHP

Text Books:

1. Web Development for beginners: Learn HTML/CSS/Javascript step by step with this Coding uide, Programming Guide for beginners, Website development, White Belt Mastery, ISBN 9781667003771.
2. The Road to React: Your journey to master React.js in JavaScript (2021 Edition), Kindle Edition.

3. Learning PHP, MySQL & JavaScript with j Query, CSS & HTML5, Publisher Shroff Publishers & Distributers, ISBN-13 978-9352130153

ReferenceBooks:

1.Mastering Html, Css & Javascript Web Publishing , BPB Publications , ISBN-13 978-8183335157
2. A Complete Overview On: Web-development, Notion Press, ISBN-13978-1685098407.

IT8TE06C	Advance Tools for Software	3 Credit

COURSE OUTCOMES:

CO1**.** Ability to understand Cyber Security Tools concepts.
CO2. Ability to understand and apply Business Management Strategy.
CO3. Ability to understand and use automated test generation techniques
CO4. Ability to use various Business analaysis tools/frameworks.
CO 5 Ability to understand various CRM Software Tools,

Unit 1: Cyber Security Software Tools **[7 Hrs]**
Introduction, How Important Is Cybersecurity , Types of CyberSecurity Tools , Comparison of Top CyberSecurity Software List of Best CyberSecurity Tools SolarWinds Security Event Manager Syxsense System Mechanic Ultimate Defense Acunetix Netsparker

Unit 2: Business Management Software **[7 Hrs]**
What Is Business Management Software?, Benefits of Business Management Software, List of Best Business Management Software, Comparison of Top Business Management Software monday.com , Studio Creatio, Oracle NetSuite, Keap , Process Bliss, HubSpot ,Additional Business Management Tools
,

Unit 3: CRM Software Tools **[7 Hrs]**
Introduction to CRM Tool , Features of CRM System, Benefits:, several famous CRM toolslike Salesforce CRM, SAP CRM, ZOHO CRM, Oracle CRM, Microsoft Dynamics CRM, Nimble CRM, Sugar CRM, Hubspot CRM, PIPEDRIVE CRM, CRM Creatio **,**

Unit 4: Business Analysis Tools **[8 Hrs]**
Introduction, Importance of Business Analysis , Business Analysis Techniques , Business Analysis Process – Sequentially , How Do Business Analysts Analyze BusinessRequirements? , Most Popular Business Analysis Tools :- Pipedrive (CRM) , Oracle NetSuit, Xplenty , Wrike, Business Process Diagramming, Wire framing, Flowcharts, Model Building Designing , Requirements Management**.**

Unit 5: Test Tools and Automation Testing Tools **[7 Hrs]**
Introduction, Tool Selection, . Tool Lifecycle, Tool Metrics, Automation testing Tools :-Selenium Webdriver Tools ,QTP/UFT,Load Runner & QC AutoIT, Rest Assured Framework,Agile Scrum Methodology, Appium. Framework TestNG ,POM .

Text Books:

1. Advanced Software Testing - Vol. 2, 2nd Edition, 2nd Edition. O'REILLY MEDIA, INC
2. Paul C. Jorgensen, Software Testing: A Craftsman‟s Approach, 3rd Edition, CRC Press, 2007.
3. Learning Path Learn Selenium , O’Reilly Media, INC.

Reference Books

1. Boris Beizer, Software Testing Techniques, Dreamtech, 2009

IT8TE06D	**Advanced Distributed Database System**	**3 Credit**

Course Outcomes:

1. Understand theoretical and practical aspects of distributed database systems.

2. Study and identify various issues related to the development of distributed database system.

3. Understand the design aspects of object-oriented database system and related development.

4. To understand the difference between the centralized and distributed database systems.

5. To introduce the students to the needed techniques that are used to design and manage a distributed database, such as fragmentation, query processing, recovery and replication.

Course Objectives:

1 .The aim of this module is to build on the previous background of database systems by deepening the understanding of the theoretical and practical aspects of the database technologies.

2 The need for distributed database technology to tackle deficiencies of the centralized database systems.

3 Introducing the concepts and techniques of distributed database including principles, architectures, design, implementation and major domain of application.

Unit 1 **[7Hrs]**

Introduction:

Introduction: Distributed Data Processing, Distributed Database System, Promises of DDBSs, Problem areas.
Distributed DBMS Architecture:
Architectural Models for Distributed DBMS, DDMBS Architecture.
Distributed Database Design:
Alternative Design Strategies, Distribution Design issues, Fragmentation, Allocation.

Unit 2

Query processing and decomposition **[7Hrs]**

Query processing and decomposition:
Query processing objectives, characterization of query processors, layers of query processing, query decomposition, localization of distributed data.
Distributed query Optimization:
Query optimization, centralized query optimization, distributed query optimization algorithms.

Unit 3 **[7 Hrs]**

Transaction Management

Transaction Management:

Definition, properties of transaction, types of transactions, distributed concurrency control: serializability, concurrency control mechanisms & algorithms, time - stamped & optimistic concurrency control Algorithms, deadlock Management.

Unit 4 **[7 Hrs]**

Distributed DBMS Reliability:

Reliability concepts and measures, fault-tolerance in distributed systems, failures in Distributed DBMS, local & distributed reliability protocols, site failures and network partitioning.

Parallel Database Systems:

Parallel database system architectures, parallel data placement, parallel query processing, load balancing, database clusters.

Unit 5 **[8 Hrs]**

Distributed object Database Management Systems:

Fundamental object concepts and models, object distributed design, architectural issues, object management, distributed object storage, object query Processing.

Object Oriented Data Model:

Inheritance, object identity, persistent programming languages, persistence of objects, comparison OODBMS and ORDBMS

TEXT BOOKS:

1. M. Tamer OZSU and Patuck Valduriez: Principles of Distributed Database Systems, Pearson Edn. Asia, 2001.

2. Stefano Ceri and Giuseppe Pelagatti: Distributed Databases, McGraw Hill.

REFERENCE BOOKS:

1. Hector Garcia-Molina, Jeffrey D. Ullman, Jennifer Widom: “Database Systems: The Complete Book”, Second Edition, Pearson International Edition

IT8P001	Project Phase II	5 Credit

This is continuous work to the project phase I. Every students will have to submit a completed report (3 copies)* of the project work. Report preparation guidelines should be followed as per given format. The students will prepare a power point presentation of the work. Panel of examiners comprising of guide, internal examiner, senior faculty, external examiner, etc. will assess the performance of the students considering their quality of work.

Phase II

1. Coding/Implementation.
2. Use cases.
3. Testing/Trouble shooting.
4. Data dictionary/ Documentation.
5. Finalization of project in all respect.

*(For guide, Personal copy, Departmental library.)

In a presentation, the students should focus to clarify problem definition and analysis of the problem.

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Website: www.jdcoem.ac.in E-mail: info@jdcoem.ac.in

An Autonomous Institute, with NAAC "A" Grade

Affiliated to DBATU, RTMNU & MSBTE, Mumbai

Department of Civil Engineering

"Building Better Development"

Session 2021-22 (ODD SEM)

Education to Eternity

VISION	MISSION
To be a well-known center for shaping professional leaders of Glob Standards in Civil Engineering	Provide quality education and excellent learning Environment for overall development of students. Making Sustainable efforts for integrating academics with Industry.

Date: 17/07/2021

NOTICE

All the VII Semester students are hereby informed that the list of professional elective subjects as for Elective-IV and Elective-V and their corresponding syllabus are displayed on the official Whatsapp group of the class. Kindly refer it and fill up the Elective choice form on or before 22/07/2021. The link of the Google form is circulated on official Whatsapp group.

Elective In-charge

Academic In-charge

HoD

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Education to Eternity

Department of Civil Engineering

"Building Better Development"

Session 2021-22 (EVEN SEM)

VISION	MISSION
To be a well-known center for shaping professional leaders of Globa Standards in Civil Engineering	Provide quality education and excellent learning Environment for overall development of students. Making Sustainable efforts for integrating academics with Industry.

Date: 03/01/2022

NOTICE

All the Sixth Semester students are hereby informed that the list of professional elective subjects as for Elective-I and Elective-II and their corresponding syllabus are displayed on the official Whatsapp group of the class. Kindly refer it and fill up the Elective choice form on or before 07/01/2022. The link of the Google form is circulated on official Whatsapp group.

Elective In-charge

Academic In-charge

HoD

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(An Autonomous Institute, with NAAC "A" Grade)

Affiliated to DBATU, RTMNU & MSBTE Mumbai

Department of Electronics and Telecommunication Engineering

"Rectifying Ideas, Amplifying Knowledge"

2021-22 (Even Sem)

VISION	MISSION
"To be a Department providing high quality & globally competent knowledge of concurrent technologies in the field of Electronics and Telecommunication."	1. To provide quality teaching learning process through well-developed educational environment and dedicated faculties. 2. To produce competent technocrats of high standards satisfying the needs of all stakeholders.

Date: 01/12/2021

Notice

All the students of third year are hereby informed to submit **Professional Elective** subject choice for **Sixth Semester** B. Tech (Electronics and Telecommunication Engineering) for the Session 2021-22.

- **Name of offered Professional Elective Course:**

1.Embedded Processor & its Interfacing with RTOS
2.AI:Knowledge Representation & Reasoning
3.VLSI Physical Design
4.Satellite Communication
5.Wireless IP Networks
6.Computer Vision
7.Database Management System
8.Switching Theory
9.Strength,Kinematics &Design of Machine Elements
10.Embedded Systems Design
11.Neural Networks and Fuzzy Logic

Prof. Avinash Ikhar
Academic Incharge

Dr. P. Kshirsagar
HOD ETC Dept

JAIDEV EDUCATION SOCIETY

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Department of Electronics and Telecommunication Engineering

"Rectifying Ideas, Amplifying Knowledge"

2021-22 (Odd Sem)

VISION	MISSION
"To be a Department providing high quality & globally competent knowledge of concurrent technologies in the field of Electronics and Telecommunication."	1. To provide quality teaching learning process through well-developed educational environment and dedicated faculties. 2. To produce competent technocrats of high standards satisfying the needs of all stakeholders.

Date: 01/06/2021

Notice

All the students of third year are hereby informed to submit **Professional Elective** subject choice for **Fifth Semester** B. Tech (Electronics and Telecommunication Engineering) for the Session 2021-22.

Name of offered Professional Elective Course:

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1.Introduction to Robotics and Computer Programming

2. Telecommunication Switching System

3.AISearch Methods for Problem Solving.

4.Digital System Design & Hardware Modelling Using Verilog

5.Embedded C Programming

6.Advanced Wireless Communication & Coding Technique

7.Introduction to Java Programming and Salesforce

8.Introduction to Deep Learning

9.Sensor Technology

Prof. Avinash Ikhar
Academic Incharge

Dr. P, Kshirsagar
HOD ETC Dept

Education to Eternity

॥ज्ञानम् सर्वार्थ साधनम्॥

VISION	MISSION
To be recognized for excellent engineering, developing global leaders both in educational and research in the domain of computer science and wireless engineering.	1. To create self-learning environment by facilitating leadership qualities, team spirit and ethical responsibilities. 2. To improve department-industry collaboration, interaction with professional society through technical knowledge and internship program. 3. To promote research and development with current techniques through well qualified resources in the area of computer science and wireless engineering.

Notice

Date: 05/09/2021

All the V SEM & VII SEM Students of Computer Science & Engineering department are here by informed that they have to select **Electives** on or before **14th Sept 2021** If students fail to do so, their further selection would not be considered. The following link is used to select the same.

Google Link: https://forms.gle/NfVmCeM3qPuCnM2U7 (V SEM)
https://forms.gle/omViX7f53oK5PoBXA (VII SEM)

V SEM	VII SEM
Elective-I 1. Augmented Reality 2. Block Chain 3. 3D Printing & Design	**Elective - VIII** (A) Big Data Analytics (B) Distributed System (C) Fundamental of Digital Image Processing **Elective - IX** (A) Cloud Computing (B) Business Intelligence (C) Natural Language Processing **Open Elective - X** A) Blockchain Technology (B) Computer Graphics (C) Embedded Systems

Prof. Nitin Choudhary
Academic Incharge

Prof. Supriya Sawwashere
HOD, CSE-IT-AI, JDCOEM

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Department of Computer Science & Engineering
"A Place to Learn, A Chance to Grow"
Session: 2021--2022 EVEN

VISION	MISSION
To be recognized for excellent engineering, developing global leaders both in educational and research in the domain of computer science and wireless engineering.	1. To create self-learning environment by facilitating leadership qualities, team spirit and ethical responsibilities. 2. To improve department-industry collaboration, interaction with professional society through technical knowledge and internship program. 3. To promote research and development with current techniques through well qualified resources in the area of computer science and wireless engineering.

Notice

Date: 05/03/2022

All the VI & VIII SEM Students of Computer Science & Engineering department are here by informed that they have to select **Electives** on or before **14th March 2022** If students fail to do so, their further selection would not be considered. The following link is used to select the same.

Google Link: https://forms.gle/yndAGpr25PmaKLXHA (VI SEM)
https://forms.gle/S2ebytoRsxo1Y7YA6 (VIII SEM)

VI SEM	VIII SEM
Elective -II 1. Cloud Computing 2. Angular JS 3. Middleware Technologies 4. Human Computing **Elective -III** **1.** Brain Machine Interface and Interaction 2. Computer Forensic 3. Deep Learning 4. Quantum Computing	**Elective – XI** Deep Learning Social Networks Randomized Algorithms

Prof. Swati Raut
Academic Incharge

Prof. Supriya Sawwashere
HOD, CSE-IT-AI, JDCOEM

VISION	MISSION
"To develop competent and committed Electrical Engineers to serve the society"	1. To impart quality education in the field of Electrical Engineering. 2. To be excellent learning center through research and industry interaction.

Date: 03/01/22

NOTICE

All the Sixth Semester students are hereby informed that the list of professional elective subjects as for Elective-III and Elective-IV and their corresponding syllabus are displayed on the official Whatsapp group of the class. Kindly refer it and fill up the Elective choice form on or before 07/01/22. The link of the Google form is circulated on official Whatsapp group.

Mr.A.V.Joshi	**Mr.A.V.Joshi**	**Dr.S.R.Vaishnav**
Elective In-charge	**Academic In-charge**	**HOD**

VISION	MISSION
"To develop competent and committed Electrical Engineers to serve the society"	1. To impart quality education in the field of Electrical Engineering. 2. To be excellent learning center through research and industry interaction.

Date: 17/07/21

NOTICE

All the Fifth Semester students are hereby informed that the list of professional elective subjects as for Elective-I and Elective-II and their corresponding syllabus are displayed on the official Whatsapp group of the class. Kindly refer it and fill up the Elective choice form on or before 22/07/21. The link of the Google form is circulated on official Whatsapp group.

Mr.A.V.Joshi	**Mr.A.V.Joshi**	**Dr.S.R.Vaishnav**
Elective In-charge	**Academic In-charge**	**HOD**

VISION	MISSION
"To develop competent and committed Electrical Engineers to serve the society"	1. To impart quality education in the field of Electrical Engineering. 2. To be excellent learning center through research and industry interaction.

Date: Date: 16/07/21

NOTICE

All the Seventh Semester students are hereby informed that the list of professional elective subjects as for Elective-IX and Elective-X their corresponding syllabus are displayed on the official Whatsapp group of the class. Kindly refer it and fill up the Elective choice form on or before 20/07/21. The link of the Google form is circulated on official Whatsapp group.

Mr.A.V.Joshi	**Mr.A.V.Joshi**	**Dr.S.R.Vaishnav**
Elective In-charge	**Academic In-charge**	**HOD**

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Department of Electronics and Telecommunication Engineering

"Rectifying Ideas, Amplifying Knowledge"

Session 2021-22 (5th sem Odd)

VISION	MISSION
"To be a Department providing high quality & globally competent knowledge of concurrent technologies in the field of Electronics and Telecommunication."	1. To provide quality teaching learning process through well-developed educational environment and dedicated faculties. 2. To produce competent technocrats of high standards satisfying the needs of all stakeholders.

List ofdepartment electives introduced

Sr No.	Name of Course	Course code	Semester	Year of Introduction
1	Introduction to Robotics and Co	ET5E004A	5th sem Autonomy	2021-22
2	Telecommunication Switching S	ET5E004B	5th sem Autonomy	2021-22
3	AISearch Methodsfor ProblemS	ET5E004C	5th sem Autonomy	2021-22
4	Digital System Design & Hardwa	ET5E004D	5th sem Autonomy	2021-22
5	Embedded C Programming	ET5E004E	5th sem Autonomy	2021-22
6	Advanced Wireless Communica	ET5E004F	5th sem Autonomy	2021-22
7	Introduction to Java Programmi	ET5E004G	5th sem Autonomy	2021-22
8	Sensor Technology	ET5E004H	5th sem Autonomy	2021-22
9	Introduction to Deep Learning	ET5E004I	5th sem Autonomy	2021-22

Mr. Shailesh M. Sakhare
Secretary BOS
Department of ETC
JDCOEM, Nagpur

Mrs. Neetu N. Gyanchandani
Chairman BOS
Department of ETC
JDCOEM, Nagpur

JAIDEV EDUCATION SOCIETY'S

J D COLLEGE OF ENGINEERING AND MANAGEMENT

KATOL ROAD, NAGPUR

An Autonomous Institute, with NAAC "A" Grade

Department of Electronics and Telecommunication Engineering

"Rectifying Ideas, Amplifying Knowledge"

Session 2021-22 (6th sem Even)

VISION	MISSION
"To be a Department providing high quality & globally competent knowledge of concurrent technologies in the field of Electronics and Telecommunication."	1. To provide quality teaching learning process through well-developed educational environment and dedicated faculties. 2. To produce competent technocrats of high standards satisfying the needs of all stakeholders.

List ofdepartment electives introduced

Sr No.	Name of Course	Course code	Semester	Year of Introduction
1	Embedded Processor & its Interfacin	ET6E004A	6th sem Autonomy	2021-22
2	AI:Knowledge Representation & Rea	ET6E004B	6th sem Autonomy	2021-22
3	VLSI Physical Design	ET6E004C	6th sem Autonomy	2021-22
4	Satellite Communication	ET6E004D	6th sem Autonomy	2021-22
5	Wireless IP Networks	ET6E004E	6th sem Autonomy	2021-22
6	Computer Vision	ET6E004F	6th sem Autonomy	2021-22
7	Database Management System	ET6E004G	6th sem Autonomy	2021-22
8	Switching Theory	ET6E004H	6th sem Autonomy	2021-22
9	Strength,Kinematics &Design of Mac	ET6E004I	6th sem Autonomy	2021-22
10	Embedded Systems Design	ET6E004J	6th sem Autonomy	2021-22
11	Neural Networks and Fuzzy Logic	ET6E004K	6th sem Autonomy	2021-22

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KATOL ROAD, NAGPUR

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Department of Electronics and Telecommunication Engineering

"Rectifying Ideas, Amplifying Knowledge"

Session 2021-22 (Odd Sem)

VISION	MISSION
"To be a Department providing high quality & globally competent knowledge of concurrent technologies in the field of Electronics and Telecommunication."	1. To provide quality teaching learning process through well-developed educational environment and dedicated faculties. 2. To produce competent technocrats of high standards satisfying the needs of all stakeholders.

Sr No.	Name of Course	Course code	Semester	Year of Introduction
1	Microwave Theory	BTETPE702	7th sem DBATU	2020-21
2	RF Circuit Design		7th sem DBATU	2020-21
3	Satellite Communi		7th sem DBATU	2020-21
4	Fiber Optic Commu		7th sem DBATU	2020-21
5	Wireless Sensor Ne		7th sem DBATU	2020-21
6	Mobile Computing		7th sem DBATU	2020-21
1	Embedded System	BTETPE703	7th sem DBATU	2020-21
2	Artificial Intelligen		7th sem DBATU	2020-21
3	VLSI Design & Tech		7th sem DBATU	2020-21
4	Data Compression		7th sem DBATU	2020-21
5	Big Data Analytics		7th sem DBATU	2020-21
6	Cyber Security		7th sem DBATU	2020-21
1	Consumer Electron	BTETPE704	7th sem DBATU	2020-21
2	Analog Integrated		7th sem DBATU	2020-21
3	Soft Computing		7th sem DBATU	2020-21
4	Advance Industrial		7th sem DBATU	2020-21
5	Mechatronics		7th sem DBATU	2020-21
6	Electronics in Smar		7th sem DBATU	2020-21

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JDCOEM, Nagpur

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KATOL ROAD, NAGPUR

An Autonomous Institute, with NAAC "A" Grade

Department of Electronics and Telecommunication Engineering

"Rectifying Ideas, Amplifying Knowledge"

Session 2021-22 (Even Sem)

VISION	MISSION
"To be a Department providing high quality & globally competent knowledge of concurrent technologies in the field of Electronics and Telecommunication."	1. To provide quality teaching learning process through well-developed educational environment and dedicated faculties. 2. To produce competent technocrats of high standards satisfying the needs of all stakeholders.

List ofdepartment electives introduced

Sr No.	Name of Course	Course code	Semester	Year of Introduction
1	Introduction to Internet of Things	BTETPE801A	8TH sem DBATU	2020-21
2	Computer Vision and Image Processing	BTETPE801B	8TH sem DBATU	2020-21
3	Biomedical Signal Processing	BTETPE801C	8th sem DBATU	2020-21
4	Industrial Automation and Control	BTETPE801D	8th sem DBATU	2020-21
5	Cryptography and Network Security	BTETPE801E	8th sem DBATU	2020-21
6	Digital IC Design	BTETPE801F	8th sem DBATU	2020-21

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JDCOEM, Nagpur

JAIDEV EDUCATION SOCIETY'S

J D COLLEGE OF ENGINEERING AND MANAGEMENT

KATOL ROAD, NAGPUR

An Autonomous Institute, with NAAC "A" Grade

Department Of Electrical Engineering

"Igniting minds to illuminate the world"

2021-22 (Odd Sem)

List of department Subject/electives introduced

Sr No.	Name of Course	Course code	Semester	Year of Introduction
1	Power Electronics	EE5T001	V	2021
2	Control System I	EE5T002	V	2021
3	Power System II	EE5T003	V	2021
4	Elective I	EE5TE01	V	2021
5	Elective II	EE5TE02	V	2021
6	Open Elective I	EE5TO01	V	2021
7	Power Electronics Lab	EE5L001	V	2021
8	Control System I Lab	EE5L002	V	2021
9	Power System II Lab	EE5L003	V	2021
10	Mini Project (Phase I)	EE5P003	V	2021
11	Consumer Affairs	EE5T004	V	2021
12	Microprocessor and microcontroller	EE6T001	VI	2021
13	Advanced Control System	EE6T002	VI	2021
14	Elective III	EE6TE03	VI	2021
15	Elective IV	EE6TE04	VI	2021
16	Open Elective II	EE6TO01	VI	2021
17	Microprocessor and microcontroller Lab	EE6L001	VI	2021
18	Cad Lab	EE6L003	VI	2021
19	Mini Project phase II	EE6P004	VI	2021
20	Research Methodology	EE6T003	VI	2021

B.O.S Secretraty

B.O.S Chairmam

Note: All documents should be duly signed and sealed

JAIDEV EDUCATION SOCIETY'S

J D COLLEGE OF ENGINEERING AND MANAGEMENT

KATOL ROAD, NAGPUR

An Autonomous Institute, with NAAC "A" Grade

Department of CSE

"A place to Learn; A Chance to Grow"

Session-2021-22

Education to Eternity

॥ज्ञानम् सर्वार्थ साधनम्॥

VISION	MISSION
To be recognized for excellent engineering, developing global leaders both in educational and research in the domain of computer science and wireless engineering.	1. To create self-learning environment by facilitating leadership qualities, team spirit and ethical responsibilities.
	2. To improve department-industry collaboration, interaction with professional society through technical knowledge and internship program.
	3. To promote research and development with current techniques through well qualified resources in the area of computer science and wireless engineering.

List of New Courses

Sr No.	Name of Course	Course code	Semester	Year of Introduction
1	Internet Of Things	CS5T001	5th sem	19-20
2	TCP/IP	CS5T002	5th sem	19-20
3	Design and Analysis of Algorithm	CS5T003	5th sem	19-20
4	Open Elective-1	CS5O001	5th sem	19-20
5	Elective -I	CS5TE01	5th sem	19-20
6	Internet Of Things (Lab)	CS5L004	5th sem	19-20
7	TCP/IP(Lab)	CS5L005	5th sem	19-20
8	Python Programming(Lab)	CS5L006	5th sem	19-20
9	Mini Project	CS5P007	5th sem	19-20
10	Field Training/ Industrial Visit	CS5P008	5th sem	19-20
11	Innovation and Enterpreneurship Development	CS5T009	5th sem	19-20
12	**Open Elective-1 : OSOS (Open Source Operating System)**			
13	Artificial Intelligence & Robotics	CS6T001	6th sem	19-20
14	Neural Networks and Machine Learning	CS6T002	6th sem	19-20
15	Elective -II	CS6TE02	6th sem	19-20
16	Elective-III	CS6TE03	6th sem	19-20
17	Open Elective-2	CS6O002	6th sem	19-20
18	Neural Networks and Machine Learning(Lab)	CS6L003	6th sem	19-20
19	Full Stack Development(Lab)	CS6L004	6th sem	19-20
20	Advance Java Programming(LAB)	CS6L005	6th sem	19-20
21	Mini Project	CS6P006	6th sem	19-20
22	CRT(Campus Recruitment Training)	CS6P007	6th sem	19-20
23	Skill Development	CS6P008	6th sem	19-20
24	Intellectual Property Rights	CS6T009	6th sem	19-20
25	**Open Elective-1 : Software Engineering (Open Source Operating System)**			

Prof . Nisha Dable
(Secretory)

Prof. Supriya Sawwashere.
(Chairman BOS CSE)

JAIDEV EDUCATION SOCIETY'S
J D COLLEGE OF ENGINEERING AND MANAGEMENT
KATOL ROAD, NAGPUR
Website: www.jdcoem.ac.in E-mail: info@jdcoem.ac.in
(An Autonomous Institute, with NAAC "A" Grade)
Affiliated to DBATU, RTMNU & MSBTE Mumbai
Department of Computer Science & Engineering
"A Place to Learn, A Chance to Grow"
Session: 2021-2022

VISION	MISSION
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List of department electives introduced

Sr No.	Name of Course	Course code	Semester	Year of Introduction
	UG			
1.	**Elective -I** 1. Augmented Reality 2. Block Chain 3. 3D Printing & Design	1. CS5TE01A 2. CS5TE01B 3. CS5TE01C	V	**2019-20**
2.	**Open Elective-1** OSOS (Open Source Operating System)	CS5O001	V	**2019-20**
3.	**Elective -II** 1. Cloud Computing 2. Angular JS 3. Middleware Technologies 4. Human Computing	1. CS6TE02A 2. CS6TE02B 3. CS6TE02C 4. CS6TE02D	VI	**2019-20**
4.	**Elective -III** 1. Brain Machine Interface and Interaction 2. Computer Forensic 3. Deep Learning 4. Quantum Computing	1. CS6TE03A 2. CS6TE03B 3. CS6TE03C 4. CS6TE03D	VI	**2019-20**
5.	**Open Elective-** SE (Software Engineering)	CS6O002	VI	**2019-20**
6.	**Elective - VIII** (A) Big Data Analytics (B) Distributed System (C) Fundamental of Digital Image Processing	BTCOE702	VII	**2017-18**
7.	**Elective - IX** (A) Cloud Computing (B) Business Intelligence (C) Natural Language Processing	BTCOE703	VII	**2017-18**
8.	**Open Elective - X** A) Blockchain Technology (B) Computer Graphics (C) Embedded Systems	BTCOE704	VII	**2017-18**
9.	**Elective – XI** Deep Learning Social Networks Randomized Algorithms	BTCOE801	VIII	**2017-18**
10.	**Open Elective – XII** Introduction to Industry 4.0 and Industrial Internet of Things Cryptography and Network Security	BTCOE802	VIII	**2017-18**

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	Model Checking			
	PG			
11.	**Elective 1** 1. Cloud Computing 2. Game Theory 3. Natural Language Processing 4. Social Network Analysis	CT1E101-104	I	**2019-20**
12.	**Elective II** 1. Intrusion Detection System 2. Model Checking 3. Artificial Intelligence and Knowledge Reasoning 4. High Performance Computing	CT1E201-204	I	**2019-20**
13.	**Elective III** 1. Software Testing 2.Algorithms for Big Data 3.Software Language Engineering 4.Cryptography and Network Security	CT2E301	II	**2019-20**
14.	**Elective 4** 1. Introduction to Cognitive Sciences 2. Virtual Reality 3. Mobile Computing 4. Storage Systems	CT2E401	II	**2019-20**
15.	**Elective 5**: 1. Functional Programming 2. Object Oriented Systems 3. Reinforcement Learning 4. Pattern Recognition	CT2E501	II	**2019-20**

Prof. Nisha Dable
Secretary BOS, CSE

Prof. Supriya Sawwashere
Chairman BOS, CSE

JAIDEV EDUCATION SOCIETY'S

J D COLLEGE OF ENGINEERING AND MANAGEMENT

KATOL ROAD, NAGPUR

An Autonomous Institute, with NAAC "A" Grade

Department of AI

"A place to Learn; A Chance to Grow"

Session-2021-22

Education to Eternity

॥ज्ञानम् सर्वार्थ साधनम्॥

VISION	MISSION
To be recognized for excellent engineering, developing global leaders both in educational and research in the domain of computer science and wireless engineering.	1. To create self-learning environment by facilitating leadership qualities, team spirit and ethical responsibilities.
	2. To improve department-industry collaboration, interaction with professional society through technical knowledge and internship program.
	3. To promote research and development with current techniques through well qualified resources in the area of computer science and wireless engineering.

List of New Courses

Sr No.	Name of Course	Course code	Semester	Year of Introduction
1	Organization Behaviour	AI3T001	3rd Sem	20-21
2	Universal Human Values	AI3T002	3rd Sem	20-21
3	Mathematics-III	AI3T003	3rd Sem	20-21
4	Statistical Data Analysis	AI3T004	3rd Sem	20-21
5	Computer Architecture and Organisation	AI3T005	3rd Sem	20-21
6	Internet of Things	AI3T006	3rd Sem	20-21
7	Data Structure & Algorithms	AI3T007	3rd Sem	20-21
8	Introduction to Internet of Things (Lab)	AI3L008	3rd Sem	20-21
9	Data Structure & Algorithms (Lab)	AI3L009	3rd Sem	20-21
10	Data Analytics (Lab)	AI3L010	3rd Sem	20-21
11	Theory of Computation	AI4T001	4rth Sem	20-21
12	Design & Analysis of Algorithm	AI4T002	4rth Sem	20-21
13	Operating System & Virtualization	AI4T003	4rth Sem	20-21
14	Neural Networks & Fuzzy System	AI4T004	4rth Sem	20-21
15	Discrete Mathematics & Graph Structures	AI4T005	4rth Sem	20-21
16	Database Management Systems	AI4T006	4rth Sem	20-21
17	Introduction to Robotics-(Lab)	AI4L007	4rth Sem	20-21
18	Neural Networks & Fuzzy System (Lab)	AI4L008	4rth Sem	20-21
19	DBMS-(Lab)	AI4L009	4rth Sem	20-21
20	Consumer Affairs	AI4T010	4rth Sem	20-21
21	Field Training (Project)	AI4P011	4rth Sem	20-21

Prof . Madhuri Babar
(Secretory)

Prof. Milind Tote
(Chairman BOS)

JAIDEV EDUCATION SOCIETY'S

J D COLLEGE OF ENGINEERING AND MANAGEMENT

KATOL ROAD, NAGPUR

Website: www.jdcoem.ac.in **E-mail:** info@jdcoem.ac.in

(An Autonomous Institute, with NAAC "A" Grade)

Affiliated to DBATU, RTMNU & MSBTE Mumbai

Department of Artificial Intelligence

"A Place to Learn, A Chance to Grow"

Session: 2022-2023

VISION	MISSION
To be recognized for excellent engineering, developing global leaders both in educational and research in the domain of computer science and wireless engineering.	1. To create self-learning environment by facilitating leadership qualities, team spirit and ethical responsibilities. 2. To improve department-industry collaboration, interaction with professional society through technical knowledge and internship program. 3. To promote research and development with current techniques through well qualified resources in the area of computer science and wireless engineering.

List of department electives introduced

Sr No.	Name of Course	Course code	Semester	Year of Introduction
	UG			
1.	**Elective -I** 1. Probability and Statistics Using R 2. Advanced Java Programming 3. NoSQL Databases 4. AI in Business Intelligence	1. AI5TE01A 2. AI5TE01B 3. AI5TE01C 4. AI5TE01D	V	**2020-2021**
2.	**Open Elective-1** Ethics in IT	AI5O001	V	**2020-2021**
3.	**Elective -II** 1. Brain Machine Interface and Interaction 2. Semantic Web 3. ML with Big Data - Tools & Techniques 4. Intelligent Information Retrieval	1. AI6TE02A 2. AI6TE02B 3. AI6TE02C 4. AI6TE02D	VI	**2020-2021**
4.	**Elective -III** 1. AI in Satellite and Radar Communication 2. Graph Analytics for Big Data 3. Computer Forensics & Bitcoin 4. Machine Learning with Large Data Sets	1. AI6TE03A 2. AI6TE03B 3. AI6TE03C 4. AI6TE03D	VI	**2020-2021**
5.	**Open Elective-** Object Oriented Methodology	AI6O002	VI	**2020-2021**

Prof. Sujata Helonde
Secretary BOS, CSE

Prof. Swati Raut
Chairman BOS, CSE

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Department of Artificial Intelligence

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Session: 2022-2023

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List of department electives introduced

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	UG			
1.	**Elective -I** 1. Probability and Statistics Using R 2. Advanced Java Programming 3. NoSQL Databases 4. AI in Business Intelligence	1. AI5TE01A 2. AI5TE01B 3. AI5TE01C 4. AI5TE01D	V	**2020-2021**
2.	**Open Elective-1** Ethics in IT	AI5O001	V	**2020-2021**
3.	**Elective -II** 1. Brain Machine Interface and Interaction 2. Semantic Web 3. ML with Big Data - Tools & Techniques 4. Intelligent Information Retrieval	1. AI6TE02A 2. AI6TE02B 3. AI6TE02C 4. AI6TE02D	VI	**2020-2021**
4.	**Elective -III** 1. AI in Satellite and Radar Communication 2. Graph Analytics for Big Data 3. Computer Forensics & Bitcoin 4. Machine Learning with Large Data Sets	1. AI6TE03A 2. AI6TE03B 3. AI6TE03C 4. AI6TE03D	VI	**2020-2021**
5.	**Open Elective-** Object Oriented Methodology	AI6O002	VI	**2020-2021**

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Secretary BOS, CSE

Prof. Swati Raut
Chairman BOS, CSE

Dr. Babasaheb Ambedkar Technological University, Lonere

(Established as a University of Technology in the State of Maharashtra)

(Under Maharashtra Act No. XXIX of 2014)

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Course Structure and Detailed Syllabus
for

Final Year
B. Tech. Programme in Information Technology
(Academic Year 2020-21)

Rules and Regulations

1. The normal duration of the course leading to B.Tech degree will be EIGHT semesters.
2. The normal duration of the course leading to M.Tech. degree will be FOUR semesters.
3. Each academic year shall be divided into 2 semesters, each of 20 weeks duration, including evaluation and grade finalization, etc. The Academic Session in each semester shall provide for at least 90 Teaching Days, with at least 40 hours of teaching contact periods in a five to six days session per week. The semester that is typically from Mid-July to November is called the ODD SEMESTER, and the one that is from January to Mid-May is called the EVEN SEMESTER. Academic Session may be scheduled for the Summer Session/Semester as well. For 1st year B. Tech and M. Tech the schedule will be decided as per the admission schedule declared by Government of Maharashtra.
4. The schedule of academic activities for a Semester, including the dates of registration, mid-semester examination, end-semester examination, inter-semester vacation, etc. shall be referred to as the Academic Calendar of the Semester, which shall be prepared by the Dean (Academic), and announced at least TWO weeks before the Closing Date of the previous Semester.
5. The Academic Calendar must be strictly adhered to, and all other activities including co-curricular and/or extra -curricular activities must be scheduled so as not to interfere with the Curricular Activities as stipulated in the Academic Calendar.

REGISTRATION:

1. Lower and Upper Limits for Course Credits Registered in a Semester, by a Full-Time Student of a UG/PG Programme:
   A full time student of a particular UG/PG programme shall register for the appropriate number of course credits in each semester/session that is within the minimum and maximum limits specific to that UG/PG programme as stipulated in the specific Regulations pertaining to that UG/PG programme.
2. Mandatory Pre-Registration for higher semesters:
   In order to facilitate proper planning of the academic activities of a semester, it is essential for the every institute to inform to Dean (Academics) and COE regarding details of total no. of electives offered (Course-wise) along with the number of students opted for the same. This information should be submitted within two weeks from the date of commencement of the semester as per academic calendar.
3. PhD students can register for any of PG/PhD courses and the corresponding rules of evaluation will apply.
4. Under Graduate students may be permitted to register for a few selected Post Graduate courses, in exceptionally rare circumstances, only if the DUGC/DPGC is convinced of the level of the academic achievement and the potential in a student.

Course Pre-Requisites:

1. In order to register for some courses, it may be required either to have exposure in, or to have completed satisfactorily, or to have prior earned credits in, some specified courses.
2. Students who do not register on the day announced for the purpose may be permitted

LATE REGISTRATION up to the notified day in academic calendar on payment of late fee.

3. REGISTRATION IN ABSENTIA will be allowed only in exceptional cases with the approval of the Dean (Academic) / Principal.
4. A student will be permitted to register in the next semester only if he fulfills the following conditions:

(a) Satisfied all the Academic Requirements to continue with the programme of Studies without termination
(b) Cleared all Institute, Hostel and Library dues and fines (if any) of the previous semesters;
(c) Paid all required advance payments of the Institute and hostel for the current semester;
(d) Not been debarred from registering on any specific ground by the Institute.

EVALUATION SYSTEM:

1. Absolute grading system based on absolute marks as indicated below will be implementeds from academic year 2019-20,starting from I year B.Tech.

Perentage of marks	Letter grade	Grade point
91-100	EX	10.0
86-90	AA	9.0
81-85	AB	8.5
76-80	BB	8.0
71-75	BC	7.5
66-70	CC	7.0
61-65	CD	6.5
56-60	DD	6.0
51-55	DE	5.5
40-50	EE	5.0
<40	EF	0.0

2. Class is awdared based on CGPA of all eigth semster of B.Tech Program.

CGPA for pass is minimum 5.0	
CGPA upto < 5.50	Pass class
CGPA $\geq$ 5.50 & < 6.00	SecondClass
CGPA $\geq$ 6.00 & < 7.50	First Class
CGPA $\geq$ 7.50	Distinction
[Percentage of Marks =CGPA*10.0]	

3. A total of 100 Marks for each theory course are distributed as follows:

1	MidSemester Exam (MSE) Marks	20
2	ContinuousAssesment Marks	20
	End SemesterExamination(ESE)Marks	60

4. A total of 100 Marks for each practical course are distributed as follows:

1	Continuous Assesment Marks	60
2	End Semester Examination (ESE)Marks	40

It is mandatory for every student of B.Tech to score a minimum of 40 marks out of 100, <u>with a minimum of 20 marks out of 60 marks in End Semester Examination for theory course.</u>

This will be implemented from the first year of B.Tech starting from Academic Year 2019-20

5. Description of Grades:

EX Grade: An 'EX' grade stands for outstanding achievement.
EE Grade: The 'EE' grade stands for minimum passing grade.
The students may appear for the remedial examination for the subjects he/she failed for the current semester of admission only and his/her performance will be awarded with EE grade only.
If any of the student remain Absent for the regular examination due to genuine reason and the same will be verified and tested by the Dean (Academics) or committee constituted by the University Authority.
FF Grade: The 'FF' grade denotes very poor performance, i.e. failure in a course due to poor performance .The students who have been awarded 'FF' grade in a course in any semester must repeat the subject in next semester.

6. Evaluation of Performance:

1. Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA)

(A) Semester Grade Point Average (SGPA) The performance of a student in a semester is indicated by Semester Grade Point Average (SGPA) which is a weighted average of the grade points obtained in all the courses taken by the student in the semester and scaled to a maximum of 10. (SGPI is to be calculated up to two decimal places). A Semester Grade Point Average (SGPA) will be computed for each semester as follows:

$$SGPA = \frac{[\sum_{i=1}^{n} c_i g_i]}{[\sum_{i=1}^{n} c_i]}$$

Where
'n' is the number of subjects for the semester,
'ci' is the number of credits allotted to a particular subject, and
'gi' is the grade-points awarded to the student for the subject based on his performance As per the above table.
-SGPA will be rounded off to the second place of decimal and recorded as such.

(B) Cumulative Grade Point Average (CGPA): An up to date assessment of the overall performance of a student from the time he entered the Institute is obtained by calculating Cumulative Grade Point Average (CGPA) of a student. The CGPA is weighted average of the grade points obtained in all the courses registered by the student since s/he entered the Institute. CGPA is also calculated at the end of every semester (upto two decimal places).Starting from the first semester at the end of each semester (S), a Cumulative Grade Point Average (CGPA) will be computed as follows:

$$CGPA = \frac{[\sum_{i=1}^{m} c_i g_i]}{[\sum_{i=1}^{m} c_i]}$$

Where
'm' is the total number of subjects from the first semester onwards up to and including the semester S,
'ci' is the number of credits allotted to a particular subject, and
'gi' is the grade-points awarded to the student for the subject based on his/her performance as per the above table.

-CGPA will be rounded off to the second place of decimal and recorded as such.

Award of Degree of Honours
Major Degree
The concept of Major and Minors at B.Tech level is introduced , to enhance learning skills of students, acquisition of additional knowledge in domains other than the discipline being pursued by the student, to make the students better employable with additional knowledge and encourage students to pursue cross-discipline research.

A. Eligibility Criteria for Majors

1. The Student should have Minimum CGPA of 7.5 up to 4th Semester
2. Student willing to opt for majors has to register at the beginning of 5th Semester
3. The Student has to complete 5 additional advanced courses from the same discipline specified in the curriculum. These five courses should be of 4 credits each amounting to 20 credits. The students should complete these credits before the end of last semester.
4. Student may opt for the courses from NPTEL/ SWAYAM platform. (if the credits of NPTEL/ SWAYAM courses do not match with the existing subject proper scaling will be done)

Student complying with these criteria will be awarded B.Tech (Honours) Degree.
B. Eligibility Criteria for Minors

1. The Student should have Minimum CGPA of 7.5 up to 4th Semester
2. Student willing to opt for minors has to register at the beginning of 5th Semester
3. The Student has to complete 5 additional courses from other discipline of their interest, which are specified in the respective discipline. These five courses should be of 4 credits each amounting to 20 credits.
4. Student may opt for the courses from NPTEL/ SWAYAM platform. (if the credits of NPTEL/ SWAYAM courses do not match with the existing subject proper scaling will be done)

Student complying with these criteria will be awarded with B.Tech Degree in ------- Engineering with Minor in ------ --Engineering.

(For e.g.: B. Tech in Civil Engineering with Minor in Computer Engineering)

For applying for Honours and Minor Degree the student has to register themselves through the proper system.

ATTENDANCE REQUIREMENTS:

1. All students must attend every lecture, tutorial and practical classes.
2. To account for approved leave of absence (eg. Representing the Institute in sports, games or athletics; placement activities; NCC/NSS activities; etc.) and/or any other such contingencies like medical emergencies, etc., the attendance requirement shall be a minimum of 75% of the classes actually conducted.
   If the student failed to maintain 75% attendance, he/she will be detained for appearing the successive examination.
   The Dean (Academics)/ Principal is permitted to give 10% concession for the genuine reasons as such the case may be.
   In any case the student will not be permitted for appearing the examination if the attendance is less than 65%.
3. The course instructor handling a course must finalize the attendance 3 calendar days before the last day of classes in the current semester and communicate clearly to the students by displaying prominently in the department and also in report writing to the head of the department concerned.
4. The attendance records are to be maintained by the course instructor and he shall show it to the student, if and when required.

TRANSFER OF CREDITS

The courses credited elsewhere, in Indian or foreign University/Institutions/ Colleges/Swayam Courses by students during their study period at DBATU may count towards the credit requirements for the award of degree. The guidelines for such transfer of credits are as follows:

a) 20 % of the total credit will be considered for respective calculations.

b) Credits transferred will be considered for overall credits requirements of the programme.

c) Credits transfer can be considered only for the course at same level i.e UG, PG etc.

d) A student must provide all details (original or attested authentic copies)such as course contents, number of contact hours, course instructor /project guide and evaluation system for the course for which he is requesting a credits transfer. He shall also provide the approval or acceptance letter from the other side. These details will be evaluated by the concerned Board of Studies before giving approval. The Board of Studies will then decide the number of equivalent credits the student will get for such course(s) in DBATU. The complete details will then be forwarded to Dean for approval.

e) A student has to get minimum passing grades/ marks for such courses for which the credits transfers are to be made.

f) Credits transfers availed by a student shall be properly recorded on academic record(s) of the student.

g) In exceptional cases, the students may opt for higher credits than the prescribed.

Teaching and Evaluation Scheme for Final Year B. Tech. Programme in Information Technology

(For Academic year 2020-21)

Sr. No.	Course Code	Course Title	Teaching Scheme			Evaluation Scheme					Total Marks	Credits	Total Hours
			L	T	P	MSE	CA		ESE				
							CA-I	CA- II	Internal	External			
Semester VII													
1	BTITC701	Cloud Computing and Storage Management	2	-	-	20	20		60		100	2	2
2	BTITC702	Artificial Intelligence#	3	-	-	20	20		60		100	3	3
3		**Elective VII**	3	-	-	20	20		60		100	3	3
	BTITE703A	A) Pattern Recognition											
	BTITE703B	B) Soft Computing											
	BTITE703C	C) Electronic Payment System@											
4		**Elective VIII** (Open)	3	-	-	20	20		60		100	3	3
	BTITOE704A	A) Natural Language Processing											
	BTITOE704B	B) Machine Learning											
5		**Elective IX**	3	-	-	20	20		60		100	3	3
	BTITPE705A	A) Real Time Systems											
	BTITPE705B	B) Information Security											
	BTITPE705C	C) Management Information Systems											
	BTITPE705D	D) Distributed Computing											
	BTITPE705E	E) Data Warehousing and Data Mining											
6	BTITL706	Cloud Computing and Storage Management Lab	-	-	2	-	15	15	10	10	50	1	2
7		**Elective VII Lab**	-	-	2	-	15	15	10	10	50	1	2
	BTITEL707A	A) Pattern Recognition Lab											
	BTITEL707B	B) Soft Computing Lab											
	BTITEL707C	C) Electronic Payment System Lab											
8		**Elective IX Lab**	-	-	2	-	15	15	10	10	50	1	2
	BTITPEL708A	A) Real Time Systems Lab											
	BTITPEL708B	B) Information Security Lab											
	BTITPEL708C	C) Management Information Systems Lab											
	BTITPEL708D	D) Distributed Computing Lab											
	BTITPEL708E	E) Data Warehousing and Data Mining Lab											
9	BTITP709	Project Phase I*	-	-	4	-	30		10	10	50	2	4
10	BTITF710	Field Training / Internship/ Industrial Training-III Evaluation	-	-	-	-	-		50		50	1	-
Summary of Semester Assessment Marks, Credit & Hours			**14**	**-**	**10**	**100**	**220**		**430**		**750**	**20**	**24**

Semester VIII												
1	BTITC801	Internet of Things#	3	-	-	20	20	60		100	3	3
2	BTITC802	Mobile Computing#	3	-	-	20	20	60		100	3	3
3	BTITP803	Project Phase II/ Project with Internship**	-	-	24	-	50	50	50	150	12	24
Summary of Semester Assessment Marks, Credit & Hours			**6**	**-**	**24**	**40**	**90**	**220**		**350**	**18**	**30**

These courses are to be studied on self –study mode using SWAYAM/NPTEL/Any other source.

@ Course designed and run by ELECTRONIC PAYMENT AND SERVICES (P) LTD, Mumbai.

* *In case of students opting for Internship in the eighth semester, the Project must be industry-based.*

** *Six months of Internship in the industry.*

Course Code	Course Title	SWAYAM course URL
BTITC702	Artificial Intelligence	https://nptel.ac.in/courses/106/102/106102220/
BTITC801	Internet of Things	https://nptel.ac.in/courses/106/105/106105166/
BTITC802	Mobile Computing	https://nptel.ac.in/courses/106/106/106106147/

Course Title:	**Cloud Computing and Storage Management**	**Semester**	**VII**
Course Code	**BTITC701**	**Course Type**	**Compulsory**
Pre-requisite	**Nil**	**L – T – P**	**2 – 0 – 0**
Stream	**Core**	**Credits**	**2**

Course Objectives:

1. To learn the concept of cloud computing.
2. To understand the trade-off between deploying applications in the cloud over local infrastructure.
3. To identify different storage virtualization technologies and their benefits.
4. To understand and articulate business continuity solutions including backup and recovery technologies, local and remote replication solutions.

Course Outcomes:

After learning the course, the student will be able:

1. To understand the key dimensions of the challenge of Cloud Computing.
2. To assess the economics, financial and technological implications for selecting cloud computing for organization.
3. To describe and apply storage technologies.
4. To identify leading storage technologies that provide cost-effective IT solutions for medium to large scale businesses and data centers.
5. To describe important storage technology features such as availability, replication, scalability and performance.

Course Content:

UNIT I

Introduction: Distributed Computing and Enabling Technologies, Cloud Fundamentals: Cloud Definition, Evolution, Architecture, Applications, Deployment models and service models.

UNIT II

Virtualization: Issues with virtualization, Virtualization technologies and architectures, Internals of virtual machine monitors/hypervisors, Virtualization of data centers and Issues with Multi-tenancy.

UNIT III

Implementation: Study of Cloud computing Systems like Amazon EC2 and S3, Google App Engine and Microsoft Azure, Build Private/Hybrid Cloud using open source tools, Deployment of Web Services from inside and outside a Cloud Architecture, MapReduce and its extensions to Cloud Computing, HDFS and GFS.

UNIT IV

Storage virtualization: Fixed Content and Archives, Types, Features, Benefits, CAS Architecture, Object storage and retrieval, Examples: Storage Virtualization-forms of virtualization, SNIA Taxonomy – Storage virtualization configurations, Challenges, Types of storage virtualization - Business Continuity- Overview of emerging technologies such as Cloud storage, Virtual provisioning, Unified Storage, FCOE, FAST.

UNIT V

Business Continuity and Recovery: Information Availability, BC Terminology, Life cycle, Failure analysis: Backup and Recovery- Backup purpose, considerations, Backup Granularity, Recovery considerations- Backup methods, Process, backup and restore operations, Overview of emerging technologies: Duplication, Off site backup.

UNIT VI

Storage security and Management: Storage security framework, Securing the Storage infrastructure, Risk triad: Managing the storage infrastructure, Monitoring the storage infrastructure, identify key parameters and components to monitor in a storage infrastructure, List key management activities and examples, Define storage management standards and initiative-Industry trend.

Text Books:

1. Rajkumar Buyya, James Broberg, Andrzej Goscinski, ***"Cloud Computing Principles and Paradigms"***, Wiley Publishers, 2011.
2. Barrie Sosinsky, ***"Cloud Computing Bible"***, Wiley Publishers 2010.
3. Tim Mather, Subra Kumaraswamy, Shahed Latif, ***"Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance"***, O'Reilly 2010.
4. EMC Corporation, ***"Information Storage and Management"***, 1st Edition, Wiley India 2009..

Reference Books:

1. Rajkumar Buyya, Christian Vacchiola, S Thamarai Selvi, ***"Mastering Cloud Computing"***, McGraw Hill, 2013
2. Michael Miller, ***"Cloud Computing : Web-based Applications that change the way you work and collaborate online"***, Pearson Education, 2008
3. IBM, ***"Introduction to Storage Area Networks and System Networking"***, 5th Edition, November 2012.
4. Robert Spalding, ***"Storage Networks: The Complete Reference"***, Tata McGraw Hill, Osborne, 6th reprint 2003.
5. Marc Farley, ***"Building Storage Networks"***, Tata McGraw Hill, Osborne, 1st Edition, 2001.

Course Title:	**Artificial Intelligence**	**Semester**	**VII**
Course Code	**BTITC702**	**Course Type**	**Compulsory**
Pre-requisite	**-**	**L – T – P**	**3 – 0 – 0**
Stream	**Core**	**Credits**	**3**

Course Objectives:

1. To acquaint the students with the theoretical and computational techniques in Artificial Intelligence.
2. To use various symbolic knowledge representation to specify domains and reasoning tasks of a situated software agent.
3. To use different logical systems for inference over formal domain representations and trace how a particular inference algorithm works on a given problem specification.
4. To understand the conceptual and computational trade-offs between the expressiveness of different formal representations.

Course Outcomes:

After learning the course the students should be able:

1. To find appropriate idealizations for converting real world problems into AI search problems formulated using the appropriate search algorithm.
2. To analyze, formalize and write algorithmic methods for search problem.
3. To explain important search concepts, the definitions of admissible and consistent heuristics and completeness and optimality.
4. To implement and execute by hand alpha-beta search.
5. To design good evaluation functions and strategies for game playing.
6. To carry out proofs in first order and propositional logic using techniques such as resolution, unification, backward and forward chaining.
7. To choose and implement learning algorithms such as decision trees, support vector machines, and boosting.

Course Content:

UNIT I

Introduction: Overview of Artificial intelligence- Problems of AI, AI techniques, Tic - Tac - Toe problem. Intelligent Agents: Agents & environment, Nature of environment, Structure of agents, Goal based agents, Utility based agents, Learning agents.

UNIT II

Problem Solving: Problems, Problem Space & search: Defining the problem as state space search, Production system, Problem characteristics and issues in the design of search programs. Search techniques: Solving problems by searching: problem solving agents, Searching for solutions; uniform search strategies: Breadth first search, Depth first search, Depth limited search, Bidirectional search, Comparing uniform search strategies.

UNIT III

Heuristic search strategies: Greedy best-first search, A* search, Memory bounded heuristic search: local search algorithms & optimization problems: Hill climbing search, Simulated annealing search, Local beam search, Genetic algorithms; Constraint satisfaction problems, Local search for constraint satisfaction problems. Adversarial search: Games, optimal decisions & strategies in games, The minimax search procedure, Alpha-beta pruning, Additional refinements, Iterative deepening.

UNIT IV

Knowledge & reasoning: Knowledge representation issues, Representation & mapping, Approaches to knowledge representation, Issues in knowledge representation. Using predicate logic: Representing simple fact in logic, Representing instant & ISA relationship, Computable functions & predicates, Resolution, Natural deduction. Representing knowledge using rules: Procedural verses declarative knowledge, Logic programming, Forward verses backward reasoning, Matching, Control knowledge.

UNIT V

Probabilistic reasoning: Representing knowledge in an uncertain domain, The semantics of Bayesian networks, Dempster-Shafer theory, Fuzzy sets & fuzzy logics, Planning: Overview, Components of a planning system, Goal stack planning, Hierarchical planning and other planning techniques.

UNIT VI

Natural Language processing: Introduction, Syntactic processing, Semantic analysis, Discourse & pragmatic processing. Learning: Forms of learning, Inductive learning, Learning decision trees, explanation based learning, Learning using relevance information, Neural net learning & genetic learning. Expert Systems: Representing and using domain knowledge, Expert system shells and knowledge acquisition.

Text Books:

1. Rich, E. and Knight K., ***"Artificial Intelligence"***, Tata McGraw- Hill.
2. Russell, S. and Norvig P., ***"Artificial Intelligence: A Modern Approach"***, Pearson Education.
3. Patterson, Dan W. , ***"Introduction to Artificial Intelligence & Expert Systems"***, PHI, 2005.

Reference Book:

1. Nilsson, N. J., Morgan Kaufmann, ***"Artificial Intelligence: A New Synthesis"***,Tata McGraw- Hill.

Course Title:	**Pattern Recognition**	**Semester**	**VII**
Course Code	**BTITE703A**	**Course Type**	**Elective**
Pre-requisite	**Nil**	**L – T – P**	**3 – 0 – 0**
Stream	**-**	**Credits**	**3**

Course Objectives:
1. To study pattern recognition topics and be exposed to recent developments in pattern recognition research.
2. To provide in-depth design concepts and implementation techniques of pattern recognitions.

Course Outcomes:
1. Identify and explain detailed aspects of internal structures of pattern recognitions.
2. Compare and contrast design issues for statistical pattern recognition.
3. Develop implementation skills for building pattern recognition.

Course Content:

UNIT I

Introduction: Machine Perception, Definition of Pattern Recognition (PR), Pattern Recognition system: Sensing, Segmentation & grouping, Feature extraction, Classification and Post processing, Design cycle: Data collection, Feature choice, Model choice, Training, Evaluation and computational complexity. Learning and adaptation: Supervised learning, Unsupervised learning and Reinforcement learning. Examples of PR Applications, Pattern Recognition Extensions. Machine learning : Components of learning, Learning models, Geometric models, Probabilistic models, Logic models, Grouping and grading, Learning versus design, Theory of learning, Feasibility of learning, Error and noise, Training versus testing, Theory of generalization, Generalization bound, Approximation-generalization tradeoff, Bias and variance, Learning curve.

UNIT II

Statistical Pattern Recognition (StatPR): Introduction to StatPR, Baye's theorem, Multiple features, Conditionally independent features, Decision boundaries, Unequal costs of error, Estimation of error rates, Characteristic curves, Estimating the composition of populations, Introduction to supervised parametric approaches and unsupervised approaches. Cluster analysis: Clustering techniques, Cluster analysis, Cluster validity. Feature selection & extraction: Feature selection criteria, Feature set search algorithm, Feature selection.

UNIT III

Tree Classifiers: (a) Decision Trees: CART, C4.5, ID3, (b) Random Forests, Linear Discriminants, Discriminative Classifiers: the Decision Boundary, (a) Separability, (b) Perceptrons, (c) Support Vector Machines.

UNIT IV

Parametric Techniques: Generative methods grounded in Bayesian Decision Theory (a) Maximum Likelihood Estimation (b) Bayesian Parameter Estimation (c) Sufficient Statistics. Non-Parametric Techniques :(a) Kernel Density Estimators (b) Parzen Window (c) Nearest Neighbor Methods.

UNIT V

Syntactic (Structural) Pattern Recognition (Syntpr): Introduction to SyntPR, Syntactic PR: primitive selection & pattern grammars, Higher dimensional grammars, Syntactic recognition, Automata, Error – correcting parsing, Shape & texture analysis, Image database management. Structural analysis using constraint satisfaction and structural matching, The Formal Language-based approach to SyntPR, Learning/Training in the Language-based Approach (Grammatical Inference). Problem solving methods for PR: Problem solving models, Problem solving algorithms.

UNIT VI

Unsupervised Methods : Exploring the Data for Latent Structure :(a) Component Analysis and Dimension Reduction: i. The Curse of Dimensionality, ii. Principal Component Analysis, iii. Fisher Linear Discriminant, iv. Locally Linear Embedding, (b) Clustering: i. K-Means, ii. Expectation Maximization, iii. Mean Shift. Classifier Ensembles : (a) Bagging, (b) Boosting / AdaBoost, Algorithm Independent, Topics Theoretical Treatments in the Context of Learned Tools: (a) No Free Lunch Theorem, (b) Ugly Duckling Theorem, (c) Bias-Variance Dilemma, (d) Jacknife and Bootstrap Methods.

Text Books:

1. Duda, R.O., Hart, P.E., Stork, D.G. ***"Pattern Classification",*** Wiley, 2nd Edition, 2001.
2. Eart Gose, Richard Johnsonburg and Steve Joust, ***"Pattern Recognition and Image Analysis"***, Prentice-Hall of India-2003.

Reference Books:

1. Bishop, C. M. ***"Pattern Recognition and Machine Learning"*** Springer, 2nd Edition, 2007.
2. Marsland, S., ***"Machine Learning: An Algorithmic Perspective"***, CRC Press. 2009.
3. Theodoridis, S. and Koutroumbas, K., ***"Pattern Recognition",*** 4th Edition, Academic Press, 2008.
4. Russell, S. and Norvig, N., ***"Artificial Intelligence: A Modern Approach",*** Prentice Hall, Series in Artificial Intelligence, 2003.

Course Title:	**Soft Computing**	**Semester**	**VII**
Course Code	**BTITE703B**	**Course Type**	**Elective**
Prerequisite	**Nil**	**L – T – P**	**3 – 0 – 0**
Stream	**-**	**Credits**	**3**

Course Objectives:

1. To introduce a relatively new computing paradigm for creating intelligent machines useful for solving complex real world problems.
2. To gain insight into the tools those make up the soft computing technique: fuzzy logic, artificial neural networks and hybrid systems.
3. To create awareness of the application areas of soft computing technique.
4. To learn alternative solutions to the conventional problem solving techniques in image/signal processing, pattern recognition/classification, control system.

Course Outcomes:

After learning the course the student will be able:

1. To use a new tool /tools to solve a wide variety of real world problems.
2. To find an alternate solution, more adaptable, resilient and optimum.
3. To apply knowledge of soft computing domain to real world problems**.**

Course Content:

UNIT I

Artificial Neural Network: Biological neuron, Artificial neuron model, Concept of bias and threshold, McCulloch Pits Neuron Model, Implementation of logical AND, OR, XOR functions. Soft Topologies of neural networks, Learning paradigms: Supervised, Unsupervised, Reinforcement, Linear neuron model: Concept of error energy, Gradient descent algorithm and application of linear neuron for linear regression, Activation functions: Binary, Bipolar (linear, signup, log sigmoid, tan sigmoid) Learning mechanisms: Hebbian, Delta Rule of Perceptron and its limitations.

UNIT II

Artificial Neural Network: Multilayer perceptron (MLP) and back propagation algorithm, Application of MLP for classification and regression of self organizing Feature Maps, Clustering of Learning vector quantization. Radial Basis Function networks: Cover's theorem,Mapping functions (Gaussian, Multi-quadrics, Inverse multiquadrics, Application of RBFN for classification and regression of Hopfield network, Associative memories.

UNIT III

Fuzzy Logic: Concept of Fuzzy number, Fuzzy set theory (continuous, discrete) of operations on fuzzy sets, Fuzzy membership functions (core, boundary, support), Primary and composite linguistic terms, Concept of fuzzy relation, Composition operation (T-norm, T-conorm) of Fuzzy if-then rules.

UNIT IV

Fuzzy Logic: Fuzzification, Membership value assignment techniques, De-fuzzification (Maxmembership principle, Centroid method, Weighted average method), Concept of fuzzy inference, Implication rules: Dienes-Rescher Implication, Mamdani Implication, Zadeh Implication, Fuzzy Inference systems: Mamdani fuzzy model, Sugeno fuzzy model, Tsukamoto fuzzy model, Implementation of a simple two-input single output FIS employing Mamdani model Computing.

UNIT V

Fuzzy Control Systems: Control system design, Control (Decision) Surface, Assumptions in a Fuzzy Control System Design, Fuzzy Logic Controllers, Comparison with traditional PID control, Advantages of FLC, Architecture of a FLC: Mamdani Type, Example Aircraft landing control problem.

UNIT VI

Adaptive Neuro-Fuzzy Inference Systems (ANFIS): ANFIS architecture, Hybrid Learning Algorithm, Advantages and Limitations of ANFIS Application of ANFIS/CANFIS for regression.

Text Books:

1. Laurene Fausett, ***"Fundamentals of Neural Networks: Architectures, Algorithms And Applications"***, Pearson Education, 2008.
2. Timothy Ross, "***Fuzzy Logic With Engineering Applications"***, 3^{rd} Edition, John Wiley & Sons, 2010.
3. J.S. Jang, C.T. Sun, E. Mizutani, ***"Neuro- Fuzzy and Soft Computing"***, PHI Learning Private Limited.
4. S. N. Sivanandam, S. N. Deepa, ***"Principles of Soft Computing"***, John Wiley & Sons, 2007.

Reference Books:

1. John Hertz, Anders Krogh, Richard Palmer, ***"Introduction to the theory of neural computation"***, Addison –Wesley Publishing Company, 1991.
2. Simon Haykin, ***"Neural Networks A comprehensive foundation"***, Prentice Hall International Inc-1999.
3. José C. Principe Neil R. Euliano , W. Curt Lefebvre, ***"Neural and Adaptive Systems: Fundamentals through Simulations"***, John-Wiley & Sons, 2000.
4. Peter E. Hart, David G. Stork Richard O. Duda, ***"Pattern Classification"***, 2^{nd} Edition, 2000.
5. Sergios Theodoridis, Konstantinos Koutroumbas, ***"Pattern Recognition"***, 4^{th} Edition, Academic Press, 2008.
6. Hung T. Nguyen, Elbert A. Walker, ***"A First Course in Fuzzy Logic"***, 3^{rd} Edition, Taylor & Francis Group, LLC, 2008.
7. S. N. Sivanandam, S. Sumathi, S. N. Deepa, ***"Introduction to Fuzzy Logic using MATLAB"***, Springer Verlag, 2007.

Course Title:	**Electronic Payment System**	**Semester**	**VII**
Course Code	**BTITE703C**	**Course Type**	**Elective**
Prerequisite	**Nil**	**L – T – P**	**3 – 0 – 0**
Stream	**-**	**Credits**	**3**

Course Objectives:

1. To understand common payment methods, working of different payment systems.
2. To learn basic payments processes and systems.
3. To understand emerging payments trend.
4. To gain knowledge on the underlying technologies governing payment systems.

Course Outcomes:

After learning the course, the students should be able:

1. To learn and speak Financial Services language.
2. To familiarize with banking regulations in the payment industry.
3. Gain domain knowledge for career in financial industry: Banks, Insurance & NBFC.

Course Content:

UNIT I

Evolution of payment systems in the digital world: Role of RBI in payment/clearing/settlement Indian payment systems: IMPS, NEFT/RTGS, eWallet, eKYC, AADHAR / AADHAR VAULT, RUPAY Debit/Credit cards, *99#, NACH,ABPS, BHIM, BHARAT PAY, CREDIT CARD, VISA/MASTER ROLE in CREDIT CARD PAYMENTS, CTS, UPI, BBPS, ATM.
Transformation in Social media channels & Payments: ChatBot, WhatsApp, FB.

UNIT II

Risks in Payment Systems : Credit Risk, Liquidity Risk, Systemic Risk, Operational Risk.

Risk mitigation techniques: Carefully chosen members, Novation, Central counterparty system, Loss sharing arrangements, Collateral, Other mitigation techniques like RECO.
Relationship structures: Correspondent banking, Bilateral clearing, arrangements, Network managed banking.

UNIT III

Payment types:
Book payments, Local payments, Domestic payments, Cross border payments.
Regional payments systems:
USA payment systems : Fedwire, CHIPS, NSS, ACH, SEPA payment systems : TARGET2, STEP 2 (SCT/SDD) PE- AC, China payment system : CDFCPS/CIPS, Hong Kong payment system : CHATS
Canadian payment system : LVTS, Indian payment systems : RTGS, NEFT, IMPS, UPI.

UNIT IV

Overview of SWIFT messaging: MT and MX messages, Role of SWIFT in payment systems, SWIFTnet Fin, File act, Interact, Browse SWIFT payment message processing – MT 1XX, MT 2XX, MT 9XX, MX PAIN/PACS, SWIFT Payment Messages examples, SWIFT for corporate.

UNIT V

Use of code in payment systems:
Codes – IBAN, BBAN, BIC, BEI, UID, UPIC, ABA routing codes etc., IFSC.
Foreign exchange transactions: Cash, TOM, Spot, Forwards, Interbank transactions, Merchant transactions, Exchange rate determination and rate computation.

UNIT VI

Cash management products:
Concept of float, Cash concentration, notional pooling and sweep, Virtual account management (VAM), ACH filter/ACH block, Lockboxes.
Impact of regulation:
Basel, FATF/OFAC compliance, FATCA compliance, AML compliance, FRM compliance.

Practical: Working of ATMs, Insides of an ATM, Vulnerability Points, Care to be taken while using ATM.

Text Book:

1. S. K. Nippani, B. K. Murthy, ***"Digital India Governance Transformation"***, 2018.

Online Reference for books & documentations:

https://rbidocs.rbi.org.in/rdocs/

Course Title:	**Natural Language Processing**	**Semester**	**VII**
Course Code	**BTITOE704A**	**Course Type**	**Elective**
Pre-requisite	**Nil**	**L – T – P**	**3 – 0 – 0**
Stream	**-**	**Credits**	**3**

Course Objectives:

1. To learn the leading trends and systems in natural language processing.
2. To understand the concepts of morphology, syntax, semantics and pragmatics of the language.
3. To recognize the significance of pragmatics for natural language understanding.
4. To describe simple system based on logic and demonstrate the difference between the semantic presentation and interpretation of that presentation.
5. To describe application based on natural language processing and to show the points of syntactic, semantic and pragmatic processing.

Course Outcomes:

After learning the course the student will be able:

1. To understand the models, methods and algorithms of statistical Natural Language Processing.
2. To implement probabilistic models in code, estimate parameters for such models and run meaningful experiments to validate such models.
3. To apply core computer science concepts and algorithms, such as dynamic programming.
4. To understand linguistic phenomena and explore the linguistic features relevant to each NLP task.
5. To identify opportunities and conduct research in NLP.
6. To analyze experimental results and write reports.

Course Content:

UNIT I

Introduction to NLP: Definition, Issues and strategies, Application domain, Tools for NLP, Linguistic organization of NLP, NLP vs. PLP.

UNIT II

Word Classes: Review of Regular Expressions, CFG and different parsing techniques. Morphology: Inflectional, derivational, Parsing and parsing with FST, Combinational Rules.

UNIT III

Phonology: Speech sounds, Phonetic transcription,Phoneme and phonological rules, Optimality theory, Machine learning of phonological rules, Phonological aspects of prosody and speech synthesis. Pronunciation, Spelling and N-grams: Spelling errors, Detection and elimination using probabilistic models, Pronunciation variation (lexical, allophonic, dialect), Decision tree model, Counting words in Corpora, Simple N-grams, smoothing (Add One, Written-Bell, Good-Turing), N-grams for spelling and pronunciation.

UNIT IV

Syntax: POS Tagging: Tagsets, Concept of HMM tagger, Rule based and stochastic POST, Algorithm for HMM tagging, Transformation based tagging. Sentence level construction & unification: Noun phrase, Co-ordination, Sub-categorization, Concept of feature structure and unification.

UNIT V

Semantics: Representing Meaning: Unambiguous representation, Canonical form, Expressiveness, Meaning structure of language, Basics of FOPC. Semantic Analysis: Syntax driven, Attachment & integration, Robustness. Lexical Semantics: Lexemes (homonymy, polysemy, synonymy, hyponymy), WordNet, Internal structure of words, Metaphor and metonymy and their computational approaches. Word Sense Disambiguation: Selectional restriction based, Machine learning based and dictionary based approaches.

UNIT VI

Pragmatics: Discourse: Reference resolution and phenomena, Syntactic and semantic constraints on coreference, Pronoun resolution algorithm, Text coherence, Discourse structure. Dialogues: Turns and utterances, Grounding, Dialogue acts and structures. Natural Language Generation: Introduction to language generation, Architecture, Discourse planning (text schemata, rhetorical relations).

Text Books:

1. D. Jurafsky & J. H. Martin, ***"Speech and Language Processing – An introduction to Language processing, Computational Linguistics, and Speech Recognition"***, Pearson Education.
2. Allen, James, ***"Natural Language Understanding"***, 2nd Edition, Benjamin/Cummings, 1996.

Reference Books:

1. Bharathi, A., Vineet Chaitanya and Rajeev Sangal, ***"Natural Language Processing-A Pananian Perspective",*** Prentice Hall India, 1995.
2. Eugene Cherniak, ***"Statistical Language Learning"***, MIT Press, 1993.
3. Manning, Christopher and Heinrich Schütze, ***"Foundations of Statistical Natural Language Processing",*** MIT Press, 1999.

Course Title:	**Machine Learning**	**Semester**	**VII**
Course Code	**BTITOE704B**	**Course Type**	**Elective**
Pre-requisite	**Engineering Mathematics-II**	**L – T – P**	**3 – 0 – 0**
Stream	**-**	**Credits**	**3**

Course Objectives:

1. To understand the basic concepts and methods of machine learning.
2. To make use of some elementary machine learning techniques in the design of computer systems.
3. To develop a broad perspective about the applicability of ML algorithms in different fields.
4. To understand the major machine learning algorithms, the problem settings and assumptions that underlies them.
5. To possess insights, concerning the relative strengths and weaknesses of various common machine learning methods.

Course Outcomes:

After learning the course the student will be able:

1. To demonstrate knowledge of the machine learning literature.
2. To describe how and why machine learning methods work.
3. To demonstrate results of parameter selection.
4. To explain relative strengths and weaknesses of different machine learning methods.
5. To select and apply appropriate machine learning methods to a selected problem.
6. To implement machine learning algorithms on real datasets.
7. To suggest ways to improve results.

Course Content:

UNIT-I

Introduction: Well-posed learning problems, Designing a Learning System, Perspectives and Issues in Machine learning, Concept Learning and General-to-specific Ordering: A concept learning task, Concept learning as Search, Finding a maximally specific hypothesis, Version Spaces and Candidate elimination algorithm, Inductive Bias.

UNIT-II

Decision Tree Learning: Decision tree learning algorithm, Hypothesis space search in decision tree Evaluating Hypothesis: Estimating Hypothesis accuracy, Basics of sampling theory, Deriving confidence intervals, Hypothesis testing, comparing learning algorithms.

UNIT-III

Bayesian Learning: Bayes theorem and concept learning, Maximum likelihood and least square error hypotheses, Minimum description length principle, Bayes optimal classifier, Gibbs algorithm, Naive Bayes classifier, Computational Learning Theory: Probably learning an approximately correct hypothesis, PAC learnability, The VC dimension, the mistake bound model for learning.

UNIT-IV

Linear Models for Regression: Linear basis function models, The Bias-Variance decomposition, Bayesian Linear Regression, Bayesian Model comparison

Kernel Methods: Constructing kernels, Radial basis function networks, Gaussian Processes

UNIT-V

Approximate Inferencing: Variational inference, Variational mixture of Gaussians, Variational linear regression, Variational logistic regression, Hidden Markov Models: Learning algorithms for HMM, the Viterbi algorithm, Linear Dynamical Systems.

UNIT-VI

Reinforcement Learning: The learning task, Q learning, Non-deterministic rewards and action, Temporal difference learning, Generalizing from examples.

Text Books:

1. Mitchell, Tom. M., *"Machine Learning"*, McGraw-Hill Education, 1st Edition, May 2013.
2. Segaran, Toby. **"*Programming Collective Intelligence- Building Smart Web 2.0 Applications*"**, O'Reilly Media, August 2007.

Reference Books:

1. Miroslav, Kubat. ***"An Introduction to Machine Learning"***, Springer Publishing.
2. Bishop, C. M., ***"Pattern Recognition and Machine Learning"***, Springer Publishing.
3. Conway, Drew and White, John Myles, ***"Machine Learning for Hackers"***, O'Reilly Media, February 2012.

Course Title:	**Real Time Systems**	**Semester**	**VII**
Course Code	**BTITPE705A**	**Course Type**	**Elective**
Pre-requisite	**Operating Systems, Design and Analysis of Algorithms**	**L – T – P**	**3 – 0 – 0**
Stream	**Software Application and Development**	**Credits**	**3**

Course Objectives:

1. To introduce students to the fundamental problems, concepts and approaches in the design and analysis of real-time systems.
2. To study issues related to the design and analysis of systems with real-time constraints.
3. To learn real-time scheduling and schedulability analysis.
4. To understand formal specification and verification of timing constraints and properties.
5. To design methods for real-time systems.
6. To learn new techniques of state-of-the-art real-time systems research.

Course Outcomes:

After learning the course the student will be able:

1. To characterize real-time systems and describe their functions.
2. To analyze, design and implement a real-time system.
3. To apply formal methods to the analysis and design of real-time systems.
4. To apply formal methods for scheduling real-time systems.
5. To characterize and debug a real-time system.

Course Content:

UNIT I

Introduction: Hard vs. Soft real time systems, A reference model of real time system. Real-time scheduling: Clock driven approach, Weighted Round-robin approach, Priority driven approach, Dynamic vs. static system, Effective Release Times and Deadlines, EDF and LST algorithm, Optimality and Non-Optimality of the EDF and LST algorithms, Off line vs. online Scheduling.

UNIT II

Clock-Driven Scheduling: Static, Time-Driven scheduler, General structure of Cyclic Schedules, Cyclic Executives, Improving the Average Response Time of a-periodic Jobs, Scheduling Sporadic Jobs.

UNIT III

Priority Driven Scheduling of Periodic Tasks: Fixed priority vs. Dynamic priority algorithms, Maximum Schedulable Utilization, Optimality of the RM and DM algorithms, A Schedulability test for fixed-priority tasks with short response times, Sufficient Schedulability conditions for the RM and DM algorithms.

UNIT IV

Scheduling Aperiodic and Sporadic Jobs in Priority-Driven Systems: Assumptions and Approaches, Deferrable Servers, Sporadic Servers, Constant Utilization, Total Bandwidth and Weighted Fair-Queuing Servers.

UNIT V

Resources and Resource Access control: Resource contention, Resource access control, Nonpreemptive critical section, Basic Priority-Inheritance protocol, Basic Priority Ceiling Protocol, Stack based, Priority-ceiling protocol, preemption ceiling protocol.

UNIT VI

Multiprocessor scheduling, Resource Access Control, and Synchronization: Model of multiprocessor & distributed systems, task assignment, multiprocessor Priority-ceiling protocol, Elements of Scheduling Algorithms for End-to-End Periodic Tasks- IPS protocols, PM protocols, MPM protocol.

Text Books:

1. Jane W. S. Liu, ***"Real-Time System"***, Pearson Education.
2. C. M. Krishna and K. G. Shin, ***"Real-Time Systems"***, McGraw Hill.

Reference Books:

1. Laplante, ***"Real Time System Design and Analysis: An Engineer Handbook"***, PHI.
2. Dr. K. V. K. Prasad, ***"Embedded Real Time System Concept Design and Programming"***, Wiley India.

Course Title:	**Information Security**	**Semester**	**VII**
Course Code	**BTITPE705B**	**Course Type**	**Elective**
Pre-requisite	**Internetworking Protocols**	**L – T – P**	**3 – 0 – 0**
Stream	**Infrastructure and Security Management**	**Credits**	**3**

Course Objectives:

1. To understand information security's importance in the increasingly computer-driven world.
2. To master the key concepts of information security and its working.
3. To develop a security mindset.
4. To learn to critically analyze situations of computer and network security usage.
5. To identify the salient issues, viewpoints and trade-offs of information security.

Course Outcomes:

After learning the course the student will be able:

1. To explain the challenges and scope of information security.
2. To explain security concepts as confidentiality, integrity and availability.
3. To explain the importance of cryptographic algorithms used in information security .
4. To identify and explain symmetric algorithms for encryption-based security of information.
5. To describe the access control mechanism used for user authentication and authorization.
6. To describe Secure Sockets Layer (SSL), Internet Protocol (IP) communications by using Internet Protocol Security (IPSec).
7. To explain the use of security tools as firewalls and intrusion prevention systems.
8. To explain malicious software issues introduced by software-based viruses and worms.
9. To describe the process of risk assessment in the context of IT security management.

Course Content:

UNIT I

Introduction to Information Systems: Security concepts, Computer security concepts, Threats, Attacks and Assets, Security functional requirements, A security architecture for Open Systems, Computer security trends, Computer security strategy.

UNIT II

Cryptographic Tools: Confidentiality with Symmetric Encryption, Message Authentication and Hash Functions, Public-Key Encryption, Digital Signatures and Key Management, Practical Application: Encryption of Stored Data.

UNIT III

Models, Frameworks, Standards & Legal Framework: A structure and framework of compressive security policy, policy infrastructure, policy design life cycle and design processes, PDCA model, Security policy standards and practices - ISO 27001, SSE-CMM, IA-CMM, ITIL & BS 15000, BS7799, Understanding Laws for Information Security: Legislative Solutions, Contractual Solutions, Evidential Issues, International Activity, Indian IT Act, Laws of IPR, Indian Copyright Act.

UNIT IV

Controls: Access control principles, Subjects, Objects and access rights, Discretionary access control, Role-based access control, Case study.

UNIT V

Virus and Malware: Introduction & types of Malicious Software (Malware), Propagation–Infected Content–Viruses, Propagation–Vulnerability Exploit–Worms, Propagation–Social Engineering–SPAM E-mail, Trojans, Payload–System Corruption, Payload–Attack, Agent–Zombie, Bots, Payload–Information Theft–Keyloggers, Phishing, Spyware, Payload–Stealthing–Backdoors, Rootkits, Countermeasures.

UNIT VI

Security issues: Database security challenge in the modern world, Federated Databases, securing Mobile databases, Network Security, Trusted and untrusted networks, Network attacks, Network security dimensions, Network attack – the stages; using firewalls effectively; Privacy – Privacy invasion due to direct marketing, Outsourcing using data masking ; privacy issues in smart card applications, Ethical Hacking ;Role of Cryptography in information security, digital signatures.

Text Books:

1. Nina Gobole, ***"Information Systems Security: Security Management, Metrics, Frameworks And Best Practices"***, Wiley, 2008.
2. Mark Rhodes –Ousley, ***"Information Security: The Complete Reference"***, McGraw-Hill Education, 2^{nd} Edition, 2013.
3. Dhiren R Patel, ***"Information Security Theory and Practices"***, PHI Learning, 2008.
4. Mark Stamp, ***"Information Security: Principles and Practice"***, 2^{nd} Edition, , Wiley, 2011.

Reference Books:

1. Gary R. McGraw, ***"Software Security: Building Security In"*** Addison Wesley, 2006.
2. Ankit Fadia, ***"Network Security: A Hacker's Perspective"***, 2006.

Course Title:	**Management Information Systems**	**Semester**	**VII**
Course Code	**BTITPE705C**	**Course Type**	**Elective**
Pre-requisite	**Decision Support Systems**	**L – T – P**	**3 – 0 – 0**
Stream	**Information Management & Quality Control**	**Credits**	**3**

Course Objectives:

1. To create interest and awareness about the proliferation of the Information Systems in today's organizations.
2. To understand categories of MIS: Operations Support System, Management Support System and Office automation system, Functional management system.
3. To learn Information Systems for strategic management and strategic role of information systems.
4. To plan for information systems: Identification of Applications, Business Application Planning, Systems and Critical Success Factors, Method of Identifying Applications.
5. To understand System Development Process and Approaches, System Implementation, System maintenance, Introduction to MIS Risks, System Evaluation, IT Procurement Options. Change management in IT Projects.

Course Outcomes:

After learning the course the student will be able:

1. To understand the usage and constituents of MIS in organizations.
2. To understand the classifications, understanding and the different functionalities of these MIS.
3. To explain the functions and issues at each stage of system development.
4. To identify emerging trends in MIS technologies.
5. To identify and assess MIS in real-life organization.

Course Content:

UNIT I

Management & organizational support systems for digital firm: Definition of MIS; Systems Approach to MIS: Report writing s/w, MIS and Human factor considerations, concept of organizational information sub-system, MIS & problem solving.

UNIT II

Information systems & business strategy: Information Management, Who are the users? Manager & Systems, Evolution of Computer based information system (CBIS), Model of CBIS. Information services organization: Trend to End-User computing, Justifying the CBIS, Achieving the CBIS, Managing the CBIS, Benefits & Challenges of CBIS implementation. Strategic Information System, Business level and Firm level Strategy.

UNIT III

Information systems in the enterprise: Systems from Management and functional perspective and their relationship: Executive Information System, Decision support system sales and Marketing Information System, Manufacturing Information System, Human-Resource Information System. Finance and Account Information System.

UNIT IV

Information technology for competitive advantage: Firm in its environment, What are the information resources? Who manages the information resources? Strategic planning for information resources. End-User Computing as a strategic issue, Information resource management concept.

UNIT V

E-commerce and international information system: Introduction to E-Commerce, Business Intelligence. E-Commerce strategy, Electronic Data Interchange, E-commerce methodology, E-commerce technology, Business application of the Internet. Electronic Business success strategies.

UNIT VI

Managing International Information Systems: IIS architecture, Global business Drivers, Challenges, Strategy: divide, conquer and appease, Cooptation, Business organization, Problems in implementing global information systems, Computer crime, ethics and social issues.

Text Book:

1. Kelkar, S.A., ***"Management Information Systems"***, Prentice Hall of India, 2003.

Reference Books:

1. Mark G. Simkin, ***"Introduction to computer Information System for Business"***, 1996.
2. James A. Senn, ***"Analysis & Design of Information Systems"***, McGraw-Hill.

Course Title:	**Distributed Computing**	**Semester**	**VII**
Course Code	**BTITPE705D**	**Course Type**	**Elective**
Pre-requisite	**Operating Systems**	**L – T – P**	**3 – 0 – 0**
Stream	**Networking**	**Credits**	**3**

Course Objectives:

1. To understand the major tools and techniques that allow programmers to effectively program the parts of the code that require substantial communication and synchronization.
2. To study the core ideas behind modern coordination and communication paradigms and distributed data structures
3. To introduce a variety of methodologies and approaches for reasoning about concurrent and distributed programs.
4. To realize basic principles and best practice engineering techniques of concurrent and distributed computing.
5. To study the safety and progress properties of concurrent and distributed algorithms.
6. To understand the performance of current multi-core and future many-core systems.

Course Outcomes:

After learning the course, the student will be able:

1. To identify the core concepts of distributed systems.
2. To learn orchestration of multiple machines to correctly solve problems in an efficient, reliable and scalable way.
3. To examine concepts of distributed systems in designing large systems.
4. To apply distributed computing concepts to develop sample systems.

Course Content:

UNIT I

Introduction: Historical background, Key characteristics, Design goals and challenges, Review of networking and internetworking, Internet protocols.

UNIT II

Processes and Inter process Communication: Processes and threads, Virtualization, Code migration, The API for the Internet protocols, External data representation, Client-server communication, Multicast communication, Message oriented communication, Network virtualization, Overlay networks, RPC and MPI.

UNIT III

Naming: Name services and Domain Name System, Directory services, Case study: X.500 directory service.

UNIT IV

Time, Global States and Synchronization: Physical and logical clocks, Global states, Mutual exclusion, Election algorithms, Consistency and Replication: Consistency models, Replica management, Consistency protocols, Case studies of highly available services: the gossip architecture and Coda.

UNIT V

Fault Tolerance and Security: Distributed Commit, Recovery, Security Issues, Cryptography. Distributed File Systems: File service architecture, Case study: Sun Network File System, The Andrew File System.

UNIT VI

Peer to peer Systems: Introduction, Napster, Peer-to-peer middleware, Routing overlays, Case studies: Pastry, Tapestry. Distributed Object Based Systems: Distributed objects, Java beans, CORBA.

Text Books:

1. Tanenbaum A.S, ***"Distributed Systems: Principles and Paradigms"***, 2^{nd} Edition, Pearson Education, 2006.
2. Coulouris G., Dollimore J., Kindberg T. and Blair G., ***"Distributed Systems: Concepts and Design"***, 5^{th} Edition, Addison Wesley, 2011.
3. Mahajan S., Shah S., ***"Distributed Computing"***, 1^{st} Edition, Oxford University Press, 2010.

Reference Books:

1. Hwang K., Dongarra J., Geoffrey C. Fox, ***"Distributed and Cloud Computing: From Parallel Processing to the Internet of Things"***, Morgan Kaufmann, 2011.
2. Comer D.E. and Droms, R.E., ***"Computer Networks and Internets"***, 4^{th} Edition, Prentice-Hall, 2004.

Course Title:	**Data Warehousing and Data Mining**	**Semester**	**VII**
Course Code	**BTITPE705E**	**Course Type**	**Elective**
Pre-requisite	**Database Management Systems**	**L – T – P**	**3 – 0 – 0**
Stream	**Data Science**	**Credits**	**3**

Course Objectives:

1. Introduce the concepts, techniques, design and applications of data warehousing and data mining.
2. Enable students to understand and implement classical algorithms in data mining and data warehousing.
3. Enable students to learn how to analyze the data, identify the problems and choose the relevant algorithms to apply.

Course Outcomes:

After learning the course, the student will be able:

1. Understand the functionality of the various data mining and data warehousing components.
2. Appreciate the strengths and limitations of various data mining and data warehousing models.
3. Compare the various approaches to data warehousing and data mining implementations.
4. Describe and utilize a range of techniques for designing data warehousing and data mining systems for real-world applications.

Course Content:

UNIT I

Introduction to data warehousing, Evolution of decision support systems, Modeling a data warehouse, granularity in the data warehouse, Data warehouse life cycle, building a data warehouse, Data Warehousing Components, Data Warehousing Architecture.

UNIT II

On Line Analytical Processing, Categorization of OLAP Tools, Introduction to Data mining and knowledge discovery, Relation to Statistics, Databases, Data Mining Functionalities, Steps In Data Mining Process, Architecture of a Typical Data Mining Systems, Classification of Data Mining Systems.

UNIT III

Overview of Data Mining Techniques, Data Preprocessing, Data Cleaning, Data Integration, Data Transformation and Data Reduction, Data Generalization and Summarization Based Characterization, Mining Association Rules In Large Databases.

UNIT IV

Classification and Prediction, Issues Regarding Classification and Prediction, Classification By Decision Tree Induction, Bayesian Classification, Other Classification Methods.

UNIT V

Prediction, Clusters Analysis, Types of Data In Cluster Analysis, Categorization of Major Clustering Methods, Partitioning methods, Hierarchical Methods.

UNIT VI

Applications of Data Mining, Social Impacts of Data Mining, Case Studies, Mining WWW, Mining Text Database, Mining Spatial Databases.

Text Books:

1. Adriaans, ***" Data mining"***, Addison- Wesley, 1996.
2. Margaret Dunham, ***"Data Mining: Introductory and Advanced Topics"***, Published by Prentice Hall.
3. Weiss, Sholom M.,***"Predictive data mining : a practical guide",*** Kaufmann Publishers, 1998.

Reference Books:

1. Pang-Ning Tan, Michael Steinback, Vipin Kumar, ***"Introduction to Data Mining"***, Pearson Education, 2008.
2. M.Humphires, M.Hawkins, ***"Data Warehousing: Architecture and Implementation"***, Pearson Education, 2009.
3. Anahory, Murray, ***"Data Warehousing in the Real World"***, Pearson Education, 2008.

Course Title:	**Cloud Computing and Storage Management Lab**	**Semester**	**VII**
Course Code	**BTITL706**	**Course Type**	**Compulsory**
Pre-requisite	**Internetworking Protocols**	**L – T – P**	**0 – 0 – 2**
Stream	**Core**	**Credit**	**1**

Lab Experiments Objectives:

Learner will be able to...

1. Appreciate cloud architecture.
2. Create and run virtual machines on open source OS.
3. Implement Infrastructure, storage as a Service.
4. Install and appreciate security features for cloud.

Lab Experiments List:

1. Study of Cloud Computing & Architecture.
2. Study and implementation of Infrastructure as a Service.
3. Implementation of Private cloud using Eucalyptus or Open stake.
   - Working with KVM to create VM.
   - Installation and configuration of Private cloud.
   - Bundling and uploading images on a cloud.
   - Creating web based UI to launch VM.
   - Working with Volumes – Attached to the VM.

Course Title:	**Pattern Recognition Lab**	**Semester**	**VII**
Course Code	**BTITEL707A**	**Course Type**	**Elective**
Pre-requisite	**NIL**	**L – T – P**	**0 – 0 – 2**
Stream	**-**	**Credit**	**1**

Lab Experiments Objectives:

1. To study pattern recognition topics and be exposed to recent developments in pattern recognitions research.
2. To provide in-depth design concepts and implementation techniques of pattern recognitions.

Lab Experiments List:

1. Feature Representation.
2. Mean and Covariance.
3. Linear Perceptron Learning.
4. Generation of Random Variables.
5. Bayesian Classification.
6. MLE: Learning the classifier from data.
7. Data Clustering: K-Means, MST-based.

Course Title:	**Soft Computing Lab**	**Semester**	**VII**
Course Code	**BTITEL707B**	**Course Type**	**Elective**
Pre-requisite	**Programming in Java/C/C++**	**L – T – P**	**0 – 0 – 2**
Stream	**-**	**Credit**	**1**

Lab Experiments Objectives:

1. To utilize Soft computing algorithms to solve engineering problems.
2. To compare results and provide a analysis of algorithms efficiency.
3. To apply soft computing thought process for solving issues.

Lab Experiments List:

1. Implement simple logic network using MP neuron model.
2. Implement a simple linear regression with a single neuron model.
3. Implement and test MLP trained with back-propagation algorithm.
4. Implement and test RBF network.
5. Implement SOFM for character recognition.
6. Implement fuzzy membership functions (triangular, trapezoidal, gbell, PI, Gamma, Gaussian)
7. Implement defuzzyfication (Max-membership principle, Centroid method, Weighted average method).
8. Implement FIS with Mamdani Inferencing mechanism.
9. A small project: may include classification or regression problem, using any soft computing technique studied earlier.

Course Title:	**Electronic Payment System Lab**	**Semester**	**VII**
Course Code	**BTITEL707C**	**Course Type**	**Elective**
Pre-requisite	**Programming in Java/C/C++**	**L – T – P**	**0 – 0 – 2**
Stream	**-**	**Credit**	**1**

Lab Experiments Objectives:

To design and write programs to demonstrate various real life payment system concepts.

Lab Experiments List:

Assignments and project based on syllabus.

Course Title:	**Real Time Systems Lab**	**Semester**	**VII**
Course Code	**BTITPEL708A**	**Course Type**	**Elective**
Pre-requisite	**Programming in Java/C/C++**	**L – T – P**	**0 – 0 – 2**
Stream	**Software Application and Development**	**Credit**	**1**

Lab Experiments Objectives:

1. To design and write programs to demonstrate various real time system concepts of scheduling processes.
2. To demonstrate how real time principles can be applied to business problems by simulating business processes.

Lab Experiments List:

1. Execute a program to demonstrate real time scheduling EDF vs. LST to show a comparative result.
2. Demonstrate clock driven scheduler system.
3. Develop a random generator to set priority and demonstrate a priority driven scheduler system.
4. Simulate a manufacturing process to demonstrate resource and resource control scheduling system in real time.
5. Simulate a logistics service provider scheduling of product delivery system using the principles of real-time system learned in the course.

Course Title:	**Information Security Lab**	**Semester**	**VII**
Course Code	**BTITPEL708B**	**Course Type**	**Elective**
Pre-requisite	**Programming in Java/C/C++**	**L – T – P**	**0 – 0 – 2**
Stream	**Infrastructure and Security Management**	**Credit**	**1**

Lab Experiments Objectives:

1. To be familiar with the algorithms of data mining,
2. To be acquainted with the tools and techniques used for Knowledge Discovery in Databases.
3. To be exposed to web mining and text mining.

Lab Experiments List:

1. Implement the following SUBSTITUTION & TRANSPOSITION TECHNIQUES concepts:
    a. Caesar Cipher
    b. Playfair Cipher
    c. Hill Cipher
    d. Vigenere Cipher
    e. Rail fence – row & Column Transformation.
2. Implement the following algorithms
    a. DES
    b. RSA Algorithm
    c. Diffiee-Hellman
    d. MD5
    e. SHA-1
3. Implement the SIGNATURE SCHEME - Digital Signature Standard.
4. Demonstrate how to provide secure data storage, secure data transmission and for creating digital signatures (GnuPG).
5. Setup a honey pot and monitor the honeypot on network (KF Sensor).
6. Installation of rootkits and study about the variety of options.
7. Perform wireless audit on an access point or a router and decrypt WEP and WPA.(Net Stumbler).
8. Demonstrate intrusion detection system (ids) using any tool (snort or any other s/w).

Course Title:	**Management Information Systems Lab**	**Semester**	**VII**
Course Code	**BTITPEL708C**	**Course Type**	**Elective**
Pre-requisite	**Programming in Java/Python**	**L – T – P**	**0 – 0 – 2**
Stream	**Information Management & Quality Control**	**Credit**	**1**

Lab Experiments Objectives:

1. To prepare organizational data for MIS reports and dashboards.
2. To learn what data should be used to prepare MIS reports.
3. To write programs to produce MIS reports.
4. To depict data in a MIS report to support decision making.

Lab Experiments List:

1. Prepare a MIS report for HR system to depict the various grades of employee in an organization by years of service.
2. Prepare a EIS report of Sales of an organization.
3. Prepare a graphical EIS dashboard of the Sales over a period of 1 year.
4. Prepare a manufacturing MIS report of all orders fulfilled, in progress and pending for management.
5. Prepare a monthly MIS profit and loss dashboard from financial data.
6. Prepare an EIS for reporting population demographic.

Course Title:	**Distributed Computing Lab**	**Semester**	**VII**
Course Code	**BTITPEL708D**	**Course Type**	**Elective**
Pre-requisite	**Programming in Java/C/C++**	**L – T – P**	**0 – 0 – 2**
Stream	**Networking**	**Credit**	**1**

Lab Experiments Objective:

1. To implement distributed systems paradigms practically to understand impact on resources and processes.

Lab Experiments List:

1. Load Balancing Algorithm.
2. Scalability in Distributed Environment.
3. Client/server using RPC/RMI.
4. Inter-process communication.
5. Election Algorithm.
6. Distributed Deadlock.
7. Name Resolution protocol.
8. Clock Synchronization algorithms.
9. Mutual Exclusion Algorithm.
10. Group Communication.
11. CORBA architecture.
12. Parallel Algorithms.
13. Message Passing Interface.

Course Title:	**Data Warehousing and Data Mining Lab**	**Semester**	**VII**
Course Code	**BTITPEL708E**	**Course Type**	**Elective**
Pre-requisite	**SQL**	**L – T – P**	**0 – 0 – 2**
Stream	**Data Science**	**Credit**	**1**

Lab Experiments Objectives:

1. To be familiar with the algorithms of data mining.
2. To be acquainted with the tools and techniques used for Knowledge Discovery in Databases.
3. To be exposed to web mining and text mining.

Lab Experiments List:

1. Creation of a Data Warehouse.
2. Apriori Algorithm.
3. FP-Growth Algorithm.
4. K-means clustering.
5. One Hierarchical clustering algorithm.
6. Bayesian Classification.
7. Decision Tree.
8. Support Vector Machines.
9. Applications of classification for web mining.
10. Case Study on Text Mining or any commercial application.

Course Title:	**Project Phase I**	**Semester**	**VII**
Course Code	**BTITP709**	**Course Type**	**Compulsory**
Pre-requisite	**Nil**	**L – T – P**	**0 – 0 – 4**
Stream	**Core**	**Credits**	**2**

The project should enable the students to combine the theoretical and practical concepts studied in his/her academics. The project work should enable the students to exhibit their ability to work in a team, develop planning and execute skills and perform analyzing and trouble shooting of their respective problem chosen for the project. The students should be able to write technical report, understand the importance of teamwork and group task. The students will get knowledge about literature survey, problem definition, its solution, and method of calculation, trouble shooting, costing, application and scope for future development.

Project work

The project work is an implementation of learned technology. The knowledge gained by studying various subjects separately supposed to utilize as a single task. A group of 03/04 students will have to work on assigned work. The topic could be a product design, specific equipment, live industrial problem etc. The project work involves experimental/theoretical/computational work. It is expected to do necessary literature survey by referring current journals belonging to Information Technology reference books and internet. After finalization of project, requisites like equipments, data, tools etc. should be arranged.

Project Activity

The project groups should interact with guide, who in turn advises the group to carry various activities regarding project work on individual and group basis. The group should discuss the progress every week in the project hours and follow further advice of the guide to continue progress. Guide should closely monitor the work and help the students from time to time. The guide should also maintain a record of continuous assessment of project work progress on weekly basis.

Phase I

1. Submission of project/problem abstract containing problem in brief, requirements, broad area, applications, approximate expenditure if required etc.
2. Problem definition in detail.
3. Literature survey.
4. Requirement analysis.
5. System analysis (Draw DFD up to level 2, at least).
6. System design, Coding/Implementation (20 to 30%).

Course Title:	**Internet of Things**	**Semester**	**VIII**
Course Code	**BTITC801**	**Course Type**	**Compulsory**
Pre-requisite	**Microprocessor & Micro-controllers**	**L – T – P**	**3 – 0 – 0**
Stream	**Core**	**Credits**	**3**

Course Objectives:

1. To understand the vision of IoT.
2. To understand IoT market perspective.
3. To study the data and knowledge management and use of devices in IoT technology.
4. To understand state of the art – IoT Architecture.
5. To study the real world IoT design constraints, industrial automation and commercial building automation in IoT.

Course Outcomes:

After learning the course the students should be able:

1. To interpret the vision of IoT from a global context.
2. To determine the market perspective of IoT.
3. To compare and contrast the use of devices, gateways and data management in IoT.
4. To implement state of the art architecture in IoT.
5. To illustrate the application of IoT in industrial automation and identify real world design constraints.

Course Content:

UNIT I

M2M to IoT-The Vision-Introduction, From M2M to IoT, M2M towards IoT-the global context, A use case example, Differing characteristics.

UNIT II

M2M to IoT: A Market Perspective– Introduction, Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies, M2M to IoT. An architectural overview: Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, Standards considerations.

UNIT III

M2M and IoT Technology Fundamentals - Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service (XaaS), M2M and IoT Analytics, Knowledge Management.

UNIT IV

IoT Architecture: State of the Art, Introduction, State of the art, Architecture Reference Model - Introduction, Reference model and architecture, IoT reference model.

UNIT V

IoT Reference Architecture: Introduction, Functional view, Information view, Deployment and operational View, Other relevant architectural views. Real-World Design Constraints - Introduction, Technical design constraints-hardware is popular again, Data representation and visualization, Interaction and remote control.

UNIT VI

Industrial Automation: Service-oriented architecture-based device integration, SOCRADES: realizing the enterprise integrated Web of Things, IMC-AESOP: from the Web of Things to the Cloud of Things, Commercial Building Automation: Introduction, Case study: phase one-commercial building automation today, Case study: phase two- commercial building automation in the future.

Text Book:

1. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle,***"From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence"***, Academic Press, 1st Edition, 2014.

Reference Books:

1. Vijay Madisetti, Arshdeep Bahga, ***"Internet of Things (A Hands-on-Approach)"***, VPT, 1st Edition, 2014.
2. Francis da Costa, ***"Rethinking the Internet of Things: A Scalable Approach to Connecting Everything"***, 1st Edition,Apress Publications, 2013.

Course Title:	**Mobile Computing**	**Semester**	**VIII**
Course Code	**BTITC802**	**Course Type**	**Compulsory**
Pre-requisite	**Internetworking Protocols , Operating Systems**	**L – T – P**	**3 – 0 – 0**
Stream	**Core**	**Credits**	**3**

Course Objectives:

1. To describe the basic concepts and principles in mobile computing.
2. To understand the concept of Wireless LANs, PAN, Mobile Networks, and Sensor Networks.
3. To explain the structure and components for Mobile IP and Mobility Management.
4. To understand positioning techniques and location-based services and applications.
5. To describe the important issues and concerns on security and privacy.
6. To design and implement mobile applications to realize location-aware computing.
7. To design algorithms for location estimations based on different positioning techniques and platforms.
8. To acquire the knowledge to administrate and to maintain a Wireless LAN.

Course Outcomes:

After learning the course, the students should be able:

1. To describe wireless and mobile communications systems.
2. To choose an appropriate mobile system from a set of requirements.
3. To work around the weaknesses of mobile computing.
4. To interface a mobile computing system to hardware and networks.
5. To program applications on a mobile computing system and interact with servers and database systems.

Course Content:

UNIT I

Fundamental of Wireless and basics of wireless network: Digital communication, Wireless communication system and limitations, Wireless media, Frequency spectrum, Technologies in digital wireless communication, Wireless communication channel specification, Wireless network, Wireless switching technology, Wireless communication.

UNIT II

Mobile Communications and Computing: An Overview Mobile Communication, Mobile Computing, Mobile Computing Architecture, Mobile Devices, Mobile System Networks, Data Dissemination, Mobility Management, Security, Mobile Devices and Systems, Mobile Phones, Digital Music Players, Hand-held Pocket Computers, Hand-held Devices: Operating Systems, Smart Systems, Limitations of Mobile Devices, Automotive Systems.

UNIT III

GSM and other architectures: GSM-Services and System Architectures, Radio Interfaces, Protocols Localization, Calling, Handover, Security, New Data Services, modulation, Multiplexing, Controlling the medium access, Spread spectrum, Coding methods, CDMA, IMT 2000, WCDMA and CDMA 2000, 4G Networks.

UNIT IV

Mobile Network and Transport Layer: IP and Mobile IP Network Layers, Packet Delivery and Handover Management, Location Management, Registration, Tunneling and Encapsulation, Route optimization, Dynamic Host Configuration Protocol, Mobile Transport Layer, Conventional TCP/IP Transport Layer Protocol, Indirect TCP, Snooping TCP, Mobile TCP, Mobile Ad-hoc Networks (MANET), Routing and Routing Algorithms in MANET, Security in ad-hoc networks.

UNIT V

Data Dissemination and Data Synchronization in Mobile Computing: Communication Asymmetry, classification of data delivery mechanism, data dissemination broadcast models, selective tuning and indexing techniques, synchronization, synchronization software for mobile devices, synchronization protocols.

UNIT VI

Mobile Devices and Mobile Operating System: Mobile agent, Applications framework, Application server, Gateways, Service discovery, Device management, Mobile file system, Mobile Operating Systems, Characteristics, Basic functionality of Operating Systems: Window 8, iOS, Android OS.

Text Books:

1. Raj Kamal, “Mobile Computing”, Oxford University Press-New Delhi, 2nd Edition.
2. Dr. Sunil kumar S. Manavi, Mahabaleshwar S. Kakkasageri, ***“Wireless and Mobile Networks, Concepts and Protocols”***, Wiley, India.

Reference Books:

1. Mark Ciampa, ***“Guide to Designing and Implementing wireless LANs”***, Thomson learning, Vikas Publishing House, 2001.
2. Ray Rischpater, ***“Wireless Web Development”***, Springer Publishing,
3. Sandeep Singhal, ***“The Wireless Application Protocol”***, Pearson Publication.
4. P.Stavronlakis, ***“Third Generation Mobile Telecommunication Systems”***, Springer Publishers.

Course Title:	**Project Phase II/ Project with internship**	**Semester**	**VIII**
Course Code	**BTITP803**	**Course Type**	**Compulsory**
Pre-requisite	**Nil**	**L – T – P**	**0 – 0 – 24**
Stream	**Core**	**Credits**	**12**

This is continuous work to the project phase I. Every students will have to submit a completed report (3 copies)* of the project work. Report preparation guidelines should be followed as per given format. The students will prepare a power point presentation of the work. Panel of examiners comprising of guide, internal examiner, senior faculty, external examiner, etc. will assess the performance of the students considering their quality of work.

Phase II

1. Coding/Implementation.
2. Use cases.
3. Testing/Trouble shooting.
4. Data dictionary/ Documentation.
5. Finalization of project in all respect.

*(For guide, Personal copy, Departmental library.)

In a presentation, the students should focus to clarify problem definition and analysis of the problem.

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Teaching scheme

1st Semester

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				Credit
				L	T	P	CA	MSE	ESE/ Ext. Pra.	Total	
1	HSMC	HU1T002	Introduction to Computer programming	2	0	0	20	20	60	100	2
2	BSC	MA1T001	Engineering Mathematics-I	3	1	0	20	20	60	100	4
3	BSC	CS1T005	Engineering Physics	3	1	0	20	20	60	100	4
4	ESC	CS1T006	Energy and Environment	3	0	0	20	20	60	100	3
5	HSMC	HU1L002	Introduction to Computer programming Lab	0	0	4	60	0	40	100	2
6	ESC	WS1L001	Workshop Practices	0	0	4	60	0	40	100	2
7	BSC	CS1L005	Engineering Physics Lab	0	0	2	60	0	40	100	1
8			Induction Programme	3 Weeks							
9	ESC	CS1T007	Basic Electrical and Electronics Engineering	2	0	0	10	15	25	50	Audit
				13	**2**	**10**					**18**

2nd Semester

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				Credit
				L	T	P	CA	MSE	ESE/ Ext. Pra.	Total	
1	HSMC	HU2T001	Communication Skills	2	0	0	60	0	40	100	2
2	BSC	MA2T001	Engineering Mathematics-II	3	1	0	20	20	60	100	4
3	BSC	CS2T002	Engineering Chemistry	3	1	0	20	20	60	100	4
4	ESC	CS2T003	Engineering Graphics	1	0	0	20	20	60	100	1
5	HSMC	HU2L001	Communication Skills Lab.	0	0	4	60	0	40	100	2
6	BSC	CS2L002	Engineering Chemistry Lab	0	0	2	60	0	40	100	1
7	ESC	CS2L003	Engineering Graphics Lab	0	0	4	60	0	40	100	2
8			Societal Internship/ Field	Report submission						50	1
9	ESC	CS2T004	Basic Civil and Mechanical Engineering	2	0	0	10	15	25	50	Audit
				11	**2**	**10**					**17**
				23							

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Education to Eternity

3rd Semester Information Technology

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				
				L	T	P	CA	MSE	ESE	Total	Credit
1	HSMC	IT3T001	Organization Behavior	2	0	0	20	20	60	100	2
2	BSC	IT3T002	Mathematics-III	3	1	0	20	20	60	100	4
3	ESC	IT3T003	Digital Electronics & Fundamentals of Microprocessor	3	0	0	20	20	60	100	3
4	PCC	IT3T004	Computer Arhcitecture & Organsization	3	0	0	20	20	60	100	3
5	PCC	IT3T005	Data structure using OOPs	2	1	0	20	20	60	100	3
6	PCC	IT3T006	Computer Graphics	3	0	0	20	20	60	100	3
7	PCC	IT3L007	Data structure using OOPs(Lab)	0	0	2	60	0	40	100	1
8	ESC	IT3T008	Digital Electronics & Fundamentals of Microprocessor (Lab)	0	0	2	60	0	40	100	1
9	PCC	IT3L009	Computer Graphics (Lab)	0	0	2	60	0	40	100	1
10	HSMC	IT3T011	Universal Human Values	2	1	0	20	20	60	100	3
				18	3	6	320	140	540	1000	24

4th Semester Information Technology

Sr. No.	Category of Subject	Course Code	Course Name	Tea chin g			Evalu ation Sche				
				L	T	P	CA	MSE	ESE	Total	Credit
1	PCC	IT4T001	Theory of Computation	3	1	0	20	20	60	100	4
2	PCC	IT4T002	Java Programming	3	0	0	20	20	60	100	3
3	PCC	IT4T003	Operating System	3	0	0	20	20	60	100	3
4	PCC	IT4T004	Computer Networks	2	1	0	20	20	60	100	3
5	PCC	IT4T005	DBMS	3	0	0	20	20	60	100	3
6	PCC	IT4T006	Discrete Mathematics & Graph Theory	3	0	0	20	20	60	100	3
7	PCC	IT4L007	DBMS(Lab)	0	0	2	60	0	40	100	1
8	PCC	IT4L008	Computer Networks(Lab)	0	0	2	60	0	40	100	1
9	PCC	IT4L009	Java Programming(Lab)	0	0	2	60	0	40	100	1
10	MC	IT4L010	Consumer Affairs	2	0	0	15	10	25	50	Audit
				19	2	6	300	120	530	950	22

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Education to Eternity

5th Semester Information Technology

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				Credit
				L	T	P	CA	MSE	ESE	Total	Credit
1	ESC	IT5T001	Embedded System & IoT	3	0	0	20	20	60	100	3
2	PCC	IT5T002	Cyber Security & Cryptography	2	1	0	20	20	60	100	3
3	PCC	IT5T003	Design and Analysis of Algorithm	3	1	0	20	20	60	100	4
4	PCC	IT5O001	Open Elective-1	3	1	0	20	20	60	100	4
5	PEC	IT5TE01	Elective -I	3	0	0	20	20	60	100	3
8	ESC	IT5L004	Embedded System & IoT (Lab)	0	0	2	60	20	40	100	1
9	PCC	IT5L005	Cyber Security & Cryptography (Lab)	0	0	2	60	0	40	100	1
10	PCC	IT5L006	Design and Analysis of Algorithm (Lab)	0	0	2	60	0	40	100	1
6	PROJECT	IT5P007	Internship	0	0	0	0	0	0	0	1
7	MC	IT5T008	Innovation and Enterpreneurship Development	2	0	0	15	10	25	50	Audit
				16	3	6	300	120	450	850	21

Open Elective-1 : Web Development & Design

6th Semester Information Technology

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				
				L	T	P	CA	MSE	ESE	Total	Credit
1	ESC	IT6T001	Adhoc Wireless Networks	3	0	0	20	20	60	100	3
2	PCC	IT6T002	Machine Learning	2	1	0	20	20	60	100	3
3	PEC	IT6TE02	Elective -II	3	0	0	20	20	60	100	3
4	PEC	IT6TE03	Elective-III	3	0	0	20	20	60	100	3
5	OEC	IT6O002	OPEN Elective 2	3	1	0	20	20	60	100	4
6	ESC	IT6L003	Adhoc Wireless Networks (Lab)	0	0	2	60	0	40	100	1
7	PCC	IT6L004	Machine Learning (Lab)	0	0	2	60	0	40	100	1
8	PCC	IT6L005	Multimedia (Lab)	0	0	2	60	0	40	100	1
9	PROJECT	IT6P006	Mini Project	0	0	4	25	0	25	50	3
10	MC	IT6T007	Intellectual Property Rights	2	0	0	15	10	25	50	Audit
11	PROJECT	IT6P007	CRT(Campus Recruitment Training)	0	0	2	60	0	40	100	1
				16	2	10	320	110	470	900	23

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Education to Eternity

7th Semester Information Technology

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				
				L	T	P	CA	MSE	ESE	Total	Credit
1	ESC	IT7T001	Data Science	3	1	0	20	20	60	100	3
2	PCC	IT7T002	Artificial Intelligence & Cognitive Robotics	3	0	0	20	20	60	100	3
2	PEC	IT7TE04	Elective-IV	2	1	0	20	20	60	100	3
3	PEC	IT7TE05	Elective -V	2	1	0	20	20	60	100	3
5	OEC	IT7O003	OPEN Elective -III	3	0	0	20	20	60	100	4
6	ESC	IT7L002	Data Science using R (Lab)	0	0	2	60	0	40	100	1
7	PEC	IT7L003	Middleware Technolgies(Lab)	0	0	2	60	0	40	100	1
8	PROJECT	IT7P004	Project & Seminar	0	0	6	25	0	25	50	3
9	MC	IT7T005	Research Methodology	0	0	15	10	25	50	Audit	Audit
				13	4	25	255	125	455	750	21

8th Semester Information Technology

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				
				L	**T**	**P**	**CA**	**MSE**	**ESE**	**Total**	**Credit**
1	PEC	IT8TE06	Elective –VI	3	0	0	20	20	60	100	3
2	OEC	IT8O004	OPEN Elective -IV	3	1	0	60	20	40	100	4
3	PROJECT	IT8P001	Internship	0	0	0	0	0	0	0	1
4	PROJECT	IT8P002	Major Project	0	0	6	75	0	75	150	6
				6	1	6	155	40	175	350	14

PROFESSIONAL ELECTIVE COURSES		
Code	**Subject**	**Elective**
IT5TE01A	Semantic Web	I
IT5TE02B	Quantum Computing	I
IT5TE03C	Biomedical Informatics	I
IT6TE02A	Cloud Computing	II
IT6TE02B	Expert Systems	II
IT6TE02C	Block Chain	II
IT6TE02D	Big Data Analytic Technique	II
IT6TE03A	Graph Analytic for Big Data	III
IT6TE03B	Smart Sensors For Robotics	III
IT6TE03C	Human Computing	III
IT6TE03D	Machine Learning with Big Data	III
IT7TE04A	Computational Intelligence	IV
IT7TE04B	Computer Forensic	IV
IT7TE04C	Robotics and Automation	IV
IT7TE04D	Natural Language Processing	IV
IT7TE05A	Advanced Computer Vision	V
IT7TE05B	AI In Digital Forensic	V
IT7TE05C	Brain Machine Interface and Interaction	V
IT7TE05D	Virtual Reality	V
IT8TE06A	Bitcoin and CryptoCurrencies	VI
IT8TE06B	Full Stack Development	VI
IT8TE06C	Advanced Tools for Software Testing	VI
IT8TE06D	Advanced Distributed Database System	VI

OPEN ELECTIVE COURSES (OEC)	
Course Code	**Subject**
1	Finance for Engineers
2	Engineering Economics
3	Legislative Procedure
4	Labour Law
5	Communication skills
6	Fitness Management Yoga
7	English language Proficiency
8	Quantative Aptitude & Logical Resoning
9	Personal Psychology
10	Classical Singining
11	Dancing
12	Drama
13	Physics of Engineering Materials
14	Nanotechnology
15	Biology for Engineers
16	Life and Career Skills with Interactive Learning
17	
18	Probality of Random Variable
19	Advanced Controller & Aplications
20	Internet Technologies
21	Internet of Things
22	Broadband Communication
23	PLC, SCADA
24	Mechatronics
25	MEMS
26	RF Circuit Design
27	Automotive Embedded System
28	Digital Designing with Coral Draw
29	Vehicle Maintenance & Garage Practice
30	Advanced JAVA Programing
31	.Net
32	Open Source Operating Sytem
33	Web Developmet & Design
34	SQL Programming
35	Software Engineering
36	Android App Development
37	Ethical Hacking
38	Ethics in IT
39	Big Data Analysis
40	Application of Artificial Intelligence in Finance
41	
42	Remote sencing and GIS
43	Highway Pavements
44	Traffic Engineering
45	Air pollution and Noise Pollution
46	Waste Water Management

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Education to Eternity

Teaching scheme

1st Semester

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				Credit
				L	T	P	CA	MSE	ESE/ Ext. Pra.	Total	
1	HSMC	HU1T002	Introduction to Computer programming	2	0	0	20	20	60	100	2
2	BSC	MA1T001	Engineering Mathematics-I	3	1	0	20	20	60	100	4
3	BSC	CS1T005	Engineering Physics	3	1	0	20	20	60	100	4
4	ESC	CS1T006	Energy and Environment	3	0	0	20	20	60	100	3
5	HSMC	HU1L002	Introduction to Computer programming Lab	0	0	4	60	0	40	100	2
6	ESC	WS1L001	Workshop Practices	0	0	4	60	0	40	100	2
7	BSC	CS1L005	Engineering Physics Lab	0	0	2	60	0	40	100	1
8			Induction Programme	3 Weeks							
9	ESC	CS1T007	Basic Electrical and Electronics Engineering	2	0	0	10	15	25	50	Audit
				13	**2**	**10**					**18**

2nd Semester

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				Credit
				L	T	P	CA	MSE	ESE/ Ext. Pra.	Total	
1	HSMC	HU2T001	Communication Skills	2	0	0	60	0	40	100	2
2	BSC	MA2T001	Engineering Mathematics-II	3	1	0	20	20	60	100	4
3	BSC	CS2T002	Engineering Chemistry	3	1	0	20	20	60	100	4
4	ESC	CS2T003	Engineering Graphics	1	0	0	20	20	60	100	1
5	HSMC	HU2L001	Communication Skills Lab.	0	0	4	60	0	40	100	2
6	BSC	CS2L002	Engineering Chemistry Lab	0	0	2	60	0	40	100	1
7	ESC	CS2L003	Engineering Graphics Lab	0	0	4	60	0	40	100	2
8			Societal Internship/ Field	Report submission						50	1
9	ESC	CS2T004	Basic Civil and Mechanical Engineering	2	0	0	10	15	25	50	Audit
				11	**2**	**10**					**17**
				23							

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Education to Eternity

3rd Semester Information Technology

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				
				L	T	P	CA	MSE	ESE	Total	Credit
1	HSMC	IT3T001	Organization Behavior	2	0	0	20	20	60	100	2
2	BSC	IT3T002	Mathematics-III	3	1	0	20	20	60	100	4
3	ESC	IT3T003	Digital Electronics & Fundamentals of Microprocessor	3	0	0	20	20	60	100	3
4	PCC	IT3T004	Computer Arhcitecture & Organsization	3	0	0	20	20	60	100	3
5	PCC	IT3T005	Data structure using OOPs	2	1	0	20	20	60	100	3
6	PCC	IT3T006	Computer Graphics	3	0	0	20	20	60	100	3
7	PCC	IT3L007	Data structure using OOPs(Lab)	0	0	2	60	0	40	100	1
8	ESC	IT3T008	Digital Electronics & Fundamentals of Microprocessor (Lab)	0	0	2	60	0	40	100	1
9	PCC	IT3L009	Computer Graphics (Lab)	0	0	2	60	0	40	100	1
10	HSMC	IT3T011	Universal Human Values	2	1	0	20	20	60	100	3
				18	3	6	320	140	540	1000	24

4th Semester Information Technology

Sr. No.	Category of Subject	Course Code	Course Name	Tea chin g			Evalu ation Sche				
				L	T	P	CA	MSE	ESE	Total	Credit
1	PCC	IT4T001	Theory of Computation	3	1	0	20	20	60	100	4
2	PCC	IT4T002	Java Programming	3	0	0	20	20	60	100	3
3	PCC	IT4T003	Operating System	3	0	0	20	20	60	100	3
4	PCC	IT4T004	Computer Networks	2	1	0	20	20	60	100	3
5	PCC	IT4T005	DBMS	3	0	0	20	20	60	100	3
6	PCC	IT4T006	Discrete Mathematics & Graph Theory	3	0	0	20	20	60	100	3
7	PCC	IT4L007	DBMS(Lab)	0	0	2	60	0	40	100	1
8	PCC	IT4L008	Computer Networks(Lab)	0	0	2	60	0	40	100	1
9	PCC	IT4L009	Java Programming(Lab)	0	0	2	60	0	40	100	1
10	MC	IT4L010	Consumer Affairs	2	0	0	15	10	25	50	Audit
				19	2	6	300	120	530	950	22

Education to Eternity

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5th Semester Information Technology

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				
				L	T	P	CA	MSE	ESE	Total	Credit
1	ESC	IT5T001	Embedded System & IoT	3	0	0	20	20	60	100	3
2	PCC	IT5T002	Cyber Security & Cryptography	2	1	0	20	20	60	100	3
3	PCC	IT5T003	Design and Analysis of Algorithm	3	1	0	20	20	60	100	4
4	PCC	IT5O001	Open Elective-1	3	1	0	20	20	60	100	4
5	PEC	IT5TE01	Elective -I	3	0	0	20	20	60	100	3
8	ESC	IT5L004	Embedded System & IoT (Lab)	0	0	2	60	20	40	100	1
9	PCC	IT5L005	Cyber Security & Cryptography (Lab)	0	0	2	60	0	40	100	1
10	PCC	IT5L006	Design and Analysis of Algorithm (Lab)	0	0	2	60	0	40	100	1
6	PROJECT	IT5P007	Internship	0	0	0	0	0	0	0	1
7	MC	IT5T008	Innovation and Enterpreneurship Development	2	0	0	15	10	25	50	Audit
				16	3	6	300	120	450	850	21

Open Elective-1 : Web Development & Design

6th Semester Information Technology

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				
				L	T	P	CA	MSE	ESE	Total	Credit
1	ESC	IT6T001	Adhoc Wireless Networks	3	0	0	20	20	60	100	3
2	PCC	IT6T002	Machine Learning	2	1	0	20	20	60	100	3
3	PEC	IT6TE02	Elective -II	3	0	0	20	20	60	100	3
4	PEC	IT6TE03	Elective-III	3	0	0	20	20	60	100	3
5	OEC	IT6O002	OPEN Elective 2	3	1	0	20	20	60	100	4
6	ESC	IT6L003	Adhoc Wireless Networks (Lab)	0	0	2	60	0	40	100	1
7	PCC	IT6L004	Machine Learning (Lab)	0	0	2	60	0	40	100	1
8	PCC	IT6L005	Multimedia (Lab)	0	0	2	60	0	40	100	1
9	PROJECT	IT6P006	Mini Project	0	0	4	25	0	25	50	3
10	MC	IT6T007	Intellectual Property Rights	2	0	0	15	10	25	50	Audit
11	PROJECT	IT6P007	CRT(Campus Recruitment Training)	0	0	2	60	0	40	100	1
				16	2	10	320	110	470	900	23

JAIDEV EDUCATION SOCIETY'S

J D COLLEGE OF ENGINEERING AND MANAGEMENT

Session 2022-23

Education to Eternity

7th Semester Information Technology

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				
				L	T	P	CA	MSE	ESE	Total	Credit
1	ESC	IT7T001	Data Science	3	1	0	20	20	60	100	3
2	PCC	IT7T002	Artificial Intelligence & Cognitive Robotics	3	0	0	20	20	60	100	3
2	PEC	IT7TE04	Elective-IV	2	1	0	20	20	60	100	3
3	PEC	IT7TE05	Elective -V	2	1	0	20	20	60	100	3
5	OEC	IT7O003	OPEN Elective -III	3	0	0	20	20	60	100	4
6	ESC	IT7L002	Data Science using R (Lab)	0	0	2	60	0	40	100	1
7	PEC	IT7L003	Middleware Technolgies(Lab)	0	0	2	60	0	40	100	1
8	PROJECT	IT7P004	Project & Seminar	0	0	6	25	0	25	50	3
9	MC	IT7T005	Research Methodology	0	0	15	10	25	50	Audit	Audit
				13	4	25	255	125	455	750	21

8th Semester Information Technology

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				
				L	**T**	**P**	**CA**	**MSE**	**ESE**	**Total**	**Credit**
1	PEC	IT8TE06	Elective –VI	3	0	0	20	20	60	100	3
2	OEC	IT8O004	OPEN Elective -IV	3	1	0	60	20	40	100	4
3	PROJECT	IT8P001	Internship	0	0	0	0	0	0	0	1
4	PROJECT	IT8P002	Major Project	0	0	6	75	0	75	150	6
				6	1	6	155	40	175	350	14

PROFESSIONAL ELECTIVE COURSES		
Code	**Subject**	**Elective**
IT5TE01A	Semantic Web	I
IT5TE02B	Quantum Computing	I
IT5TE03C	Biomedical Informatics	I
IT6TE02A	Cloud Computing	II
IT6TE02B	Expert Systems	II
IT6TE02C	Block Chain	II
IT6TE02D	Big Data Analytic Technique	II
IT6TE03A	Graph Analytic for Big Data	III
IT6TE03B	Smart Sensors For Robotics	III
IT6TE03C	Human Computing	III
IT6TE03D	Machine Learning with Big Data	III
IT7TE04A	Computational Intelligence	IV
IT7TE04B	Computer Forensic	IV
IT7TE04C	Robotics and Automation	IV
IT7TE04D	Natural Language Processing	IV
IT7TE05A	Advanced Computer Vision	V
IT7TE05B	AI In Digital Forensic	V
IT7TE05C	Brain Machine Interface and Interaction	V
IT7TE05D	Virtual Reality	V
IT8TE06A	Bitcoin and CryptoCurrencies	VI
IT8TE06B	Full Stack Development	VI
IT8TE06C	Advanced Tools for Software Testing	VI
IT8TE06D	Advanced Distributed Database System	VI

OPEN ELECTIVE COURSES (OEC)	
Course Code	**Subject**
1	Finance for Engineers
2	Engineering Economics
3	Legislative Procedure
4	Labour Law
5	Communication skills
6	Fitness Management Yoga
7	English language Proficiency
8	Quantative Aptitude & Logical Resoning
9	Personal Psychology
10	Classical Singining
11	Dancing
12	Drama
13	Physics of Engineering Materials
14	Nanotechnology
15	Biology for Engineers
16	Life and Career Skills with Interactive Learning
17	Human Resource Development and Organizational Behavior
18	Probality of Random Variable
19	Advanced Controller & Aplications
20	Internet Technologies
21	Internet of Things
22	Broadband Communication
23	PLC, SCADA
24	Mechatronics
25	MEMS
26	RF Circuit Design
27	Automotive Embedded System
28	Digital Designing with Coral Draw
29	Vehicle Maintenance & Garage Practice
30	Advanced JAVA Programing
31	.Net
32	Open Source Operating Sytem
33	Web Developmet & Design
34	SQL Programming
35	Software Engineering
36	Android App Development
37	Ethical Hacking
38	Ethics in IT
39	Big Data Analysis
40	Application of Artificial Intelligence in Finance
41	QILQ (Quantitative Intelligence and learning Quickness)
42	Remote sencing and GIS
43	Highway Pavements
44	Traffic Engineering
45	Air pollution and Noise Pollution
46	Waste Water Management