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
"A Place to Learn, A Chance to Grow"
Department of CSE & AI
2022-23

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.

Report on

"Online Webinar on Patent and Start-up"

Held on: 18/07/2022

Time: 10:30 am to 12:00 noon

Venue: Online Mode

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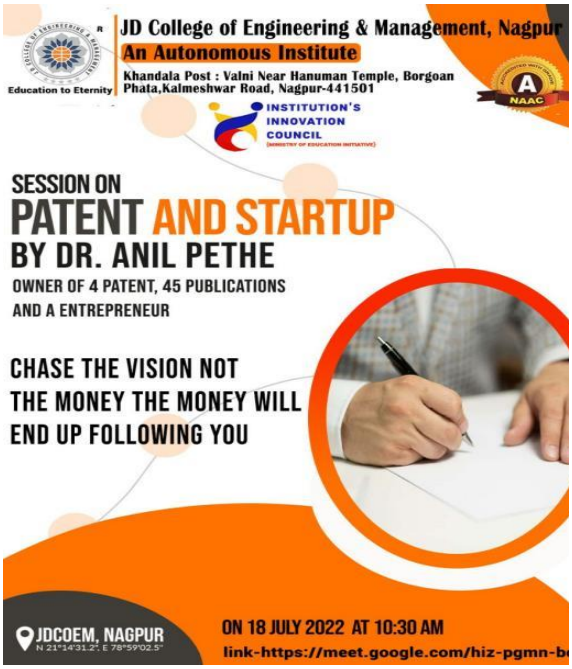
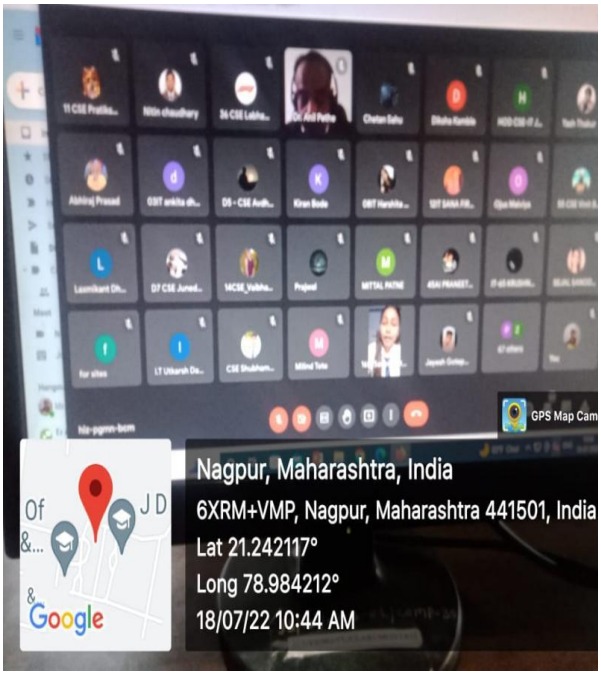
Photograph of Events





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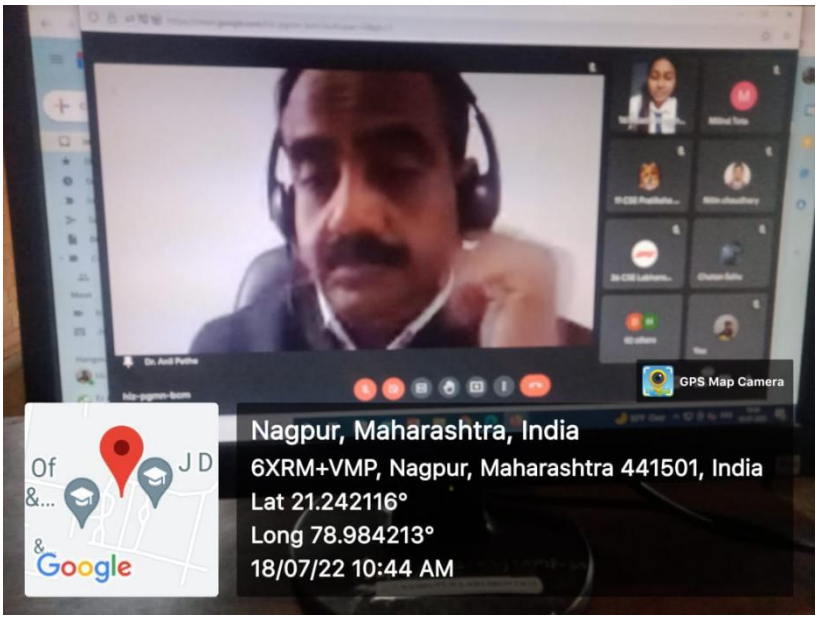

Rational/Concept of the event:

Under banner of IIC, Department of Computer Science and Engineering and Artificial Intelligence, JDCOEM organized "Webinar on Patent and StartUp" for 3rd year students of CSE & AI on 18th July 2022. Workshop was delivered by Dr. Anil Pethe, Principal, College of Pharmacy Wardha. The Webinar was attended by 95 participants approximately.

Activity mapping with PO:

PO--	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Activity	2	2	-	-	2	-	-	-	-	-	-	3

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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.

Pre event feedback:

1. What specific topics or aspects of patents and startups are you hoping to gain insights into during this session?
2. Are there any challenges or questions you currently face related to patents and startups?
3. Are you currently involved in a startup venture, or do you have plans to start one in the future?

Objectives:

The main objectives of this seminar:

1. Students should get the exposure of what is patent.
2. What could be the Ideas that can be patented.
3. What is the procedure of filling a patent?
4. Journey from Patent to Start-up.

Modalities:

The session on Startup and Patent by Dr. Anil Pethe was a highly anticipated event that drew attendees from various backgrounds eager to gain insights into the intersection of startups and intellectual property. The session provided a unique opportunity for participants to learn from Anil Pethe's wealth of experience and expertise in the field. Anil Pethe provided an overview of the legal aspects related to patents, shedding light on recent

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updates that could impact Startups. This segment ensured that participants were well-informed about the legal landscape, empowering them to make informed decisions regarding their intellectual property.

No of attendees: 95

Financial implications: Nill

Post event publicity: Status of Creation and circulation of post for whatsapp, instagram, news for the media etc.

Post Event Feedback:

1. What were the most valuable insights or takeaways you gained from the session?
2. Did the session cover topics that were relevant and beneficial to your understanding of patents in the startup context?
3. Did the session inspire or motivate you to take any specific actions or explore certain aspects further in the realm of startups and patents?

Outcome:

1. Attendees acquire practical knowledge about the patenting process for start-ups, learning how to navigate the complexities and make informed decisions.

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2. Increased awareness of legal aspects related to patents, ensuring that participants are informed about recent updates and potential legal considerations for start-ups.

Prof. Jolly R. Nikhade	**Prof. Swati Raut**	**Prof. Supriya Sawwashere**
(Webinar In charge)	(Academic I/C)	(HOD)

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Department of Electrical Engineering
"Igniting minds to illuminate the world"
Session 2023-24

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.

Industrial / Field Visit Report conducted on 31/10/2023 Under IIIC

At: Adani Thermal Power Plant,Tiroda

Website of the company: www.adanipower.com

Under the Aegis of: -

Geo tagged photos of the visit:

A. Brief Introduction of the company/institution:

B. Adani Power Maharashtra Limited is largest coal based Thermal Power Plant in the state of Maharashtra, India. The plant has a capacity to generate 3300 MW power through its 5 units of 660 MW capacity. The first unit of the plant was commissioned on 28th August 2012 and subsequently other units were commissioned. The plant achieved full capacity with the commissioning of unit V on 11th October 2014.

C. Products of the company:

KTPS generates and supplies electricity across the state of Maharashtra in India. This power plant has produces by-product after burning coal as an energy inputs. By product obtained in the form of fine ash. Which has been known fly ash and bottom ash. These by-product directly dump on the nearby area. The utility of these finer materials has proven a feasible substance in concrete constituent.

key areas of operations in case of institute:

1.Ash Handling Plant

2.Coal Handling Plant

3. Water Treatment
4. Steam Generator
5. Turbine Generator Unit

D. Customers of the company:

1. Domestic Electricity Consumer
2. Commercial Consumers
3. Industries

E. Major competitors of the company:

1. KTPS
2. Tata Power Plant
3. Reliance Power Plant

F. Turnover of the company: Around 5594 Crore

G. Number of students visited: 39

H. Semester of Students: VII

I. Objective of visit:

1. To learn the functioning of coal based power plant .
2. To understand the coal to electricity cycle.
3. To understand the best and sustainable practices in running a coal based power plant.
4. To understand the better concept of power plant.

J. Observations during the visit:

1. Students observed the working of coal handling plant.
2. Student observed the working of ash handling plant .
3. Student observed the operation of control room
4. Student observed the operation of turbine generator set

K. Key learning during the visit / Outcome of the visit:

Enhanced Knowledge: Participants gain a deeper understanding of working of thermal power plant, working of substation of thermal power plant and actual working of turbine generator set

Real-World Exposure: Exposure to real-world thermal power plant and processes helps Participants Bridge the gap between theoretical knowledge and practical implementation.

L. CO/PO Attainment/Mapping: (Evaluation policy will be decided by teacher incharge in consultation with HoD)

1. **Subject mapped with Industry Visit:** Power System-II
2. **Subject Code:** ET5T003
3. **Semester:** 5th

4. Course Outcomes:

1. Define the different parameters of power system operation.
2. Illustrate the different parameters of power system operation and control.
3. To identify the different issues related to power systems
4. Analyze the different solution methods related to power system.
5. Choose amongst the different analytical & numerical methods for power flow solutions.
6. Solve the different problems related to cost load flow, fault, reactive power and stability constraints in the power systems

5. CO – PO mapping of Subject

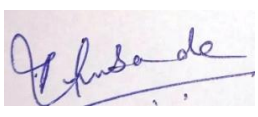
CO\ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	3	3	3	3	3	2	2	2	3
CO2	3	2	2	2	2	2	3	2	2	2	2	3
CO3	3	3	2	2	3	2	3	2	1	3	0	3
CO4	3	3	3	2	3	3	3	3	2	3	3	3
CO5	3	3	3	3	3	2	3	2	1	2	3	3
CO6	3	3	3	1	3	1	3	2	2	2	3	3

6. CO attainment of Industry visit

CO	CO Attainment
CO1	
CO2	
CO3	
CO4	
CO5	
CO6	

N. The visit was guided/supervised by: Mr. Rahul Shejao, Project Manager, Udaan

O. The visit was initiated by: Mr. P. V. Ambade and Ms. T. Khan




Prof. P.V.Ambade/Prof.Tuba Khan
Visit Incharge

Prof. Mandar Isasare
Industrial Visit Coordinator,EE

Dr.V.S. Dhok
HOD (EE)

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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.**

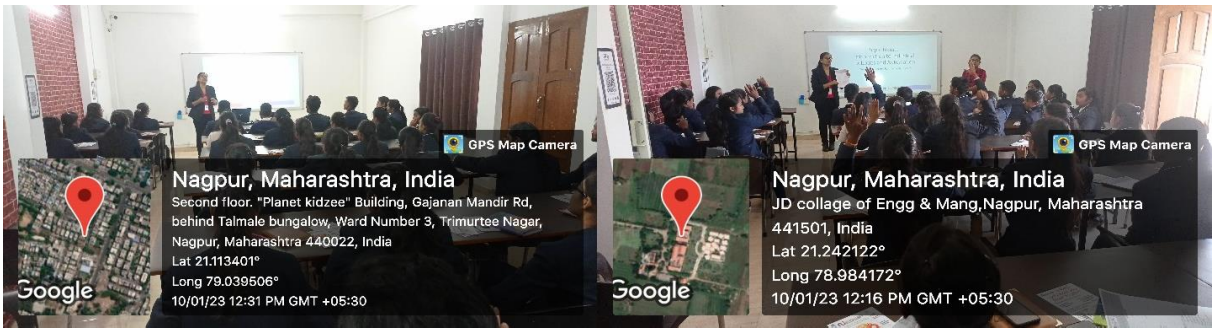
Industrial/Field Visit Report conducted on 10/01/2023 Under IIIC

At: NU Intelligence Private Limited, Nagpur (NUI)

Website of the company:https://nuintelligence.in/

Under the Aegis of: -Electrical Engineering

Geo tagged photos of the visit:



A. Brief Introduction of the company/institution:

NU Intelligence Private Limited is a Nagpur (M.S.) based, organization. NUI is pioneer (Pvt.) start up in Central India. NU Intelligence Pvt. Ltd. started in 2022 with a view to keep up with the ever growing tech-market, upgradation and enhancement. Nu Intelligence Pvt Ltd works in Industrial Robotics and Automation systems for production line factories. It works on various domains like PLC, Robotics, conveyer belt mechanism, electric vehicle kit, IoT automation, sorting mechanism. NU intelligence also provide Lab of automation, PLC, IoT , Robotics and all tools &equipments in lab under the mentor guidance

B. Products of the company/key areas of operations in case of institute:

1. Robotics lab
2. AI lab
3. IoT lab

4. AI lab
5. Internship
6. Training
7. Workshop
8. Live project

C. Customers of the company:

1. RPCE Bhandara
2. GPC Balaghat
3. JDCOEM Nagpur
4. YCCE Nagpur
5. KDK COE Nagpur
6. CCET COE Nagpur
7. SCET COE Nagpur
8. GPC Nagpur
9. JIT COE Nagpur
10. SCEP Manjhapur
11. St. Vincent Palloti COE,
12. VIT COE Nagpur
13. M.K. Umathe COE Nagpur
14. GNIET COE Nagpur
15. CEMS
16. G. H. Raisoni IET
17. NIT COE Nagpur
18. TGPCET Nagpur

D. Major competitors of the company: Fire Blaze AI School

E. Turnover of the company: Around 50 Lakhs

F. Number of students visited: 39

G. Semester of Students: III & V

H. Objective of visit:

1. **Understanding the Robotics Industry:** Gain a comprehensive understanding of the robotics industry, its scope, and its various applications in different sectors such as manufacturing, healthcare, agriculture, and more.
2. **Technology Showcase:** Witness the latest advancements in robotics technology, including robotic systems, sensors, artificial intelligence, and automation solutions.

I. Observations during the visit:

1. Students observed the working of Industrial robot.
2. Student observed the programming of industrial robot.

J. Key learning during the visit / Outcome of the visit:

1. During the visit hands-on session on designing of non programmable robot was conducted by NUI.
2. **Enhanced Knowledge:** Participants gain a deeper understanding of the robotics industry, including its technologies, applications, and significance in various sectors.
3. **Real-World Exposure:** Exposure to real-world robotics applications and processes helps Participants Bridge the gap between theoretical knowledge and practical implementation.
4. **Networking Opportunities:** Participants have the chance to network with industry professionals, potentially leading to future career opportunities, mentorship, or collaboration on projects.

K. CO/PO Attainment/Mapping: (Evaluation policy will b decided by teacher incharge in consultation with HoD)

1. **Subject mapped with Industry Visit:** Microprocessor and Microcontroller
2. **Subject Code:** EE6T001
3. **Semester:** 6^{th}
4. **Course Outcomes:**

1. To remember the architecture of 8085 and 8051
2. To understand interfacing and interrupt features of 8085 and 8051.
3. To develop program for basic applications
4. To distinguish and analyze the properties of Microprocessors & Microcontrollers
5. To explain programming logic and concepts of 8085 microprocessors and 8051 micro-controllers.
6. To build strong foundation for designing real world applications using microprocessors and microcontrollers

5. CO – PO mapping of Subject

CO\ PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	3	3	3	3	2	2	2	2	2	3
CO2	3	3	2	2	2	3	1	3	3	2	2	3
CO3	2	2	2	2	2	2	2	2	2	3	3	3
CO4	3	3	3	3	3	3	2	1	3	2	2	3
CO5	2	3	2	3	2	2	3	3	2	1	2	3
CO6	3	2	1	1	1	3	2	2	3	2	3	3

6. CO attainment of Industry visit

CO	CO Attainment
CO1	
CO2	
CO3	
CO4	
CO5	
CO6	

N. The visit was guided/supervised by:Mrs.NeemaUkhani,CEO,NU Intelligence

O.The visit was initiated by: Ms. T. Khan &Mr.Aditya Kunghadkar.

Prof.Tuba Khan/
Visit Incharge

Prof.Mandar Isasare
Industrial Visit Coordinator,EE

Dr.V.S. Dhok
HOD (EE)

Jaidev Education Society's
J D College of Engineering& Management, Katol Road, Nagpur
Department of Mechanical Engineering
Session 2022-2023

।। तमसो मा ज्योतिर्गमय ।।

REPORT ON "EXPOSURE VISIT BY BUREAU OF INDIAN STANDARDS" ON APRIL 27TH 2023

J D College of Engineering & Management, Nagpur

Activity : **"EXPOSURE VISIT BY BUREAU OF INDIAN STANDARDS"**
Date : **27/04/2023 (Thursday)**
Time : **11:00 am to 5:00 pm**
Event : **"EXPOSURE VISIT BY BUREAU OF INDIAN STANDARDS".**
Event Venue : **JDCOEM, Nagpur and ESAB Industry**

Objective: To make aware the students about Industry standards and norms.

Committee Members:

1. Prof. Suhas A. Rewatkar
2. Prof. P.M.Gupta
3. Prof. Aamir R.Sayed
4. Prof. D.A. Agrawal

Targeted Audience: Third Year students

Total No. of Student Turned up: Total =15 students and faculties

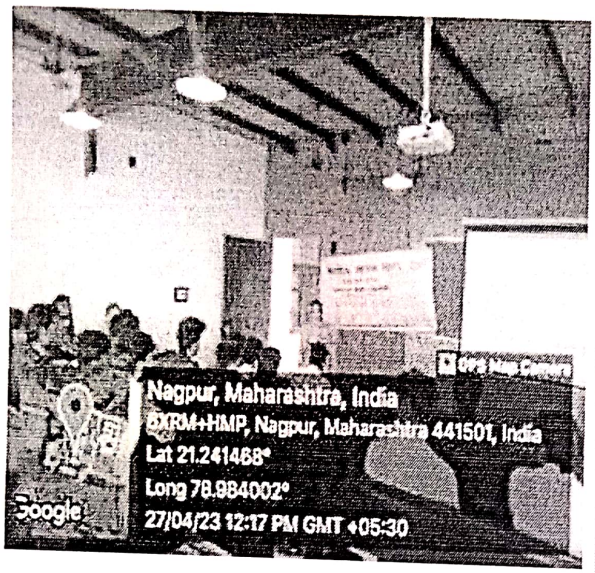
Outline of the Program is as follows :-

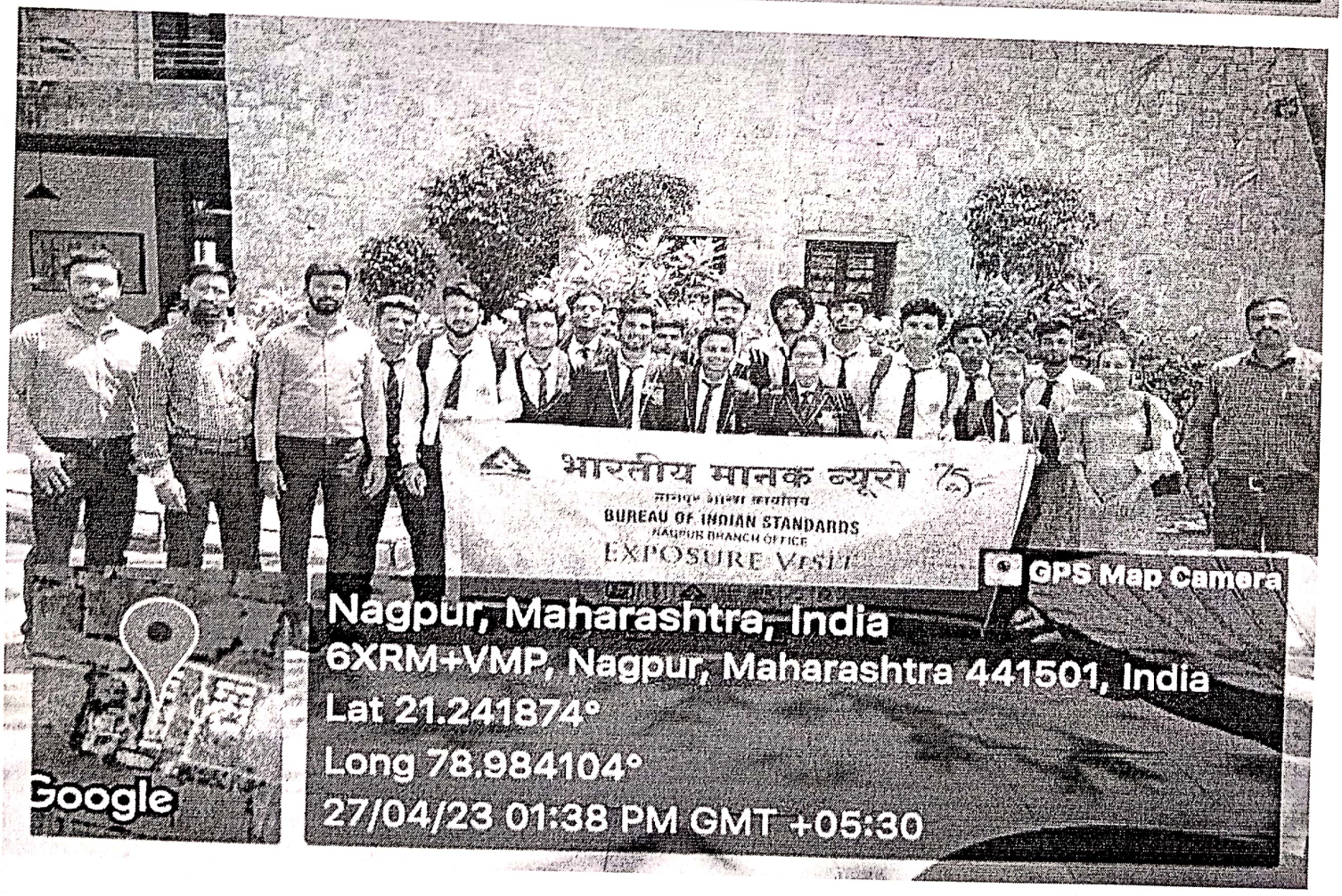
BIS is Indian Government Organization has approached our esteem institute with the intention to make aware our engineering students about industry standards and norms.

15 students from third year were selected for this purpose. Mrs. Isha Khurana, Standards Promotion Officer, BIS, Nagpur from BIS visited the college campus first on dated 27th April 2023. She had given the guidance seminar to students in the classroom and make them aware about the importance of safety and industry standards in the field of manufacturing. After the refreshment, all students along with three faculties members visited the industry at Kamleshwar, MIDC.

Industry name was ESAB and the company is in the field of manufacturing od welding electrode. Students got the opportunity to see the actual production and manufacturing process. Where they realize how precautionary measures are important.

Outcome of Activity: The students realized the importance of Indian standards, safety measures in the field of manufacturing.





T&P Co-coordinator
Asst. Prof. P. M. Gupta
DOME, JDCOEM

Academic In Charge
Asst. Prof. V.P. Katekar
DOME, JDCOEM

Head of Department
Dr. B. R. Mahajan,
DOME, JDCOEM.

Head of Department
Mechanical Engineering
JD College of Engineering & Management
Nagpur

Dept. of Mech. Engg. JDCOEM

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.

Webinar on **"Entrepreneurship Skill, Attitude & Behavior Development"**

1) Name of the Event : Webinar on **"Entrepreneurship Skill, Attitude & Behavior Development"**

2) Under the Aegis of : Institute of Electronics & Telecommunication Engineers.

3) Date & Time : 15th January, 2022 from 10:30 a.m. to 11:30 p.m.

4) Program Coordinators : Prof. Gourav Das

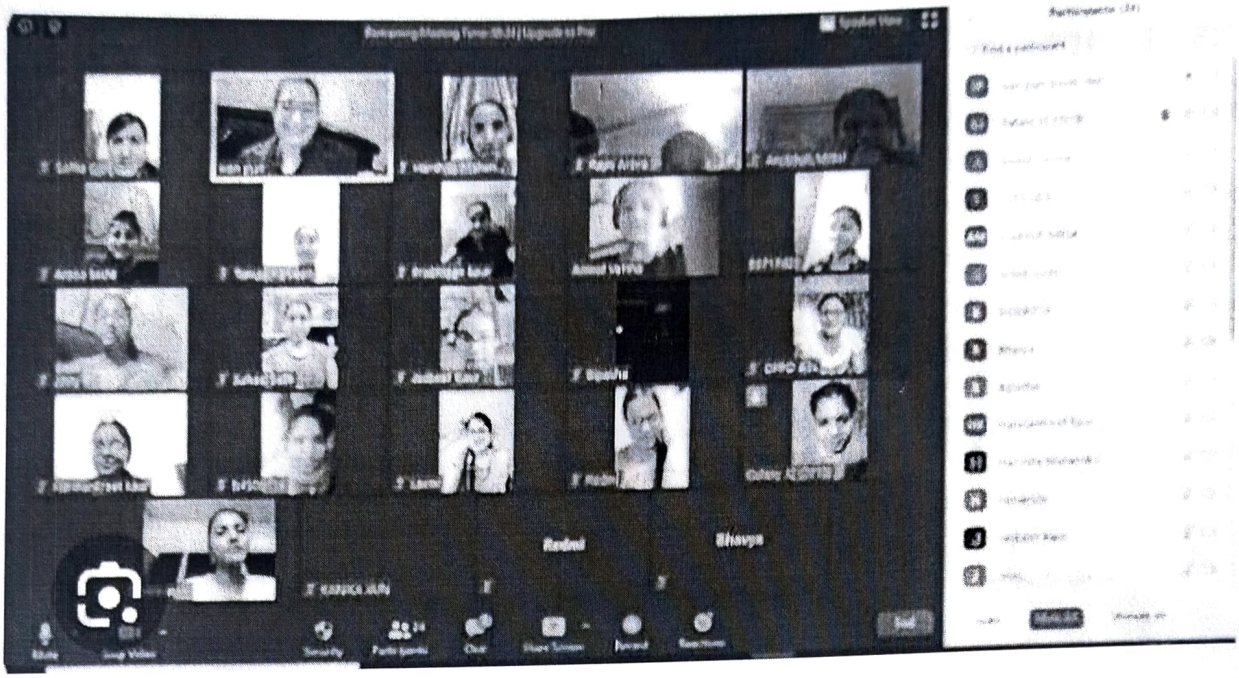
5) Event details:

Department of Electronics and Telecommunication of J D College of Engineering and Management, Nagpur which is the first autonomous institute under Dr. Babaseheb Ambedkar Technological University, Lonere with NAAC 'A' grade, organised webinar on **"Entrepreneurship Skill, Attitude & Behavior Development"** for the students under the banner of IETE student forum (ISF) ,IIIC and IIC for the session 2021-22 on 15th January, 2022. Prof. Gourav Das was the speaker for the event. He is the founder of the IIoT Labz Nagpur. Mr. Zambani completed his Engineering graduation from Nagpur university. Mr. Zambani said that as enterpreneur decisions you make along the way affect the next step in your journey. Your entrepreneurship journey may look a little different than the entrepreneur next to you, but you are still on the same trajectory through the phases of entrepreneurship.

The webinar was based on different phases of entrepreneurship development like Big data, taking the plunge, proof of concept, ready for growth and growth and long term footing.

Speaker very well explained what each phase looks like depends on the industry, type of company, approach to entrepreneurship (ie. Risk-averse vs. Risk taker), and your decisions along the way. Not every entrepreneur makes it through the 5 phases of entrepreneurship. It's a tough journey that will test your resiliency many times. But this is an easy trade off for entrepreneurs who like to take risks (whether big or small) because it allows them to take control over their own career. You just have to survive to make it.

6) Photographs of the Event:



Prof. Avinash K. Ikhar
Academic Incharge

Dr. P. Kshirsagar
HOD (ETC)

Report on "How to Become Successful Entrepreneur"

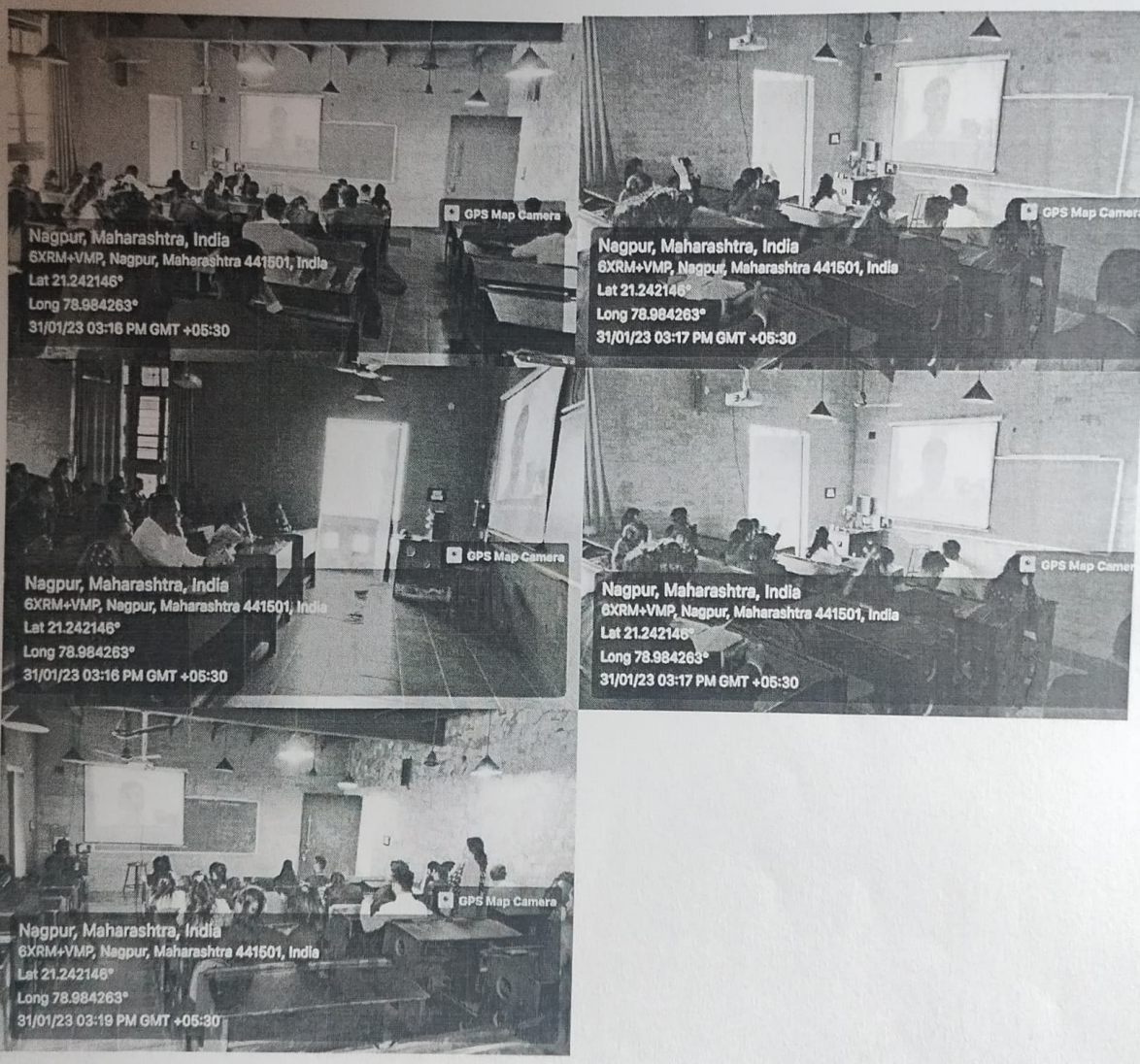
Held on: January 31, 2023

Time: 3:00 Pm - 4:00 Pm.

Venue: VS 104

Geo tagged photos 2-4 (Collage)

Photographs of the Event :-



Under the Aegis of : National Service Scheme (NSS),

: IETE (Institute of Electronics & Telecommunication Engineers

Rational/Concept of the event:

To provide education, information, and practical guidance to women and girls on various aspects of personal hygiene.

Pre event feedback:

1. Student don't know about what is Entrepreneurship.
2. Student don't know about how to become successful Entrepreneur.
3. Students don't understand business concept.

Objectives:

- 1. The main objective of the webinar was to make students to become a successful entrepreneur.
- To make students aware about the Entrepreneurship and the right way to become a successful entrepreneur.
- To make students a successful entrepreneur in future if they want to open a startup.

Modalities: (How the event was conducted)

A Webinar on "How to become Successful Entrepreneur" was organized by the department of Electronics & Telecommunication of J D college of Engineering and Management. Around 70 Students from etc departments atteded this webinar. Prof. KiranKhandareco-ordinated the webinar under the guidance of Prof. GayatriBhoyar, Head ETC Department. Dr. NamrataPradnyakar, Dean Students IIC President ,Respected Principal Dr. S. V. Sonekar, Prof. AvinashIkhar Academic Incharge ETC Department, all the faculties of ETC Department attended the webinar. The speaker of the webinar was Mr. Anil Chandaliya.

The webinar was conducted in offline and online both modes. Students of ETC DEPARTMENT attended the webinar in the classroom in the offline mode and some students attended the webinar in online mode on google meet. A google meeting link was provided to the students to attend the webinar in online mode also. The webinar was conducted of total 1 hour from time between 3:00 pm to 4:00 pm.

No of attendees: 70

Financial implications: 1500

Post event publicity: Status of Creation and circulation of post for whatsapp, instagram, facebooketc.

Post Event Feedback:

1. The feedback received from participants is positive and highlights the effectiveness of of workshop on their future.

2. Although specific feedback details are not provided, the overall positive feedback suggests that the event successfully achieved its objectives and had a positive impact to become successful entrepreneur.

3.Students now understand how to estimate the business ideas to bean entrepreneur.

Session came to a formal end as **Prof. Kiran Khandare** delivered the vote of thanks.

No of Students:15

List of students:

Sr. No.	Name of Students	Mobile Number	Semester
1	VaidehiMeshram	9075937831	VIII
2	Ganesh Mungal	9673572414	VIII
3	DaminiManapure	9834314436	VIII
4	DeepakDahiwale	8329502203	VI
5	KhushiYadav	7558784309	VI
6	SakshiParate	9146236246	VI
7	TejaswiniBawane	9145782654	IV
8	DaminiAthawale	9765967689	IV
9	AditiGhodeshwar	9850519359	VI
10	SejalAshtikar	7249710918	IV
11	Aqsa Khan	9359740372	VI
12	ManasiLandge	8767619684	VI
13	JayTete	7709934370	IV

Financial implications: 1000

Course Outcome:

1. Students aware about the Entrepreneurship and the right way to become a successful entrepreneur.
2. Students can become a successful entrepreneur in future if they want to open a startup.
3. The workshop helped them lot to move in this field.

Activity Mapping & Attainment with PO

PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
ACTIVITY	2	3		1		2	3	2	3		2	1

The Activity was initiated by: **Prof. AvinashIkhar , Prof. Kiran Khandare**

Prof. Avinash. K. Ikhar
Academic In-charge

Dr. P. Kshirsagar
HOD (ETC)

Education to Eternity

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Department of Management Studies
Session 2022-23

VISION

To evolve as a center that provides excellent learning and research environment for nurturing future management professionals.

MISSION

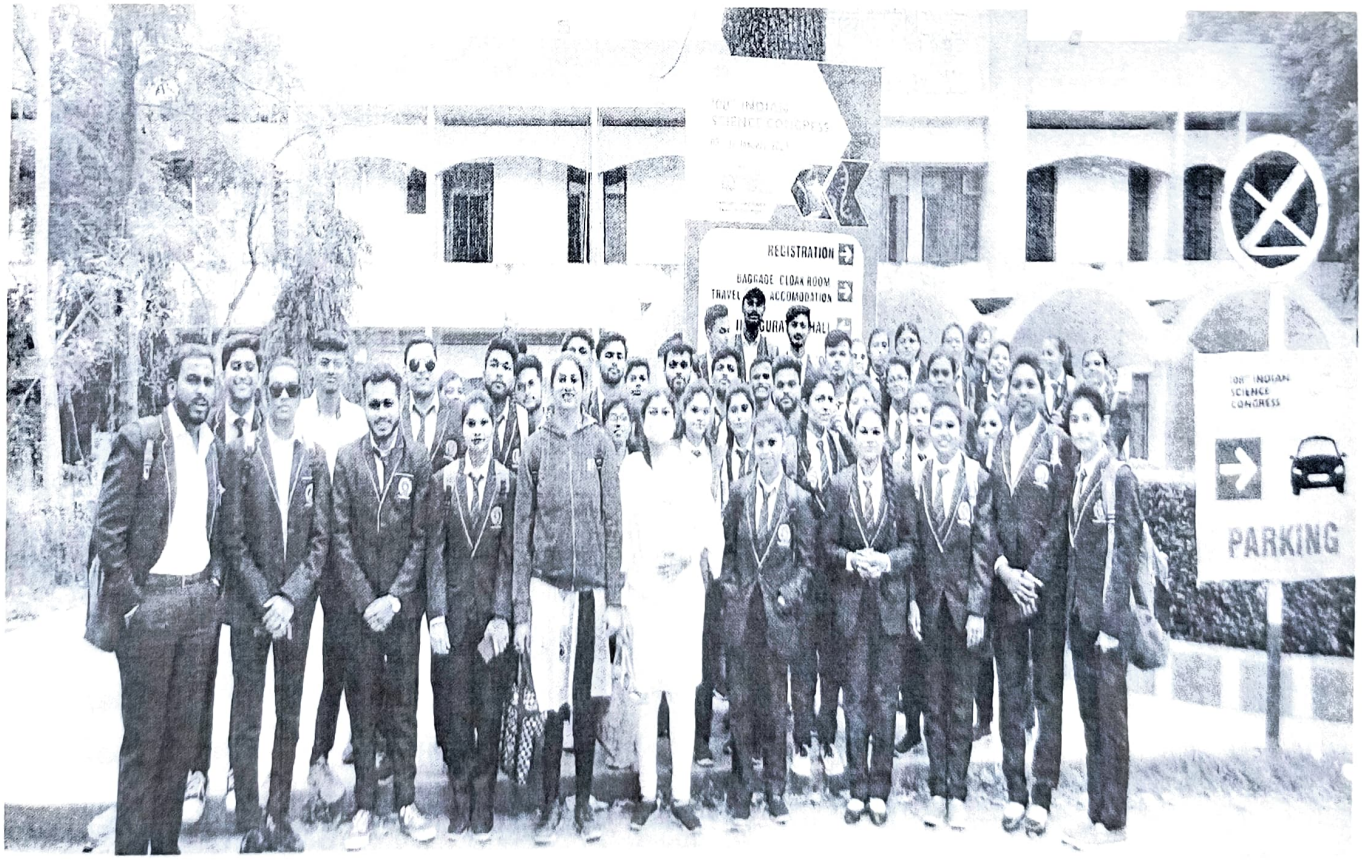
1. To develop in the students strong domain knowledge and a passion for lifelong learning.
2. To develop managerial and leadership skills in the students along with a strong sense of ethics, social responsibilities and Professional values.

Report on

"108th Indian Science Congress Conclave: Volunteer to Learn Effective Event Management"

Held on 03rd Jan to 7th Jan 2023

Venue: RTM Nagpur University



Rational/Concept of the event:

In the pursuit of fostering interdisciplinary collaboration and advancing scientific knowledge, the MBA students from J D College of Engineering & Management are thrilled to contribute their expertise and skills to the Indian Science Congress event scheduled to take place in Nagpur. This collaborative endeavor aligns seamlessly with the overarching vision of bridging the gap between scientific research and effective event management, embodying a commitment to academic excellence and community engagement.

Pre event feedback:

- **Expectations and Preferences**
  - What are you hoping to gain from this event?
  - Please rank the following aspects of this event based on how important they are to you

- **Event Logistics**
  - What is your preferred event format (virtual, hybrid, or in-person), and why?
  - What platform do you check most often? We'll use this to communicate with you.

Modalities: (How the event was conducted)

The Indian Science Congress event in Nagpur was conducted with precision, combining meticulous planning and dynamic execution. MBA students played a pivotal role in orchestrating the event's logistics, registration processes, and venue management. The modalities involved strategic task allocation, leveraging project management tools, and fostering clear communication channels. Collaborative efforts ensured seamless coordination with the Indian Science Congress organizers, aligning the management skills of MBA students with the scientific expertise of the Congress. The event unfolded through a series of plenary sessions, panel discussions, and interactive workshops, enhancing the overall participant experience. Concurrently, innovative technology solutions facilitated virtual participation, widening the reach of the congress. The success of the event was underpinned by a comprehensive feedback mechanism, allowing for continual improvement and establishing a benchmark for future collaborations between academic disciplines and management acumen.

- **Financial implications**: NIL
- **Post event publicity**: Status of Creation and circulation of post for WhatsApp, Instagram, etc.

- **Effective Collaboration and Interdisciplinary Approach**: The event fostered collaboration between MBA students and the scientific community, exemplifying the benefits of an interdisciplinary approach. This outcome emphasizes the importance of synergy between management and science in achieving successful outcomes.

- **Community Impact and Outreach**: MBA students actively contributed to the community by facilitating the dissemination of scientific knowledge. This outcome reflects a commitment to societal impact and underscores the role of educational institutions in engaging with broader audiences.

- **Strategic Use of Technology for Inclusivity:** The incorporation of innovative technology solutions showcased the importance of adapting to evolving circumstances. This outcome highlights the strategic use of technology for virtual participation, ensuring inclusivity and expanding the reach of the event beyond geographical constraints.

- **Continuous Improvement and Benchmarking:** Establishing a comprehensive feedback mechanism became a key outcome, enabling continuous improvement. This outcome emphasizes the importance of reflection, feedback analysis, and benchmarking for future collaborative efforts, setting a standard for excellence in academic and management partnerships.

Activity Mapping & Attainment with PO:

PO	PO1	PO2	PO3	PO4	PO5
ACTIVITY	2		3		1

The Activity was initiated by Prof. Mrunmayee Kanitkar, Assistant Professor, JDCOEM.

Event Coordinator **HOD** **Principal**

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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

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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

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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.

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MINUTES OF MEETING FOR 07TH ACADEMIC COUNCIL MEETING NO:JDCOEM/07/2022-23

24/03/2023

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

The 7th Meeting of Academic Council was held on 24th March 2023 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. Vaishanvi Dhoke	EE, JDCOEM
03		Mrs. Atika Ingole	CE, JDCOEM
04		Ms. Supriya Sawwashere	CSE, JDCOEM
05		Mrs. Gayatri Padole	ETC, JDCOEM
06		Mr. Suhas Rewatkar	ME, JDCOEM
07		Mr. Mirza Baig	IT, JDCOEM
08		Dr. Amit Gupta	FY, JDCOEM
09		Mr. Umesh Samarth	CSE(DS), JDCOEM
10		Ms. Swati Raut	AI, JDCOEM
11	Teacher of the College	Dr. S. L. Haridas	Dean Academics, JDCOEM
12		Dr. Namrata Pradnyakar	Dean Student, JDCOEM
13		Dr. Satish Vaishnav	Dean R&D, JDCOEM
14		Dr. Ujwala Dange	IQAC coordinator
15		Mr. Prashant Mahakalkar	Dean Diploma
16		Mr. Sunil Gupta, COE	COE, JDCOEM
17		Mr. R. P. Dhandre	ME, JDCOEM
18	Industry Experts / Academician	Dr. R. P. Borkar	GCOE, Nagpur
19		Dr. M. M. Raghuwanshi	Symbiosis Nagpur
20		Dr. Rajesh Pande	RCOEM, Nagpur

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21	University Nominee	Dr. B. F. Jogi	DBATU
22		Dr. L. D. Netak	

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

1. Dr. M. Sadaiah – University Representative
2. Mr. Amol Raghushe – Industry Expert

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

Item No. 1	To Confirm the Minutes of 6th meeting of Academic Council.

The Minutes of Sixth 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 6th Meeting of Academic Council held on 10/05/2022.

The Action Taken Report of the 6th Meeting of Academic Council was read out. The Chairman, Academic Council informed the Actions Taken on previous minutes (Annexure-II).

Item No. 3	To welcome newly nominated members on Academic council.

Following are the new members of Academic council.

1. Dr. R. P. Borkar, Principal GCOE, Nagpur
2. Dr. R. Pande, Principal RCOEM, Nagpur
3. Dr. M. M. Raghuwanshi, Symboisis, Nagpur
4. Mr. Amol Raghushe, TCS, Nagpur

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5. Dr. M. Sadaiah, DBATU, Lonere
6. Dr. B. F. Jogi, DBATU, Lonere
7. Dr. L. D. Netak, DBATU Lonere

The nomination is noted by the house (Annexure-III).

Item No. 4	To note the nominee of DBATU on Various Board of Studies.

As per the regulation of UGC one member is to be nominated on BOS from the affiliated University. The college has received letter from DBATU, about the nominee wide letter no. DBATU/AFFIL/1002/2023/447 dated 10th February 2023. DBATU has nominated Prof. U. Deshpande of VNIT & Prof. Latesh Malik of GCOE as an academician on BOS of AI & CSE (DS) respectively. The nomination is noted by the house (Annexure-IV).

Item No. 5	To approve the new course B. Tech. in Computer Science & Engineering (Data Science) from the session 2022-23 and to take on record the reduction of intake for Mechanical Engg.

College has applied for B. Tech. in Computer Science & Engineering (Data Science) for 1st division (60 students) with reduction in intake of Mechanical Engineering from 120 to 60 (Annexure-V). This new course has been approved by AICTE from 2022-23 onwards hence house unanimously permitted to start the new course Computer Science & Engineering (Data Science) (Annexure-V).

The schemes of B. Tech. in Computer Science & Engineering (Data Science) approved by Board of Studies "Computer Science & Engineering (Data Science)" have been placed before the house for approval. The house unanimously approved the Schemes of B. Tech. in Computer Science & Engineering (Data Science) (Annexure-VI).

Item No. 6	To approve the syllabus, inclusion of subjects "Problem Solving using C (HU1T003)", "Principle of Data Science(DS1T010)" and "Statistical Analysis (DS2T011)" in First year common scheme for B. Tech. in Computer Science & Engineering (Data Science).

It has been suggested by Board of Studies to keep "Problem Solving using C (Theory & Practical)", "Principle of Data Science" subjects in 1st semester and "Statistical Analysis" subject in 2nd semester subjects in place of "Introduction to programming, Basic of Electrical &

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Electronics Engineering & Basic of Civil & Mechanical Engineering" respectively. Board of study Chairman explained the concept & logic of designing the syllabus of the subjects. The house unanimously approved the syllabi of "Problem Solving using C (Theory & Practical)", "Principle of Data Science" & "Statistical Analysis" (Annexure-VII).

Item No. 7	To approve the increase in intake of MBA from 60 to 120 from the session 2022-23.

College has applied for increase in intake of MBA from 60 to 120. It has been approved by AICTE from 2022-23 onwards (Annexure-V).

The house was admitted the increase in intake of MBA.

Item No. 8	To approve the syllabus of subjects of VII and VIII - Semesters of AI.

The scheme of AI has already been approved in 3rd meeting of the house. The syllabi of First, Second and Third year were also approved in the consecutive meetings. Now Board of Studies of AI has finalized the syllabus of 4th year (VII & VIII - Sem) the house unanimously approved the syllabi of 4th year (VII & VIII - Sem) of AI (Annexure-VIII).

Item No. 9	To update the syllabus of M-III of CSE, AI, IT.

Looking into execution and requirement updating was done in the syllabus of M-III of CSE, AI & IT. The house approves the modified syllabus of the M-III (Annexure-IX).

Item No. 10	To update the syllabus of subjects in different BOS.

Looking into execution and requirement updating was done in the syllabus of following subjects by different BOS. The house approves the modified syllabus of the following subjects.

1. EE BOS : Autocad (Annexure-X)
2. CE BOS : Concrete Technology, Design of RC structure, Structural Analysis (Annexure-XI)
3. ETC BOS : EDC, S&S (Annexure-XII)

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

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1. In Introduction; under departments, table which was amended in 5th meeting of the house include following row.

17	Computer Science & Engineering (Data Science)	CSE (DS)

2. Under program Offered and under graduate programs, table was amended in 5th meeting of house include following row

8	Computer Science & Engineering (Data Science)	CSE (DS)	8	Eligibility Criteria as laid down by the competent authority from time to time

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

Item No. 12	**Amendment in Exam manual of JDCOEM under clause "1.3 Examination Cell".**

Presently in Exam manual of JDCOEM under clause 1.3 Examination Cell mentioned that "In accordance with the guidelines of the University Grants Commission to autonomous Colleges, there will be an examination cell headed by the Controller of Examinations (COE) who will be a permanent faculty appointed by the Principal on the basis of the potential of the person and in accordance with statutory norms if any".

Now it is read as "In accordance with the guidelines of the University Grants Commission to autonomous Colleges, there will be an examination cell headed by the Controller of Examinations (COE) who will be a full time regular faculty nominated by the Principal on the basis of the potential of the person and in accordance with statutory norms if any" (Annexure-XIV). The issue is kept before the house and house accepted and permits to make the changes in the "Exam Manual" (Annexure-XIII).

Item No. 13	**To extend the term of controller of Examination COE**

Our autonomy was started from 2019-20 and as per the Exam manual of JDCOEM the term of controller of examination COE is of three years. So the first term of COE is ended in 2022-23.

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College wants to extend his tenure & giving one more term of three years to COE, Mr. S. R. Gupta. The house unanimously accepts it (Annexure-XV).

Item No. 14	To approve the Academic Calendar for the session 2022-23 Even Sem.

Academic Calendars are prepared for all semester (4th, 6th & 8th sem). It is approved by the house (Annexure-XVI).

Item No. 15	To approve the Result of 2022-23 ODD sem.

3rd, 5th & 7th semester exams of 2022-23 were conducted & result of 5th & 7th sem are declared. The result is accepted & appreciated by the house (Annexure-XVII, XVIII).

Item No. 16	To approve the guidelines for Valuer.

For valuation of answer sheets guidelines are prepared for the Valuer. Since it is for uniformity in the valuation house approved the guidelines (Annexure-XIX).

Item No. 17	To approve the Internship policy.

BOS of ME, CE & EE suggested internship for B. Tech. students in 8th sem., accordingly scheme has been modified and all students of these programs are doing internship at various industries. So we prepare a guideline for execution & valuation of this internship. The house was agreed for such type of activity & policy for getting industrial culture to students and approved the policy (Annexure-XX).

Item No. 18	To approve the Continuous Assessment Rubrics from the session 2022-23.

College follows the activity based learning; to promote it we modified our continuous assessment rubrics. It is approved by the house (Annexure-XXI).

Item No. 19	To approve the guideline for MOOC.

To promote online learning college has decided that students should complete at-least two MOOC courses during his/her B. Tech. duration. It will be a credit course. Credit will be considered in 4th sem & 8th sem. For successful implementation guideline is prepared. The house appreciates & approved the guideline (Annexure-XXII).

Item No. 20	To approve the merging of Diploma program into J D College of Engineering & Management.

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The Jaidev Education Society has two colleges; Engineering & Polytechnic. Now the Polytechnic College is merged in Engineering College hence both college is under "J D College of Engineering & Management". The house noted & admits this merging (Annexure-V).

Item No. 21	To consent for going to NBA for diploma course.

According to pre-qualifier for NBA we are eligible for ME, CO, ETC and EE hence college has decided to go for NBA for these programs. This is for information to the house and it shows positive consent for the same (Annexure-XXIII).

Item No. 22	Achievement of JDCOEM in 2022-23.

Following activities are conducted during 2022-23.

1. Five faculties awarded with Ph. D. (Annexure-XXIV).
2. Organized International conference on "Advance in Materials: Engineering & Technology" in association with RTMNU, Nagpur and in collaboration with Luminescence Society of India (Annexure XXV).
3. ETC department has organized FDP on "AI/ML for Computer Vision Applications" in collaboration with NIT, Warangal (Annexure XXVI).
4. Other departments will organize FDPs in April 2023.
5. On 28-29 March 2023 Industry-Academia convention and Student summit is planned (Annexure-XXVII & XXVIII).
6. Tech-fest for students "Brainwaves" was conducted on 01-02 March 2023 (Annexure-XXIX).
7. Student & faculties (Teaching & non teaching) were felicitating in various categories (Annexure-XXX).

House appreciates all the activities & efforts for conducting these activities.

Item No. 23	Any other matter with the permission of the Chair.

No other matter was discussed.

Also the following suggestions are received from experts.

1. Dr. R. P. Borkar suggested presenting old syllabus & new syllabus both so that what changes are made in the syllabus will be clear.
2. In Continuous assessment rubrics no attendance marks should be given for less than 60% attendance.

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3. Conducted activities and planned activity should be separately present.
4. Dr. B. F. Jogi suggested collaboration for agriculture & medical based project and related activities should be done.

The chairman academic council 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.

Principal
J D College of Engineering & Management
Khandala, Katol Road
Nagpur-441501

J D COLLEGE OF ENGINEERING & MANAGEMENT NAGPUR

J D COLLEGE OF ENGINEERING & MANAGEMENT

An Autonomous College, Affiliated to DBATU, Lonere

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

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।।ज्ञानम् सर्वार्थ साधनम्।।

MINUTES OF MEETING FOR 7TH BOARD OF STUDIES (EE) MEETING NO. BOS/EE/07/2022-23 — 23/12/2022

Venue: Classroom VS-003

The 7th meeting of the Board of Studies (Electrical) was held on **22nd December 2022** at **11:00 a.m.** in classroom VS-003. Following members of the Board of Studies were present in the meeting.

Sr.No	Name of the member
1	Dr. V.S. Dhok (Chairperson)
2	Er.Ashok Kale (External Expert)
3	Dr.Nitin Ghawghawe (Internal Expert)
4	Dr.Vinod Chandrakar (External Expert)
5	Dr. S.R.Vaishnav
6	Prof. P.P. Panchbhai
7	Prof. A.V. Joshi(Member Secretary)
8	Prof. P.V. Ambade
9	Prof. M.S.Isasare
10	Prof.Tuba Khan
11	Prof.A.W.Male
12	Prof.P.P.Barekar

Item No. 1	**Confirmation of the previous BOS meeting, Inclusion and Confirmation of new members**

The Member Secretary welcomed the Chairperson of Board of Studies Dr.V.S.Dhok, External Expert Mr.Ashok Kale, Internal Expert Dr. N.D. Ghawghawe & 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 23/03/2022 and confirmation on it was taken. Few old BOS members were removed and new BOS members were included.

Item No. 2	Presentation of Action Taken report for last previous meeting held on 23/03/2022

The Secretary of BOS presented the Action taken report for the previous meeting held on 23/03/2022 and discussed it in front of the members.

Item No. 3	Revision of Scheme & Revision of the syllabus for Open Elective Subject-Electrical AUTOCAD

Scheme of was revised with minor changes and approved in BOS. Syllabus of open Elective subject 'Electrical AUTOCAD' offered by EE department was revised and approved. Following were the suggestions by experts:

1. Mr.Ashok Kale sir suggested that the syllabus of Power Electronics Lab should include topics like heat dissipation of MOSFET which can give practical exposure of subject to students.
2. Mr.Ashok Kale sir suggested that the subject related to Graph study and analysis should be taught in the curriculum.
3. Dr.N.D.Ghawghawe sir suggested that the subject Electrical AutoCAD should be renamed as Basic AutoCAD.

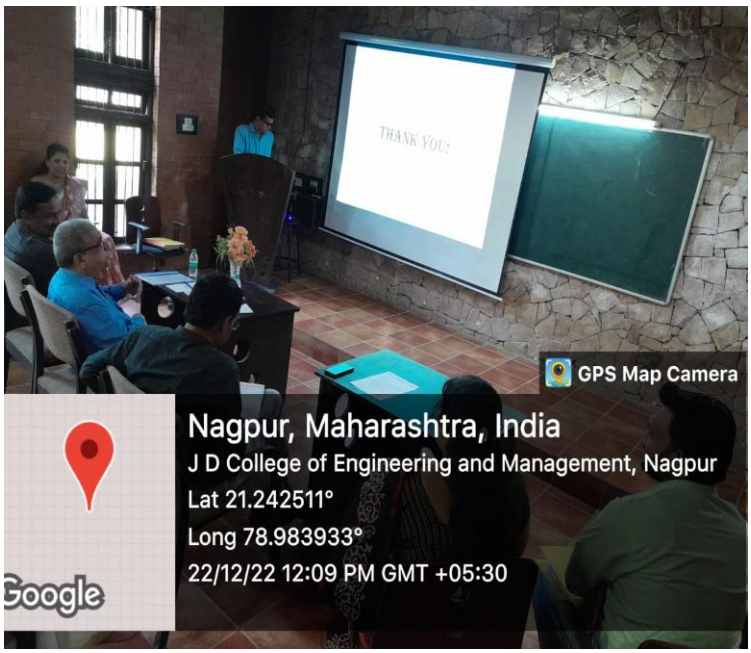
Item No. 4	MOOC Guidelines & Inclusion of MOOC in 4^{th} and 8^{th} Sem & Discussion on 8^{th} Sem Internship

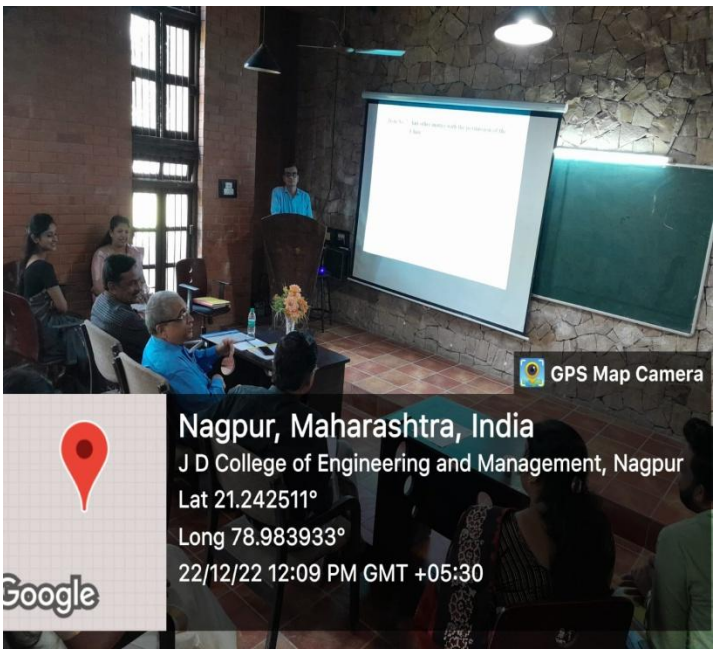
MOOC Guidelines were discussed, their inclusion in 4^{th} and 8^{th} sem was approved by BoS and valuable suggestions of experts on 8^{th} sem internship were taken. Following were the suggestions by experts:

1. Mr.Ashok Kale sir suggested that student should be classified as
    - Going for PSU with valid gate score.
    - Software and IT Companies
    - Core Companies
    - Going for start ups and should be train according to that.
2. Mr.Ashok Kale sir suggested that the companies selected for internship should not have turn over more than 3-4 crores.

Item No. 5	Any other matter with the permission of the Chair.

The meeting Concluded with the vote of thanks by Prof.Ankita Male.





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

Dr. V.S.Dhok
Chairperson, Board of Studies
Dept. of Electrical. Engg.
JDCOEM, Nagpur

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Action Taken Report

Sr.no	Item	Suggestion	Action Taken
01	**Revision of Scheme & Revision of the syllabus for Open Elective Subject-Electrical AUTOCAD**	Mr.Ashok Kale sir suggested that the syllabus of Power Electronics Lab should include topics like heat dissipation of MOSFET which can give practical exposure of subject to students.	The syllabus of Power Electronics includes the topics like heat dissipation in Switching devices.
		Mr.Ashok Kale sir suggested that the subject related to Graph study and analysis should be taught in the curriculum.	The subject Numerical methods and probability already includes Graph study and analysis.
		Dr.N.D.Ghawghawe sir suggested that the subject Electrical AutoCAD should be renamed as Basic AutoCAD.	Subject Electrical AutoCAD was renamed as Basic AutoCAD.
02	**MOOC Guidelines & Inclusion of MOOC in 4th and 8th Sem & Discussion on 8th Sem Internship**	Mr.Ashok Kale sir suggested that student should be classified as • Going for PSU with valid gate score. • Software and IT Companies • Core Companies • Going for start ups and they should be train according to that.	Students were bifurcated as per suggestion by the expert & they are provided training and internship according to their choice.
		Mr.Ashok Kale sir suggested that the companies selected for internship should not have turn over more than 3-4 crores.	As per suggestion by the expert the mentioned criteria is being considered by the department for sending students for internship.

Prof. A. V.Joshi
Member Secretary
Board of Studies, EE Dept

Dr.V.S.Dhok
Chairperson
Board of Studies, EE Dept

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REVISED SYLLABUS

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.

SYLLABUS:

Unit I: Power semiconductor devices & their characteristics (6 Hrs)

SCR, TRIAC, DIAC-construction, characteristics & applications, turning ON-OFF SCR, turn ON mechanism, different methods of turning ON-OFF SCR, series and parallel connections of SCRs, Protection of SCR gate circuit protection

Unit II : Turn on and Turn off circuits for power semiconductor devices (6Hrs)

Introduction to GTO, power MOSFET & IGBT & their construction &characteristics. Triggering circuits and optocouplers and Pulse transformer. Heat dissipation in Switching Devices.

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 (7Hrs)

Diode Rectifiers: Single phase half wave, full wave rectifiers with R and RL load, Three phase bridge rectifier with R and RL load.

Controlled Rectifiers: Principle of phase controlled rectification, single phase semi and full converter with R and RL load, power factor improvement in controlled rectifiers, three phase semi and full converter with R and RL load. (Only descriptive approach)

Unit IV: DC-AC converters(6 Hrs)

Classification , series inverter, improved series inverteroutput voltagecontrol, principle of operation for three phase bridge inverter in 120 deg. and 180 deg. mode, single phase bridge inverter.

Unit V: DC-DC converters (7Hrs)

Basic principles of chopper, time ratio control and current limit control techniques, voltage commutated chopper ckt, step-up chopper, step-down chopper

Unit VI: AC voltage controllers (AC-AC converters) (7Hrs)

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).

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Dr.V.S.Dhok
Chairperson
Board of Studies, EE Dept

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

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EE6O002	Open Elective II-Basic AutoCAD	4 Credit

PRE REQUISITES: A working knowledge of the AutoCAD® software and electrical terminology**.**

COURSE OBJECTIVES:

The objective of the course is to prepare the students:

1. Learn the basic commands necessary to utilize the AutoCAD software.
2. Learn the basic symbols for the creation of electrical drawings, consistent with industry standards and codes.
3. Create computer generated schematics and electrical drawings.

COURSE OUTCOME:

At the completion of this course, students will be able to:

- Understand the concept and techniques of Engineering drawing and become familiar with the AutoCAD user interface.
- Apply basic CAD concepts to develop and construct accurate 2D geometry through creation of basic geometric constructions.
- Create advanced drafting and modifying tools in AutoCAD
- Apply elements of drafting such as layers, dimensions, hatching, annotation, drawing formats, and 2D figures in projects with a focus on ANSI industry standards.
- Create blocks and attributes in AutoCAD

UNIT I An introduction to Engineering Drawings and AutoCAD (10 hrs)

- Introduction to Engineering Drawing
- Various types of Engineering Drawing used in Electrical Industry
- Introduction to AutoCAD
- Exploring GUI
- Workspaces
- Coordinate System
- Display Control
- File Management
- Tutorials

UNIT 2 Drafting Basic Geometry Shapes in AUTOCAD (10 hrs)

- Basic Geometry Shapes
- Setting the standards

- Drafting setting
- Drawing tools for basic geometry
- Modify tools
- Object Properties
- Tutorials

Unit 3 Advanced Drafting and Modifying Tools in AutoCAD (12 hrs)

- Drawing Tools
- Advanced Modification Tools
- Project and View
- Tutorials

Unit 4 Layer Management, Hatching and Annotations (12 hrs)

- About Layers
- Introduction to Hatching
- Isometric Drawing
- Introduction to Dimensions
- Various Dimensions creation and Editing Methods
- Other Commands related to dimensioning
- Leader
- Text Annotations
- Dimension Style Manager
- Tutorials

Unit 5 Application of Blocks and Attributes (12 hrs)

- Introduction to Blocks
- Dynamic Blocks
- Attributes
- Tutorials on creating blocks

Text Books

1. AutoCAD: A Visual Approach 2D Basics, Steven Foster, Autodesk Press, 1997.
2. Concurrent Engineering Design: Three-Dimensional Modeling, Analysis, and
3. Manufacturing Workshop for Lower Division College Faculty, Ronald Barr and DavorJurisic, University of Texas Press, 1996.

Reference Books

1. Engineering Drawing and Graphic Technology, T. French, C. Vierck, and R. Foster,McGraw-Hill, Inc., 1993.
2. Technical Drafting, C. Sshumann, Harper and Bros, Inc., New York, 1961.

3. AutoCAD 14 for Engineering Drawing by P. NageshwaraRao, Tata McGraw Hill Publication.

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AUTONOMOUS SYLLABUS SCHEME

VII Semester

Sr. No.	Subject Category	Subject Code	Course Title	Teaching Scheme			Evaluation Scheme				Credits
				L	T	P	CA	MSE	ESE	TOTAL	
1	PCC-EE	EE7T001	Switch gear and protection	3	0	0	20	20	60	100	3
2	PCC-EE	EE7T002	High Voltage Engineering	3	0	0	20	20	60	100	3
3	PEC-EE	EE7E005	**Elective V**	3	0	0	20	20	60	100	3
4	OEC-EE	EE7O003	**Open Elective III**	4	0	0	20	20	60	100	4
5	PCC-EE	EE7L001	Switch gear and protection Lab	0	0	2	60	0	40	100	1
6	PCC-EE	EE7L002	High Voltage Engineering Lab	0	0	2	60	0	40	100	1
7	PROJ-EE	EE7P006	Project-I	0	0	10	0	0	50	50	5
8	MC	EE7T003	Intellectual Property Rights	2	0	0	10	15	25	50	Audit
				15	**0**	**14**	**210**	**95**	**395**	**700**	
								Total Credits			**20**

VIII Semester

Sr. No.	Subject Category	Subject Code	Course Title	Teaching Scheme			Evaluation Scheme				Credits
				L	T	P	CA	MSE	ESE	TOTAL	
1	PEC-EE	EE8E006	Elective VI	3	0	0	20	20	60	100	3
	OEC-EE	EE8O004	Open Elective IV	4	0	0	20	20	60	100	4
	PROJ-EE	EE8P007	Project-II	0	0	6	0	0	100	100	3
OR											
2	PROJ-EE	EE8P008	Internship(6 months)	0	0	0	0	0	0	20	10
				7	**0**	**6**	**40**	**40**	**220**	**320**	
								Total Credits			**10**

Professional Electives

Elective V	A.Advance Concepts in solar Cells	B.FACTS	C.Utilization of electrical energy and traction	D.Power system dynamics and control
Elective VI	A.Introduction to Green Energy	B.Digital Signal Processing	C.Electrical Vehicles	D.Power Quality

Open Electives

Open Elective III	A.Wind and Hydro Power Systems	B.Industrial Electrical Systems
Open Elective IV	A.Automation with PLC	B.Solar PV Systems Engineering

EE7T001	Switch Gear And Protection	3 Credit

COURSE OBJECTIVES:

1. To become aware with the theory and applications of the main components used in power system protection..
2. Understand principles of protective relaying and circuit breaker
3. Understand the protection systems used for electric machines, transformers, bus bars, transmission lines..
4. To design the feasible protection systems needed for each main part of a power system.

COURSE OUTCOMES:

Students should be able to

CO1: Remember basic features of protection system and its components.

CO2: Select the different components of protection system such as CT, PT, circuit breakers, relays etc.

CO3: Apply principles of overcurrent relaying and achieve relay coordination for low and medium voltage distribution feeders.

CO4:Apply distance relaying techniques to High Voltage Transmission lines.

CO5:Design protection schemes for equipment such as transformers, generators, motors etc.

CO6:Solve different problems related to relay, circuit breaker and equipment protection.

Unit I: Fundamentals of Protection System and Protective Relaying (7Hrs)

Need of protection, protection principles,desirable attributes of protection,Faults, Primary & backup protection, Instrument transformers, basic trip circuit.

Classification of relays, Review of electromechanical relays, induction relays, Setting characteristics of over current; directional, differential, percentage differential and distance (impedance, reactance, mho) relays, numerical, introduction to static relays, advantages & disadvantages.

Unit II: Over Current Protection and Fault Analysis (7Hrs)

Review of calculation of fault currents, C. B. selection, fuse protection, over current protection, PSM and TMS setting, phase relay coordination, earth fault protection using over current relays, introduction to directional over-current relays.,Numerical overcurrent relays.

Unit III: Transmission Line Protection (7Hrs)

Over current relaying, directional- over current relay, Protective zones, Distance protection,setting and coordination of distance relays,pilot protection with distance relays,Numerical distance relays,carrier distance Schemes, Unit carrier schemes.

Unit IV: Equipment Protection (6 Hrs)

Protection of generator, transformer and bus Bars by differential relaying and other relays,restricted earth fault protection, incipient faults, Buchholz relay,Protection of Induction Motors against overloads, short circuits, thermal relays.

Unit V: Circuit Breakers **(6 Hrs)**

arc voltage, arc interruption, resistance switching, interruption of capacitive and inductive current, transient recovery voltage (TRV), circuit breaker ratings, classification of C.B.s - air break, air blast, vacuum, minimum oil and bulk oil, SF6 C.B. L.T. switchgear: - MCB, MCCB, HRC fuses, type construction and application.

Text Books

1. Fundamentals of power system protection by Y. G. Paithankar, S. R. Bhide., Prentice hall, India, second edition, 2010.".
2. Power System Protection and Switchgear- Badri Ram, Vishwakarma, McGraw Hill
3. Power System Protection and Switchgear-B. Ravindranath and M Chander,Wiley Eastern Ltd, New Delhi.

Reference Books

1. Switchgear protection and power system by Sunil S. Rao, Khanna Publishers, 13th edition, 2008..
2. Power System Relaying: Stanley H Horowitz, A G Phadke; Willey

EE7L001	**Switch Gear And Protection Lab**	**1 Credit**

List of Practical:-

1. To study different types of relay
2. To study and plot magnetisation characteristics of CT
3. To study various types of fuses and plot inverse time characteristic of HRC and Kit-Kat fuse.
4. To demonstrate the operation of various MCBs, ELCBs, MCCBs and plot inverse time characteristics of MCBs
5. To study and plot inverse, very inverse and definite time characteristics of over current relay.
6. To study and plot characteristics of impedance relay.
7. To study operation of static definite under voltage and over voltage relay
8. To study differential relay.
9. To study operation of static definite reverse power relay.
10. To Perform the Protection of Three Phase Induction Motor.
11. To study different circuit breaker.
12.

EE7T002	**High Voltage Engineering**	**3 Credit**

COURSE OBJECTIVES:

The objective of the course is to prepare the students:
1. To make students understand the breakdown mechanisms in dielectrics.
2. To make students know about overvoltage phenomenon in the power system, their protection insulation coordination.
3. To introduce students with the high voltage and high current generation and measurement techniques for testing purpose.

4. To familiarize students with the non destructive and high voltage testing of electrical equipment.

COURSE OUTCOME:

Upon the completion of this course, students will be able to understand:

1. The proper insulating medium / system; based on the insulation strength of the material for applying to high voltage systems.
2. Over voltage phenomenon in power system with protection and insulation coordination.
3. Generation & measurement techniques of high voltage and current for testing purpose.
4. HV tests carry out on various equipments e. g. Cables, CBs, Insulators etc, using relevant testing IS and be able to give analysis of the test results.

Unit - I

Breakdown in Gases: (06 hrs)

Breakdown in Uniform gap, non-uniform gaps, Ionization processes in gaseous dielectrics, Townsend's criterion for break-down, break-down in electro-negative gases, time lag for break-down, Streamer theory of break-down in gases, Paschen's law, break-down in non-uniform fields, practical considerations in using gases for insulation purpose; break-down in vacuum, Corona discharge

Unit II (06 hrs)

Breakdown in liquid and solid Insulating materials:

Breakdown in pure and commercial liquids, Solid dielectrics and composite dielectrics, intrinsic breakdown, electromechanical breakdown and thermal breakdown, Partial discharge, applications of insulating materials.

Unit – III (07 hrs)

Lightning and Switching Over Voltages : Lightning mechanism, types of lightning strokes, parameter and characteristics of lightning strokes, protection of power system against lightning over voltages, types of lightning arresters, surge absorbers; types of switching over voltages and their causes, protection against switching over voltages; Insulation coordination, BIL and SIL.

Unit – IV (07 hrs)

Generation of High Voltage and Currents : Generation of high D.C. voltage by rectifier, voltage doublers and multiplier circuit, generation of high AC voltage by cascade transformers, resonant transformer; generation of high frequency AC high voltage; impulse waveform, generation of impulse voltage, tripping and control of impulse generator; generation of switching surges; generation of impulse current.

Unit – V (07 hrs)

Measurement of High Voltage and Current : Measurement of high AC and DC voltages by micro ammeter, generating voltmeters, resistance and capacitance potential divider, series impedance voltmeter, CVT, magnetic type potential transformers, electrostatic voltmeter, peak reading AC voltmeters, sphere gap arrangement; measurement of impulse voltage by potential dividers and peak reading voltmeters; measurement of high AC, DC and impulse currents.

Unit – VI (07 hrs)

Non-destructive Testing: Significance of non-destructive testing, measurement of DC resistivity, measurement of dielectric constant and loss-factor, partial discharge phenomenon and measurement, discharge detection in power cables.

High Voltage Testing of Electrical Apparatus : Various standards for HV Testing of electrical apparatus, IS, IEC standards, Testing of insulators, bushings, isolators, circuit breakers, cables, transformers, lightning arresters and power capacitors.

Text Books

1. High Voltage Engineering by M. S. Naidu, V. Kamaraju, Tata McGraw Hill Publication Co. Ltd New Delhi, 2013, ISBN-978-1-25-906289-6
2. High Voltage Engineering by C. L. Wadhwa, New Age International Publishers Ltd.
3. High Voltage Engineering by Prof. D. V. Razevig Translated from Russian by Dr.M. P. Chourasia Khanna Publishers, New Delhi.

Reference Books

1. High Voltage Engineering Fundamentals by E. Kuffel, W. S. Zaengl, J. Kuffel Newnes Publication, ISBN-0-7506-3634-3
2. High Voltage and Electrical Insulation Engineering by Ravindra Arora, Wolf Gang Mosch New Age International Publishers Ltd. Wiley Eastern Ltd., ISBN-978-0-470-60961-3
3. Various IS standards for HV Laboratory Techniques and Testing
4. Fundamentals of High Voltage Engineering: S. K. Singh, Dhanpatrai & Co.

EE7L002	High Voltage Engineering Lab	1 Credit

List of Practical:-

1. Study of Faraday Cage for HV labs.
2. To study standard HV Laboratory layout.
3. To study the use of Sphere gap as a Voltmeter for measurement of High Voltages.
4. To measure the dielectric Strength of transformer oil.
5. To measure the breakdown strength of various solid dielectrics.
6. To perform High voltage withstand test on Cables/ Safety gloves/ Safety shoes etc.
7. To study Horn-gap and Rod Gap surge diverter.
8. To study Impulse generator.
9. Measurement audible and visible corona inception and extinction voltage.
10. Study of Effect of EHV field on Human, Animals & Plants

(Minimum ten experiments out of the above mentioned list to be performed)

EE7E005(A)	Advance Concepts in solar Cells	3 Credit

PRE REQUISITES: (If required)

COURSE OBJECTIVES:

The course focuses on Advance Concepts in solar Cells

COURSE OUTCOME:

CO1. To remember a basics of solar power generation from PV panels and
CO2. To understand the exposure to different cell technologies
CO3. To utilize knowledge of manufacturing processes of various types of solar cell.
CO4. Analyse Solar module manufacturing process in detail
CO5. Explain an exposure to advanced cell technology and usage of different materials.

Unit - I **(7Hrs)**

Introduction : Basics of solar cell; Intrinsic, extrinsic and compound semiconductor; Energy levels; Electrical conductivity; Determination of Fermi energy level; Probability of occupation of allowed states; Dynamics of energy density of allowed states; Density of electrons and holes. Carrier transport: Drift, diffusion, continuity equations; Absorption of light; Recombination process; Basic equations of semiconductor devices physics.

Unit – II **(8 Hrs)**

Solar Cell Physics: pn junction: homo and hetro junctions, Metal semiconductor interface; Dark and illumination characteristics; Figure of merits of solar cell; Variation of efficiency with band-gap and temperature; Spectral response of solar cell, parasitic resistance effect, Working and Efficiency limits: Thermodynamic limit and detailed balance limit of solar cell.

Unit – III **(8Hrs)**

Silicon; Physical and chemical properties relevant to photovoltaic. Preparation of Metallurgical; Refining, Casting and crushing. Preparation of semiconductor grade silicon (Polysilicon); Siemens process, Union Carbide Process. Solar grade Silicon; Crystallization, Simplification and Polysilicon method. Growth of single crystal Silicon: Czokralski (CZ) and Float Zone (FZ) method, Multicrystalline Silicon; Ingot fabrication, Doping, Crystal defect, Impurities. Wafering; Multiwire and microscopic process, Saw damage, Description and manufacturing technology.

Unit – IV **(8Hrs)**

Solar PV Cell and modules: Cell structure, Front and back surface, optical properties of solar Cell, Different losses and mitigation, Anti reflective coating; properties and materials, Surface passivation with back surface, Passivation with Hydrogen, Optical confinement. The layers of PV modules, Cell matrix, Lamination and curing, Encapsulation and framing, Testing, Electrical and thermal properties, Module mismatching, Shading and hot-spot formation, Environmental effect on PV module performance.

Unit – V **(8Hrs)**

High efficiency III-V, II-VI multi-junction solar cell; Photo conversion efficiency, Theoretical limits, spectral splitting, Cell configuration; Four-terminal, three terminal voltage-matched interconnections, two terminal series-connected. Current and voltage characteristics, efficiency and band gap. Deposition of GaAs, GaInP, Ge cells. Amorphous Silicon-based solar cell; fabrication techniques and material properties. Staebler- Wronski effect. Module manufacturing; Using different substrate, safety and cost.

Dye-sensitized solar cells; Introduction, fabrication and development..

Text Books

1 Solar Photovoltaics: Fundamentals, Technologies and Applications, C. S. Solanki, Prentice Hall of India, 2011.
2. S. P. Sukhatme "Solar Energy,-Principles of Thermal Collection & Storage", TMHPublishing Co., New Delhi.

EE7E005(B)	Flexible AC Transmission Systems	3 Credit

PRE REQUISITES: (If required)

COURSE OBJECTIVES:

1. To understand the importance of FACTS controllers
2. To understand the application of FACTS devices.
3. To investigate the key concepts of FACTS devices.
4. To enable students solve problems in the power system using FACTS controllers.

COURSE OUTCOME:

Upon completion of this course ,student should be able to

1. Remember basic principles of operation of various types of compensators used for VAR generation in the power systems.
2. Understand the problems and constraints related with stability of large interconnected systems and to study their solutions using different FACTS controllers
3. To identify the different issues related to the stability, active and reactive power control in power systems..
4. Analyse the operation, characteristics and working of different FACTS controllers.
5. Evaluate the operation, characteristics and working of different FACTS controllers.
6. Solve the different problems related to controlling the various parameters of transmission lines using different types of FACTS controllers.

Unit I: FACTS concept and general system consideration: (7 Hrs)

Transmission interconnection, flow of power in an AC System, factors affecting the loading capacity, power flow and dynamic stability consideration of transmission interconnection, relative importance of controllable parameters, facts controller.

Unit II: Static shunt compensators: SVC And STATCOM: (6 Hrs)

Objective of shunt compensation, midpoint voltage regulation voltage instability prevention, improvement of transient stability. Power oscillation damping methods of controllable Var Generation, static Var compensators SVC And STATCOM,Comparison between STATCOM and SVC,Static VAR System

Unit III: Static Series Compensators: GCS, TSSC,TCSC and SSSC (7 Hrs)

Objective of series compensation, improvement of transient stability, power oscillation damping, Variable impedance type series compensators, Switching Converter type series Compensators (only SSSC) , external (System) control for series reactive compensators. Application of SSSC in load Flow and transient stability studies.

Unit IV: Static Voltage and phase angle regulators: TCVR and TCPAR (6 Hrs)

Objective of voltage and phase angle regulators, approaches to thyristor controlled voltage and phase angle regulators (TCVR and TCPARs),switching converter-based,voltage and phase angle regulator, hybrid phase angle regulators.

Unit V: Combined Compensators (UPFC,IPFC) and special purpose Facts controllers (6 Hrs)

The UPFC, operating principal V-I characteristics UPFC principal of operation modes of operation application.NGH-SSR damping scheme,Thyristor –controlled braking Resistor(TCBR).

Text Books

1. Understanding FACTS, Naryan G. Hingorani and Laszlo Gyugyi (Standard Publishers).
2. Flexible AC Transmission System (FACTS) by K.R.Padiyar(New Age Publications)

Reference Books

1. Flexible AC Transmission System (FACTS)'Yong Hua Song and Johns (IEEE Publishers).
2. Thyristor Based FACTS controllers for Electrical Transmission System R. Mohan Mathur and Rajiv K. Verma (IEEE Press)

EE7E005(C)	**Utilization of Electrical Energy and Traction**	**3 Credit**

COURSE OBJECTIVES:

1. To understand the basic principle of electrical heating, welding,
2. To understand the concepts of illumination, fans and pumps
3. To understand the concepts of compressors and DG sets
4. To understand the basic principle of electrical traction

COURSE OUTCOME:

CO1: Remember the types of electrical heating and welding processes
CO2: Understand concepts of illumination in indoor and factory lighting systems
CO3: Apply energy saving measures in pumping systems and DG sets
CO4: Analyze the characteristics of DC and AC traction motor
CO5: Evaluate the performance of lighting systems and compressors
CO6: Discuss methods of control and braking in electric traction

Unit I : Electric Heating (6Hrs)

i) Electric Heating : Types and methods of electrical heating, advantages of electrically produced heat, types & application of electric heating equipments, transfer of heat. ii) Resistance Ovens : General constructions, design of heating elements, efficiency & losses, radiant heating. iii) Induction heating: Core type & core less induction furnace, indirect induction oven, medium and high frequency eddy - current heating. iv) Dielectric heating: Principle and application. v) Arc furnace : Direct & indirect arc furnace, power supply, characteristics & control.

Unit II : Electric Welding (6 hrs)

i) Importance, Advantages & Disadvantages of welding, classification of welding processes. ii) Resistance welding, Butt welding, Spot welding, Projection welding, Seam welding. iii) Electric arc welding: Carbon arc welding, metal arc welding, submerged arc welding, Stainless Steel welding iv) Ultrasonic welding, electron beam welding, laser beam welding.

Unit III : Illumination (7 hrs)

Nature of light, terms used in illumination, solid angle, laws of illumination, polar curves, Colour Rendering Index (CRI), Design of illumination systems, indoor lighting systems, factory lighting, outdoor lighting design, flood lighting, street lighting, energy saving in lighting systems.

Unit IV : Fans and Pumps (7 hrs)

Fans and Blowers: Fan types, fan performance evaluation & efficient system operation, fan design & selection criteria, flow control strategies, fan performance assessment, energy saving

opportunities. Pumps: Pump types, system characteristics. Pump curves, factors affecting pump performance, efficient pumping system operation, flow control strategies, energy conservation opportunities in pumping system.

Unit V : Compressors and DG sets (7 hrs)

Compressors: Compressor types, Compressor efficiency, Compressed air system components. Diesel Generating Systems: Introduction, selection and installation factors, operational factors, energy performance assessment in DG sets, energy saving measures for DG sets.

Unit VI : Electrical Traction (7 hrs)

System of traction, System of Track electrification, Running Characteristics of DC and AC traction motor. Control of motor: Tapped field control, Rheostatic control, Series parallel control, Metadyne control. Braking : Regenerative Braking, Braking with 1-phase series motor, Magnetic Braking. Speed- Time curve for train movement, crest speed, average speed and schedule speed, simplified speed-time curve.

Text Books

- Utilization of Electric Power & Electric Traction by J. B. Gupta, Kataria& Sons
- Utilization of Electrical Power by R. K. Rajput, Laxmi Publications Pvt. Ltd.

Reference Books

- Utilization of Electrical Power by Dr. N. Suryanarayan, Wiley Eastern Ltd, Age International
- Utilization of Electrical Energy by E.Openshaw Taylor, Orient Longman

EE7E005(D)	Power system dynamics and control	3 Credit

COURSE OUTCOME:

Student should be able to

CO1. To remember basic concepts of power system stability,operationand control

CO2. To understand concepts of power system stability, operation andcontrol

CO3. To apply knowledge of active and reactive power control, synchronous machine modeling, excitation system in any power system CO4. To examine power system stability and control its variables underdifferent operating conditions.

CO5. To justify about system stability and its controlling operations

CO6. To modify any system for its stable operation

Unit - I (6 Hrs)

Concept of Power system stability, Types of stability, Classical model of single machine connected to infinite bus and a multi machine system, mathematical modeling of power system elements for stability studies.

Unit - II (7 Hrs)

Small Signal Analysis, Fundamental concepts of Stability of Dynamic Systems, Small Signal Stability of Single Machine Infinite Bus(SMlB) System, Effects on Excitation system,Block diagram representation with exciter and AVR, Power System Stabiliser (PSS), State matrix including PSS, Small Signal Stability of Multi Machine Systems.

Unit – III (7 Hrs)

Rotor angle stability, classical method of rotor angle stability, equal area criteria for SMIB system, two machine systems, Numerical solution of swing equation, Multi-machine stability, factor affecting transient stability.

Unit - IV (7 Hrs)

Voltage stability & Voltage Collapse, Reactive power and voltage control, Voltage stability analysis, different criteria for voltage stability.

Unit – V **(7 Hrs)**

Unit Commitment Constraints in unit commitment – Spinning reserve – Thermal unit constraints – Other constraints – Solution using Priority List method, Dynamic programming method - Forward DP approach Lagrangian relaxation method – adjusting .

Unit VI **(6 Hrs)**

Economic Dispatch Control Incremental cost curve- co-ordination equations with loss included (No derivation of Bmn coefficient) solution of co- ordination equations using Bmn co-efficient by iteration method Base point & participation factors.

Textbooks:

1. Power System Stability and Control by P.Kundur , EPRI Publications, California
2. Power System Operation and Control by A.J Wood and B.F Wollenberg, John Wiley and Sons

Reference Books:

1. Power System Dynamics: K R Padiyar, B.S. Publishers, 2003, 2nd Edition.
2. Power system Stability and Control: P Kundur, , McGraw-Hill Inc., 1994
3. Power System Dynamics and Stability: P W Sauer & M A Pai, Pearson, 2003

EE7T003	Intellectual Property Rights	Audit

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:

CO1: 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 trust law, 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, Cengage leam'ng.
3. Inrelletul property right - Unleasbing the knowledgeconomy, Pmbuddha Ganguli, Tata Mccraw HiU Publishing Company Ltd.

Reference 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 Inrellectual Prcperty Ridls, London Sepiedber 2002

EE8E006(A)	Introduction to Green Energy	3 Credit

COURSE OBJECTIVES:

1. To understand the basic principle of solar photovoltaic cells
2. To understand the concepts of green composites
3. To understand the concepts of wind energy conversion systems
4. To understand the basic principle nuclear fission and geothermal energy

COURSE OUTCOME:

CO1: Remember the types of solar cells and geothermal energy sites
CO2: Understand concepts of wind energy conversion system
CO3: Apply green building measures for energy management
CO4: Analyze the characteristics of wind energy conversion systems
CO5: Evaluate the energy demand and renewable energy potential
CO6: Discuss concepts of energy generation using hydro power and geothermal energy.

Unit I **(8 Hrs)**

Energy sources: Introduction to nexus between Energy, Environment and Sustainable Development; Energy transformation from source to services; Energy sources, sun as the sourceof energy; biological processes; photosynthesis; food chains, classification of energy sources,quality and concentration of energy sources; fossil fuel reserves - estimates, duration; theory ofrenewability, renewable resources; overview of global/ India's energy scenario.

Unit II **(8 Hrs)**

Solar Energy:

Basic theory of flat plate collectors, solar heating of buildings, solar still, solar water heaters, solar driers; conversion of heat energy in to mechanical energy, solar thermal power generation systems. Solar Photovoltaic: Principle of photovoltaic conversion of solar energy, types of solar cells. Roof top solar PV systems.

Wind Energy: Atmospheric circulations, classification, factors influencing wind, wind shear, turbulence, wind speed monitoring, Betz limit, WECS: classification, characteristics, and applications.

Unit III **(8 Hrs)**

Ocean Energy: Ocean energy resources-ocean energy routes - Principles of ocean thermal energy conversion systems- ocean thermal power plants- Principles of ocean wave energy conversion and tidal energy conversion.

Other Sources: Hydropower, Nuclear fission and fusion-Geothermal energy: Origin, types ofgeothermal energy sites, site selection, geothermal power plants; Magneto-hydro-dynamic (MHD) energy conversion.

Unit IV **(6 Hrs)**

Green Buildings :Environmental implications of buildings energy, carbon emissions, water use, waste disposal;Building materials: sources, methods of production and environmental Implications. EmbodiedEnergy in Building Materials: Transporation Energy for Building Materials; Maintenance Energyfor Buildings. Green Composites for buildings: Concepts of

Green Composites. Water Utilisation in Buildings, Management of Solid Wastes.Urban Environment and Green Buildings. Green Cover and Built Environment.

Unit V **(6 Hrs)**

Policy Issues: The United Nations Framework Convention on Climate Change (UNFCCC). The Intergovernmental Panel on climate change (IPCC), the Kyoto Protocol. Energy Demand: Global and Indian trends - Determinants of energy demand; energy productivity and management of energy demand - Policy toward Electricity in India: pricing, implications of state subsidies, case for and against privatization in electricity generation and distribution; relevance to India of California experience in privatization of electricity distribution - Potential for renewable energy use in India (solar and wind energy)

Text Books

1. Energy and the Environment, 2nd Edition, John Wiley, 2006, Authors: Ristinen, RobertA. Kraushaar, Jack J. AKraushaar, Jack P. Ristinen, Robert A., Publisher: Wiley, Location: New York, 2006.
2. Fundamentals of Solar Cells: PV Solar Energy Conversion, Alan L Fahrenbruch and Richard H Bube Academic Press, New York , 1983
3. Wind and Solar Power Systems , Mukund R. Patel, CRC Press; (1999)

Reference Books

1. Jerry Yudelson Green building Through Integrated Design. McGraw Hill, 2009.
2. Fundamentals of Integrated Design for Sustainable Building By Marian Keeler, Bill Burke

EE8E006	**Digital Signal Processing**	**3 Credit**

COURSE OBJECTIVES:

1.To aware with the different types of signals and systems with their representations.

2.To familiarize the relationships between continuous-time and discrete-time signals and systems

3.To understand the different transform for the discrete time signals.

4.To introduce with representation and designing of the digital filter.

COURSE OUTCOME:

Student should be able to

CO1: Remember different types of signals and systems.

CO2: Understands signals mathematically in continuous and discrete-time, and in the frequency domain.

CO3: Analyze discrete-time systems using z-transform.

CO4:Solve DFT using various FFT algorithms.

CO5:Represent and design digital filters for various application.

CO6:Apply digital signal processing for the analysis of real-life signals.

Unit I: Introduction to Digital Signal Processing **(7Hrs)**

Frequency domain description of signals & systems, Advantages of Digital over Analog Signal Processing, Classification of signal and systems:Linearity, causality, stability, static dynamic, Time Invariance Time variance. Linear convolution, circular convolution, Analog-to-Digital and Digital-to-Analog Conversion.

Unit II: Discrete-Time Signals And Systems (7 Hrs)

Discrete time signals and systems: Sequences; representation of signals on orthogonal basis; Representation of discrete systems using difference equations, Sampling and reconstruction of signals - aliasing; Sampling theorem and Nyquist rate, Discrete-Time Systems Described by Difference Equations.Solutions of linear difference equations.

Unit III: The Z –Transform And Its Applications (6 Hrs)

Definition. Properties of the region of convergence for the Z- transformer, Z - transform properties, Inverse Z - transform using contour integration, partial fraction expansion, Parseval's theorem,Interpretation of stability in z-domainSolutions of difference equations.

Unit IV: Discrete Fourier Transform (7Hrs)

Frequency Domain Analysis, Discrete Fourier Transform (DFT), Properties of DFT, Convolution of signals, Fast Fourier Transform Algorithm, Implementation of Discrete Time Systems.

Unit V: Filter Design Techniques (7Hrs)

Design of discrete time IIR filters from continuous time filters. Frequency transformations of low pass IIR filters, Direct form I, Direct form II, Cascade and parallel structure for IIR and FIR Filter, Design of FIR filters by windowing method, FIR filter design by Fourier series method method.

Text Books

1.Digital signal processing Theory & Applications: N.G.Palan, Tech Max Publication, Prows and Manolakis, PHI Ltd, 3rd Edition.
2.Digital Signal Processing, P Ramesh Babu,SCITECH Publications, Chennai, 4th edition,2010
3.Digital Signal Processing- A computer based approach: S. K. Mitra, McGraw Hill, 2011.

Reference Books

3. Theory and Application of Digital Signal Processing: L. R. Rabiner and B. Gold, Prentice Hall, 1992.
4. Digital Signal Processing: S Salivahanan, AVallavaraj, Mc. Graw Hill Publication. 2nd Edition 2. Discrete time signal processing.
5. Introduction to Digital Signal Processing: J. R. Johnson, Prentice Hall, 1992.
6. S.K.Mitra, "Digital Signal Processing", TMH Pub.

EE8E006(C)	**Electrical Vehicle**	3 Credit

COURSE OBJECTIVES:

The course focuses on architecture and component of EV based on the requirements to power flow management, power conversion and thus to vehicle dynamics and energy/fuel efficiency

COURSE OUTCOME:

CO1. To remember the basics of electric vehicles, and fundamentals
CO2.To Understand the models and architecture, technologies to describe electric vehicles
CO3:To apply the basic concepts to describe electric vehicles and their performance.
CO4. To Analyze the different possible ways of energy storage
CO5 To Compare the different strategies related to energy storage systems.

Unit - I **(7Hrs)**

Introduction : Conventional Vehicles: Basics of vehicle performance, vehicle power source Characterization, transmission characteristic.

Unit – II **(8 Hrs)**

Hybrid and Electric Vehicle: Introduction to Hybrid Electric Vehicles: History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies, Hybrid Electric Drive-trains: Basic concept of hybrid traction,introduction to various hybrid drive train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis.

Unit – III **(8Hrs)**

Electric Trains : Electric Drive-trains: Basic concept of electric traction, introduction to various electric drive-train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis. Electric Propulsion unit: Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives

Unit – IV **(8Hrs)**

Energy Storage: Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis

Unit – V **(8Hrs)**

Energy Management Strategies: Energy Management Strategies: Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy management strategies.

Text Books

1. Hybrid Electric Vehicles - Principles and Applications with Practical Perspectives: C. Mi, M. A.Masrur and D. W. Gao, John Wiley & Sons, 2011.
2. Hybrid Electric Vehicles - Energy Management Strategies: S. Onori, L. Serrao and G. Rizzoni,Springer, 2015.
3. Modern Electric, Hybrid Electric, and Fuel Cell Vehicles - Fundamentals, Theory, and Design: M.Ehsani, Y. Gao, S. E. Gay and A. Emadi, CRC Press, 2004.
4. Electric and Hybrid Vehicles: T. Denton, Routledge, 2016

EE8E006(D)	**Power Quality**	**3 Credit**

PRE REQUISITES: Power sytems

COURSE OBJECTIVES:

1. To understand the importance of Power quality
2. To understand the application of FACTS devices.
3. To investigate the key concepts of various terms of Power quality.
4. To enable students solve power quality problems in the power systems.

COURSE OUTCOME:

Upon completion of this course ,student should be able to

1. Remember the basic principles related to Power quality.
2. Understand the problems and constraints related with quality of power in large interconnected power systems.
3. To identify the different issues related to the power quality in power systems.
4. Analyse the characteristics of different power quality problems.
5. Evaluate the operation, and working of different mitigation methods for power quality problems.
6. Solve the different problems related to different power quality issues by controlling the various parameters in distribution systems.

Unit – I **(6Hrs)**

Introduction to Electric Power Quality, Power Quality standards, Different Power Quality terms and definitions.

Unit – II **(7Hrs)**

Voltage Sag and Interruptions, Sources of Voltage sag and interruptions, type and characteristics of voltage sag and interruptions, Factors affecting characteristics of voltage sag and interruptions, behavior of different equipments during voltage sag, concept of area of vulnerability, CBEMA and ITI Curves .

Unit – III **(7Hrs)**

Voltage Swell and transient over voltage, sources of over voltage like capacitor switching, load switching, lighting etc, various causes of voltage flicker and their effects. Short term and long term flickers, various means to reduce flickers, Transient over voltages, sources, impulsive transients, switching transients, Effect of surge impedance and line termination, control of transient voltages.

Unit –IV **(7Hrs)**

Harmonic distortions, voltage and current harmonics, THD, sources of harmonics, ill effects of harmonics, interharmonics, harmonics filters, IEEE 519-1992 definitions, reactive power under harmonics, K-rated transformer.

Unit – V **(7Hrs)**

Voltage Unbalance, Impact on equipment performance, other power quality related issues like EMI, noise, notching, DC offset , Typical wiring and grounding problems causing poor power quality,solution to wiring and grounding problems.

Unit – VI **(6 Hrs)**

Need of power quality monitoring and approaches followed in power quality monitoring. Power quality monitoring objectives and requirements. Initial site survey. Power quality Instrumentation. Selection of power quality monitors, selection of monitoring location and period. System wide and discrete power quality monitoring. Setting thresholds on monitors, data collection and analysis. Selection of transducers. Harmonic monitoring, Transient monitoring, event recording and flicker monitoring, Mitigation techniques at different environments.

Text Books

1. Electrical power system quality – R. C. Dugan, Mark F. McGranghan, Surya santoso, H. Wayne Beaty, Second edition, McGraw Hill.
2. Understanding power quality problems, voltage sag and interruptions - M. H.J. Bollen, IEEE press, 2000, series on power engineering
3. Power Quality: C.Sankaran, CRC Press

Reference Books

1. IEEE std 519-1992/ IEEE std 1159 IEEE recommended practices and requirements for harmonics control in electrical power system.

2. Power system quality assessment: J. Arrillaga, M.R. Watson, S. Chan, John Wiley and sons.

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Department Of Electrical Engineering
"Igniting minds to illuminate the world"
2022-23 (Odd Sem)

VISION	MISSION
"To develop competent and committed Electrical Engineers to serve the society"	To impart quality education in the field of Electrical Engineering. 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- I	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
			Total	**11**	**2**	**10**	**310**	**75**	**365**	**750**	**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- II	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
			Total	**13**	**2**	**10**	**270**	**95**	**385**	**800**	**19**

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	3	0	0	20	20	60	100	3
2	BSC	EE3T002	Engineering Mathematics –III	2	1	0	20	20	60	100	3
3	ESC	EE3T003	Fundamentals of Electrical Engineering	2	1	0	20	20	60	100	3
4	PCC-EE	EE3T004	Network Analysis	3	0	0	20	20	60	100	3
5	PCC-EE	EE3T005	Electrical Machine I	3	1	0	20	20	60	100	4
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 training/ Industrial visit	0	0	0	0	0	50	50	1
11	HSMC	EE3T007	Universal Human Values -II	3	0	0	20	20	60	100	3
			Total	**18**	**4**	**6**	**320**	**140**	**590**	**1050**	**26**

IV Semester

Sr. No.	Subject Category	Subject Code	Course Title	Teaching Scheme			Evaluation Scheme				Credits
				L	T	P	CA	MSE	ESE	**TOTAL**	
1	BSC	EE4T001	Numerical method and probability	2	1	0	20	20	60	100	3
2	ESC	EE4T002	Power Station Practice	4	0	0	20	20	60	100	4
3	PCC-EE	EE4T003	Electronic Devices and circuits	3	0	0	20	20	60	100	3
4	PCC-EE	EE4T004	Power System I	2	1	0	20	20	60	100	3
5	PCC-EE	EE4T005	Electrical Machine II	3	0	0	20	20	60	100	3
6	BSC	EE4L001	Python Lab	0	0	2	60	0	40	100	1
7	PCC-EE	EE4L004	Power System I Lab	0	0	2	60	0	40	100	1
8	PCC-EE	EE4L005	Electrical Machine II Lab	0	0	2	60	0	40	100	1
9	PROJ-EE	EE4P002	Field trainning/ Internship/ industrial visit	0	0	0	0	0	50	50	1
10	MC	EE4T007	Innovation and entrepreneurship Development	2	0	0	10	15	25	50	Audit
11	PROJ-EE	EE4P001	MOOC	0	0	0	15	0	35	50	2
			Total	**16**	**2**	**6**	**305**	**115**	**530**	**950**	**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	3	0	0	20	20	60	100	3
3	PCC-EE	EE5T003	Power System II	3	0	0	20	20	60	100	3
4	PEC-EE	EE5E001	**Elective I**	3	0	0	20	20	60	100	3
5	PEC-EE	EE5E002	**Elective II**	3	0	0	20	20	60	100	3
6	OEC-EE	EE5O001	**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/Seminar (Phase I)	0	0	2	30	0	20	50	1
11	MC	EE5T004	Consumer Affairs	2	0	0	10	15	25	50	Audit
			Total	**21**	**0**	**8**	**340**	**135**	**525**	**1000**	**23**

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	EE6E003	**Elective III**	3	0	0	20	20	60	100	3
4	PEC-EE	EE6E004	**Elective IV**	3	0	0	20	20	60	100	3
5	OEC-EE	EE6O002	**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	Computer Aided Design Lab	0	0	2	60	0	40	100	1
8	PROJ-EE	EE6P004	Mini Project/Seminar(phase II)	0	0	2	30	0	20	50	1
9	PROJ-EE	EE6P005	Campus Recruitment Training(CRT)	0	0	2	50	0	0	50	1
10	PROJ-EE	EE6P006	Skill Development Courses	0	0	2	15	0	35	50	1
11	MC	EE6T003	Research Methodology	2	0	0	10	15	25	50	Audit
			Total	**15**	**0**	**10**	**305**	**95**	**400**	**800**	**21**

VII Semester

Sr. No.	Subject Category	Subject Code	Course Title	Teaching Scheme			Evaluation Scheme				Credits
				L	T	P	CA	MSE	ESE	TOTAL	
1	PCC-EE	EE7T001	Switch gear and protection	3	0	0	20	20	60	100	3
2	PCC-EE	EE7T002	High Voltage Engineering	3	0	0	20	20	60	100	3
3	PEC-EE	EE7E005	**Elective V**	3	0	0	20	20	60	100	3
4	OEC-EE	EE7O003	**Open Elective III**	4	0	0	20	20	60	100	4
5	PCC-EE	EE7L001	Switch gear and protection Lab	0	0	2	60	0	40	100	1
6	PCC-EE	EE7L002	Computer Applications in Electrical Engineering Lab	0	0	2	60	0	40	100	1
7	PROJ-EE	EE7P006	Project-I	0	0	10	75	0	75	150	5
8	MC	EE7T003	Intellectual Property Rights	2	0	0	10	15	25	50	Audit
			Total	**15**	**0**	**14**	**285**	**95**	**420**	**800**	**20**

VIII Semester

Sr. No.	Subject Category	Subject Code	Course Title	Teaching Scheme			Evaluation Scheme				Credits
				L	T	P	CA	MSE	ESE	TOTAL	
	PEC-EE	EE8E006	Elective VI	3	0	0	20	20	60	100	3
	OEC-EE	EE8O004	Open Elective IV	4	0	0	20	20	60	100	4
1	PROJ-EE	EE8P007	Project-II	0	0	6	50	0	50	100	3
	PROJ-EE	EE8P009	MOOC	0	0	0	15	0	35	50	2
			OR								
2	PROJ-EE	EE8P008	Internship(3 months)	0	0	0	0	0	0	300	10
	PROJ-EE	EE8P009	MOOC	0	0	0	15	0	35	50	2
			Total							**350**	**12**

EE Credits		124
First Year		35
Total Credits		**159**

EE Marks		4950
First Year Marks		1550
Total Marks		**6500**

Prof. A. V.Joshi
Member Secretary
Board of Studies, EE Dept

Dr.V.S.Dhok
Chairman
Board of Studies, EE Dept

Basic science Courses

Sr. No.	Course Code	Course Title	Hrs/Week L: T: P	Credits	Semester
1	BSC	Engineering Mathematics- I	03:01:00	4	I
2	BSC	Engineering Mathematics- II	03:01:00	4	II
3	BSC	Engineering Mathematics- III	03:01:00	4	III
5	BSC	Engineering Physics	03:01:02	5	I
4	BSC	Engineering Chemistry	03:01:02	5	I or II
6	BSC	Numerical method and probability	02:01:02	4	IV
		Total		**26**	

Engineering Science and Courses

Sr. No.	Course Code	Course Title	Hrs/Week L: T: P	Credits	Semester
1	ESC	Energy and environment Engineering	03:00:00	3	I
2	ESC	Workshop Practices	00:00:04	2	I
3	ESC	Basic Electrical and Electronics Engineering	02:00:00	Audit	I
4	ESC	Engineering Graphics	01:00:04	3	II
5	ESC	Basic Civil and Mechanical Engineering	02:00:00	Audit	II
6	ESC	Theory of electrical engineering	03:01:00	4	III
7	ESC	Power Station Practice	04:00:00	4	IV
		Total		**16**	

Humanities &social sciences including management

Sr. No.	Course Code	Course Title	Hrs/Week L: T: P	Credits	Semester
1	HSMC	Introduction to Computer programming	02:00:04	4	I or II
2	HSMC	Communication Skills	02:00:04	4	I or II

3	HSMC	Engineering Economics	02:00:00	2	III
4	HSMC	Universal Human Values -II	03:00:00	3	III
		Total		**13**	

Mandatory Courses

Sr. No.	Course Code	Course Title	Hrs/Week L: T: P	Credits	Semester
1	MC	Innovation and entrepreneurship Development	02:00:00	Audit	IV
2	MC	Consumer Affairs	02:00:00	Audit	V
3	MC	Research Methodology	02:00:00	Audit	VI
4	MC	Intellectual Property Rights	02:00:00	Audit	VII
		Total	**8**		

Professional Core Courses (Electrical Engineering)

Sr. No.	Course Code	Course Title	Hrs/Week L: T: P	Credits	Semester
1	PCC-EE	Network Analysis and synthesis	03:00:02	4	III
2	PCC-EE	Electrical Machine I	02:01:02	4	III
3	PCC-EE	Measurment and Instrumentation	02:01:02	4	III
4	PCC-EE	Electronic Devices and circuits	03:00:00	3	IV
5	PCC-EE	Power System I	02:01:02	4	IV
6	PCC-EE	Electrical Machine II	03:00:02	4	IV
7	PCC-EE	Power Electronics	03:00:02	4	V
8	PCC-EE	Control System I	03:01:02	4	V
9	PCC-EE	Power System II	02:01:02	4	V
10	PCC-EE	Microprocessor and microcontroller	03:00:02	4	VI
11	PCC-EE	Advance Control System	03:00:00	3	VI

12	PCC-EE	CAD Lab	00:00:02	1	VI
13	PCC-EE	Switch gear and protection	03:00:02	4	VII
14	PCC-EE	High Voltage Engineering	04:00:00	3	VII
15	PCC-EE	Computer Applications in Electrical Engineering Lab	00:00:02	1	VII
			TOTAL	**51**	

Professional Elective Courses (Electrical Engineering)

Sr. No.	SEM	DOMIAN	NCES(A)	Electronics & Power Electronics (B)	Elecrtical Drives (C)	Electrical Power and control System(D)	Genral (E)	Credits
1	V	**Elective I**	Renewable Energy System	Electromagnetic Field	Introduction to Special Machines	Electrical Power Utilization & Practice	Renewable Energy System	3
2	V	**Elective II**	Advance Renewable Energy System	Analog Digital Electronics	Electrical Machine design	Electrical Installlation and Design	Analog Digital Electroni	3
3	VI	**Elective III**	Electrical Energy Conservation & Audit	Linear Electronic Ciruits	Introduction to AC and DC Drive	Electrical Power Distribution System	Introduction to DC and AC Drive	3
4	VI	**Elective IV**	Solar Photovoltaic Devices	High power semiconductor Devices	Power Semiconductor Based Drive	HVDC	HVDC	3

5	VII	**Elective V**	A.Advance Concepts in solar Cells	B.FACTS	C.Utilization of electrical energy and traction	D.Power system dynamics and control	Utilization of electrical energy and traction	3
6	VIII	**Elective VI**	A.Introduction to Green Energy	B.Digital Signal Processing	C.Electrical Vehicles	D.Power Quality	D.Power Quality	3
							TOTAL	**18**

Open Elective Courses (Electrical Engineering)

This is only an indicative list

Sr. No.	Course Code	Course Title	Hrs/Week L: T: P	Credits	Semester
1	OEC-EE	Open Elective I	04:00:00	4	V
2	OEC-EE	Open Elective II	04:00:00	4	VI
3	OEC-EE	Open Elective III	04:00:00	4	VII
4	OEC-EE	Open Elective IV	04:00:00	4	VIII
			TOTAL	**16**	

TOTAL CREDIT 140

OPEN ELECTIVE COURSES (OEC)	
Course Code	**Subject**
1	Finance for Engineers
2	Engineering Economics
3	Legislative Procedure
4	Labour Law
5	Professional Effectiveness and Business 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	Pattern Recognition
21	Internet of Things
22	Broadband Communication
23	PLC, SCADA
24	Mechatronics
25	MEMS
26	RF Circuit Design
27	Automotive Embedded System
28	Block Chain
29	Vehicle Maintenance & Garage Practice
30	Advanced JAVA Programing
31	.Net
32	LINUX
33	Web Developmet & Design
34	Machine Learning
35	Cyber Security
36	Android App Development
37	Ethical Hacking
38	Data Science
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		
47	Electrical Safety and Management -V		
48	Electrical AUTOCAD-VI		
49	Smart Grid Technology -VI		
50	Industrial Instrumentation-V		
51	Wind and Hydro Power Systems -VII		
52	Industrial Electrical Systems-VII		
53	Automation with PLC-VIII		
54	Solar PV Systems Engineering-VIII		

Field training / Project (Electrical Engineering)

Sr. No.	Course Code	Course Title	Hrs/Week L: T: P	Credits	Semester
1	EE3P001	Field trainning/ Industrial visit		1	III
2	EE4P002	Field trainning/ Internship/ industrial visit		1	IV
3	EE5P003	Mini Project (Phase I)	00:00:02	1	V
4	EE6P004	Mini Project (Phase II)	00:00:02	1	VI
5	EE6P005	Campus Recruitment Training(CRT)	00:00:02	1	VI
6	EE6P006	Skill Development Courses	00:00:02	1	VI
7	EE7P006	Project-I	00:00:10	5	VII
8	EE8P007	Project-II	00:00:06	3	VIII
			TOTAL	**14**	
			TOTAL CREDIT	**154**	

Structure of Undergraduate Electrical Engineering Program:

Sr. No	Course Code	Total Credit As Per AICTE	Total Credits As Per Our Scheme	New Policy 07.08.2020	New Policy 19.08.2020	New Policy 17.09.2021	New Policy 15.11.2021
1	HSMC	12	12	10	12	13	13
2	BSC	26	26	26	26	26	26
3	ESC	20	15	18	16	16	16
4	PCC	53	53	52	53	53	53
5	PEC	18	18	18	18	18	18
6	OEC	18	18	18	16	16	16
7	PROJECT+SEMINAR+FIELD TRAINING	11	15	15	15	15	14
	TOTAL	**158**	**157**	157	156	157	156

Guidelines for preparing schemes

1. Total Credits should be 150 to 160 (first sem to eighth sem).
10% variation is allowed in each category.
subject is CA-10, MSE-15 & ESE-25.
4. Program elective should start from fifth sem while open elective should start from sixth sem.
5. Credit of Internship/Industrial Visit/Field training should be one without work load.
6. Mini-project/Project should start from fifth semester.
Induction trainbing / field Training, MC.
8. Six theory subject & one audit subject should be kept for third & fourth semester.
9. Five theory subject & one audit subject should be kept for fifth, sixth & seventh semester.
10. Two theory subject & one audit subject should be kept for eighth semester.
11. Internship (small duration) / Field training / Industrial training should be kept for third to seventh semester.
12. Three practicle should be kept for third, fourth, fifth & Sixth semester.
13. Two practicle should be kept for Seventh semester.
14. For Eighth semester no practicle.
15. Internship (six month) should be kept in Eighth semester.

Mech keep one of the audit subject is on Enternship. One audit subject should be research Methodology.

17. Proper numbering for each head.

18. In syllabus of audit courses credit shold not be mentioned.

SEM	DOMIAN	NCES
IV	**Elective I**	Renewable Energy System
V	**Elective II**	Advance Renewable Energy System
VI	**Elective III**	Electrical Energy Conservation & Audit
VII	**Elective IV**	Solar Photovoltaic Devices
VIII	**Elective V**	Advance Conpect in solar Cells
VIII	**Elective VI**	Introduction to smart grid

Sr.No.	Course Code	Course Title
1	PEC-EE	**Elective I**
	PEC-EE	1. Solid State devices
	PEC-EE	2. Electromagnectic Field
	PEC-EE	3. Physics Of Transistor
2	PEC-EE	**Elective II**
	PEC-EE	1. Power Station Pratice
	PEC-EE	2. Non Conventional Energy sources
	PEC-EE	3. Utilization of electric energy
3	PEC-EE	**Elective III**
	PEC-EE	1. Wind and Solar Energy
	PEC-EE	2. Electric Drives
	PEC-EE	3.Electrical Installation and Design
4	PEC-EE	**Elective IV**
	PEC-EE	1. High Voltage Engineering
	PEC-EE	2. Power Quality and FACTS
	PEC-EE	3. Switch Gear and Protection
5	PEC-EE	**Elective V**
	PEC-EE	1. HVDC Transmission
	PEC-EE	2. Control system Design
	PEC-EE	3. Power system dynamics and control
6	PEC-EE	**Elective VI**
	PEC-EE	1. Introduction to Electric vehicle
	PEC-EE	2. Computer Application in Power System
	PEC-EE	3.Digital Signal Processing
	PEC-EE	4. Advance Electrical Drives
	PEC-EE	5.Advanced Power Electronics

Professional Elective Courses (Electrical Engineerir

Electronics & Power Electronics	Elecrtical Drives
Electromagnectic Field	Electrical Machine design
Analog Digital Electronics	Introduction to DC and AC Drive
Linear Electronic Ciruits	Introduction to Special Machines
High power semiconductor Devices	Utilization of electrical energy and traction
Circuit simulation in power electronics	Introduction to Electric vehicle
High power converters and utility applications	Digital Signal Processing

Hrs/Week L: T: P	Credits
03:00:00	3
03:00:00	3
03:00:00	3
03:00:00	3
03:00:00	3
03:00:00	3
TOTAL	**18**

ıg)

Electrical Power and control System	Genral	Credits
Electrical Power Utilization & Practice		3
Power System II		3
Electrical Power Distribution System		3
Advance Control System		3
Power system dynamics and control		3
Power Quality and FACTS		3
	TOTAL	**18**

Semester
IV
V
VI
VII
VII
VIII

Education to Eternity

J D COLLEGE OF ENGINEERING & MANAGEMENT

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/06/2022

Date: 21/03/2022

Notice

This is informing to all BoS Members that the **06th** meeting of the **Board of Studies** will be held on **Tuesday, 22nd March, 2022** at **02:45 pm** at Room No. **TS-205,** Department of Mechanical Engineering, JDCOEM, Nagpur. The agenda for the meeting is attached herewith.

All the members of the Board of Studies are requested to attend the meeting.

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

CC To:

1. Principal, JDCOEM, Nagpur
2. Dean, Academics, JDCOEM
3. Other Concerned Members

J D COLLEGE OF ENGINEERING & MANAGEMENT

An Autonomous College, Affiliated to DBATU, Lonere

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

DEPARTMENT OF MECHANICAL ENGINEERING

Session: 2021-22

Sr. No.	Name of the Members	Signature	Sr. No.	Name of the Members	Signature
1	Prof. S. A. Rewatkar		8	Prof. H. K. Baitule	
2	Prof. P. P. Ulhe		9	Prof. R. B. Sharma	
3	Prof. A. A. Junankar		10	Prof. S. S. Ghosh	
4	Prof. P. M. Gupta		11	Prof. D. A. Yelure	
5	Prof. A. R. Sayed		12	Prof. S. G. Chakraborty	
6	Prof. J.S. Pachbhai		13	Prof. N. R. Meshram	
7	Prof. G. M. Gohane		14	Prof. V. P. Katekar	

Dr. B. R. Mahajan,
Chairman, BoS & Head,
DOME, JDCOEM,
Nagpur

J D COLLEGE OF ENGINEERING & MANAGEMENT

An Autonomous College, Affiliated to DBATU, Lonere

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

AGENDA FOR 06TH BOARD OF STUDIES MEETING NO. BOS/DOME/06/2022 — 21/03/2022

Venue: Room TS-205, Department of Mechanical Engineering, JDCOEM, Nagpur

he **06th** meeting of the **Board of Studies** will be held on **22nd March, 2022** at **2.45 p.m.** at **oom TS-205, Department of Mechanical Engineering, JDCOEM, Nagpur**. All the embers of the Board of Studies are requested to attend the meeting. The agenda for the meeting ill be as below.

em No. 1 | **Conformation of previous BOS Minutes.**

o review work done based on previous meeting agenda.

em No. 2 | **Action taken report of previous BOS Meeting.**

o prepare and present action taken over previous meeting.

em No. 3 | **To finalize the syllabus of 7th & 8th Semester.**

o approve, discuss and finalize the syllabus of 7th & 8th Semester including professional ourse electives and open elective subjects.

em No. 4 | **To review Status of 3rd sem and 4th Sem Course**

o review status of 3rd sem and 4th sem course for any modification or updation.

em No. 5 | **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.

C:
lon' Directors, JES
espected Principal, JDCOEM
ean Academics
ll concerned faculty members.

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

J D COLLEGE OF ENGINEERING & MANAGEMENT

An Autonomous College, Affiliated to DBATU, Lonere

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

AGENDA FOR 6th BOARD OF STUDIES MEETING VENUE: DOME/03/2022 **21/03/2022**

Venue: Room TS-205, Department of Mechanical Engineering, JDCOEM, Nagpur

The 06th meeting of the **Board of Studies** will be held on 22nd **March, 2022** at **2.45 p.m.** at **Room TS-207, 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	**To finalize the syllabus of 7th & 8th Semester.**

To approve, discuss and finalize the syllabus of 7th & 8th Semester including professional course electives and open elective subjects.

Item No. 4	**To review Status of 3rd sem and 5th Sem Course**

To review status of 3rd sem and 5th sem course for any modification or updation.

Item No. 5	**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
Dean Academics
All concerned faculty members.

Sr. No.	Name of the BoS Members	Designation	Sign
1.	Mr. Nikhil Bhende, Assistant Professor, DOME	Secretary	
2.	Mr. V. P. Katekar, Assistant Professor, DOME	Member	

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

MINUTES OF MEETING FOR BOARD OF STUDIES MEETING HELD ON DOME DEPARTMENT

22/03/2022

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

The 6th Meeting of the Board of Studies was held on Tuesday, 22nd March, 2022 at 3:00 P.M. held via Google Meet for Experts and Offline for Departmental BoS Members and Faculty. 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. 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
5.	Dr. Sachin Bagde, Subject Expert, Assistant Professor, YCCE, Nagpur	Invitee
6.	Mr. Imran Khan, Industry Expert, IGTR, GOI, Nagpur	Invitee
7.	Mr. Pravin Jadhav, Industry Expert, F6 Solutions Pvt.Ltd., Nagpur	Invitee
8.	Mr. Pravin Borkar, Final Year Student, JDCOEM	Invitee
9.	Ms. Sakshi Ingole, Final Year Student, JDCOEM	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. Deoghare, Subject Expert, NIT, Silchar, Dr. J. P. Modak, Technical Advisor, JDCOEM, Nagpur, Dr. Sachin Bagde, Subject Expert, YCCE, Nagpur, Mr. Imran Khan, Industry Expert, IGTR, Nagpur, Mr. Pravin Jadhav, Industry Expert, F6 Solutions, Nagpur, Mr. Pravin Borkar and Ms. Sakshi Ingole, Students, from Final year Mechanical Department 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.	5th BoS Meetings	Action Taken Report
1.	Students to be included in BoS Meeting here onwards - Dr. A. B. Deoghare	Ms. Sakshi Ingole (8th Sem), Mr. Pravin Borkar (8th Sem) and Mr. Pravin Jadhav (Alumni-2015 batch)
2.	Entrepreneurship Online Course from IIT, Powai can be register by students- Dr. A. B. Deoghare	Audit Course included in 4th Sem Syllabus
3.	Heat Transfer (5th Sem) syllabus content is too heavy and thereby some contents can be eliminated. Holman Book can be kept at first serial no. of text books- Saboo Sir	The content from Heat Transfer is under review and will be discussed in next BoS Meeting.
4.	TOM-II (5th Sem) syllabus course also lengthy. Gyroscope and Governor can be excluded. Norton Book can be added in list of Text books – Dr. J. P. Modak	The content from TOM-II is under review and will be discussed in next BoS Meeting.
5.	Analysis and Synthesis of Mechanism (6th Sem) have good contents but can be better if integrated with Robotics- Dr. A. B. Deoghare	The content from this subject is under review and will be discussed in next BoS Meeting.
6.	In Advance Manufacturing Technology (6th Sem) syllabus real time application based topics may be included- Dr. A. B. Deoghare	Syllabus will be again reviewed and will be presented in next BoS meeting.
7.	2-Wheeler and 4-Wheeler Transportation system, Vehicle Maintenance, Train and Locomotive technologies related topics can be included - Saboo Sir	Elective Subject named Automotive Vehicle Maintenance at 5th Sem added in the scheme.

8.	In Finite Element Method (6th sem) ANSYS, APDL languages, coding and Interface must be exposed to students. MATLAB Tool can be used as demonstration – Saboo Sir	Syllabus will be again reviewed and will be presented in next BoS meeting.
9.	CO to be covered and mapped properly and must be mentioned in question papers.	Every Question from question paper is mentioned with CO. All subjects are being mapped.

Item No. 2	**Syllabus Finalization for 7th & 8th Semesters.**

Chairman Sir begin the main agenda of the meeting i.e. Syllabus Finalization for 7th & 8th 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 **CAD/CAM** subject Saboo Sir asked to add CAE topics in the syllabus.
2. In **Lean Production** Subject Saboo Sir asked to have practical exposure of students from visiting industries like Mahindra and Mahindra or Haldiram Factory.
3. In **Design of Mechanical Drives** Subject, Dr. J. P. Modak sir suggested to introduce Design of Clutches and Brakes topic instead of Design of IC Engine Components. Dr. Sachin Bagde also suggested to include topic Gear Box Design or it can be included in separate subject like Tool Design.
4. In **Project Evaluation and Management** subject, experts suggested to include only 4 units.
5. In Robotics and Subtractive Manufacturing Subject, Imran Sir suggested that more practical exposure to students must be given although it is a NPTEL based subject.
6. In Value Engineering subject also experts suggested to keep 4 units only.

Dr. Sachin Bagde sir and Mr. Vinood Saboo sir felt syllabus is fantastically designed and appreciated faculties for same.

Item No. 3	**Review of 3rd and 4th Semester Syllabus**

Experts felt that the review of 3rd and 4th sem can be done in next Board of Studies meeting.

Item No.4	**Any other matter with the permission of the Chair.**

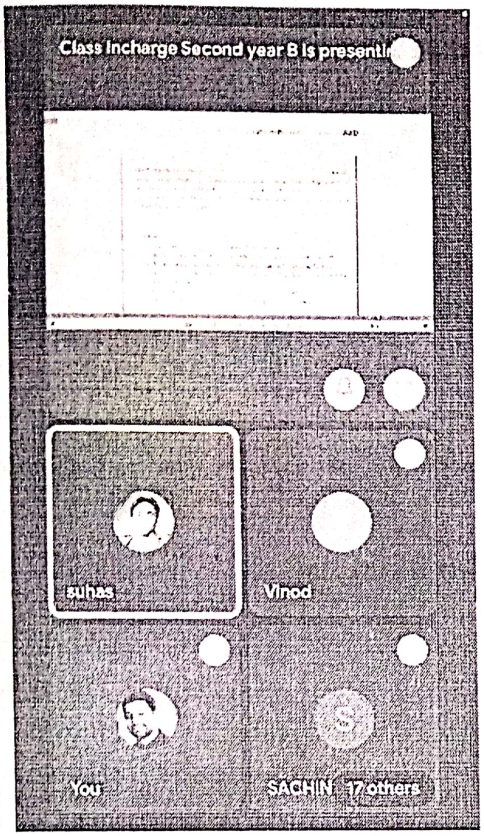
No other issue was raised by any members the meeting was concluded with vote of thanks.

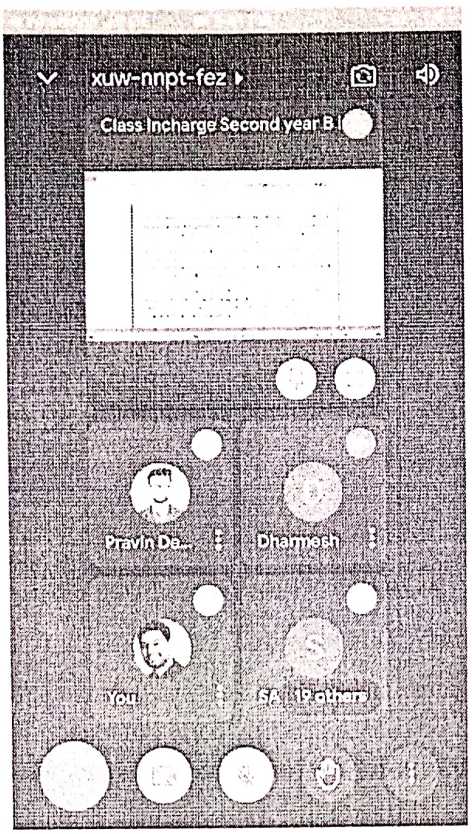
Sr. No.	Name of the BoS Members	Designation	Sign
1.	Mr. Nikhil Bhende, Assistant Professor, DOME	Secretary	
2.	Mr. Nozendra Meshram, Assistant Professor, DOME	Faculty	
3.	Mr. Shamal Chakravarty, Assistant Professor, DOME	Faculty	
4.	Mr. Dinesh Yelure, Assistant Professor, DOME	Faculty	
5.	Mr. Rohit Sharma, 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	
24.	Dr. B. R. Mahajan, HoD, Mechanical Department	Chairman	

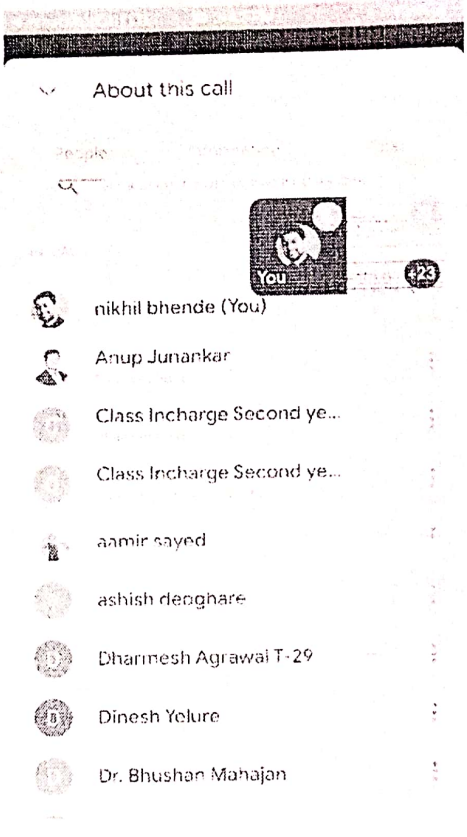
Following members could not attend the meeting as leave of absence was granted to them.

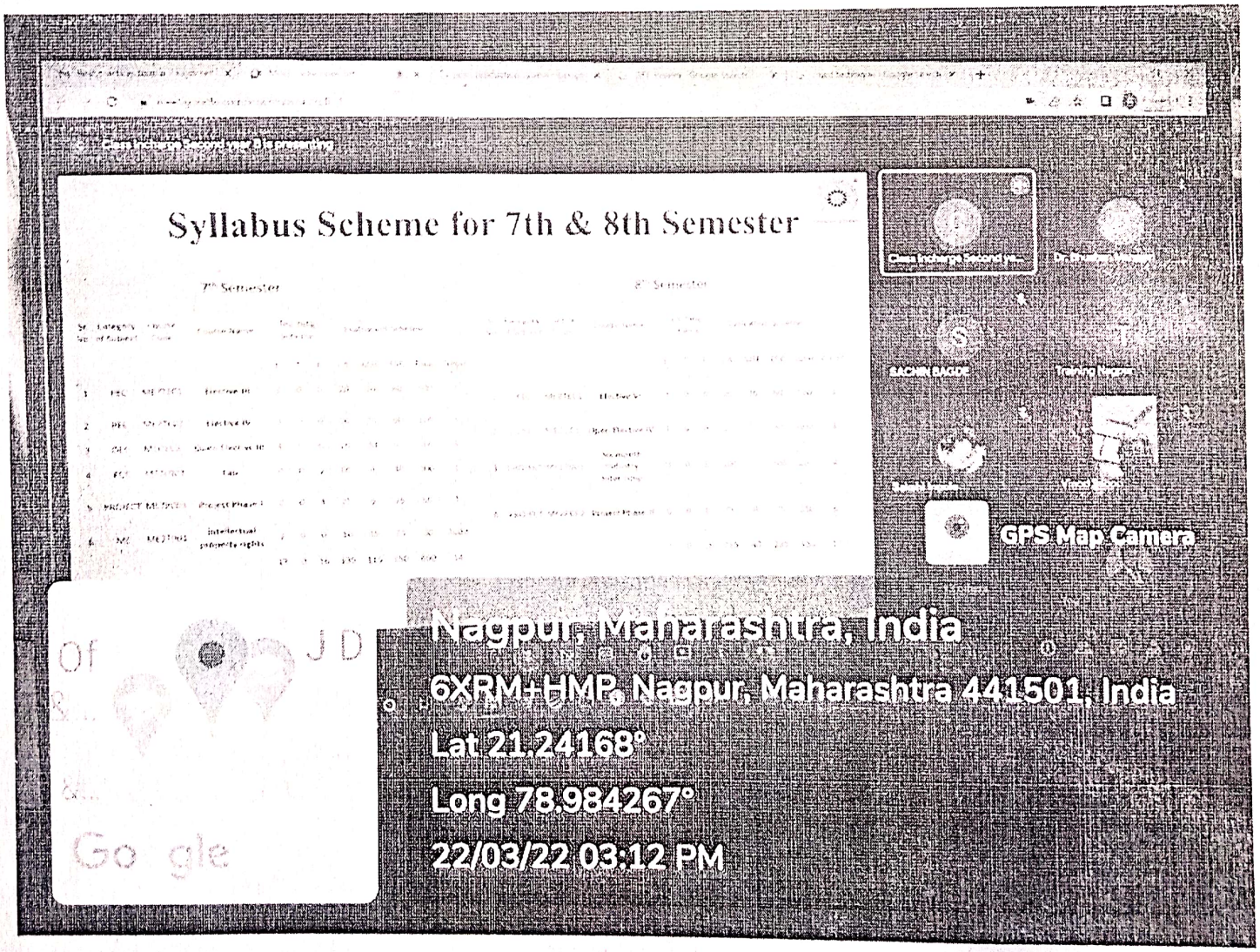
Sr. No.	Name of the BoS Members	Designation
1.	Dr. A. M. Kuthe, Subject Expert, VNIT, Nagpur	Subject Expert

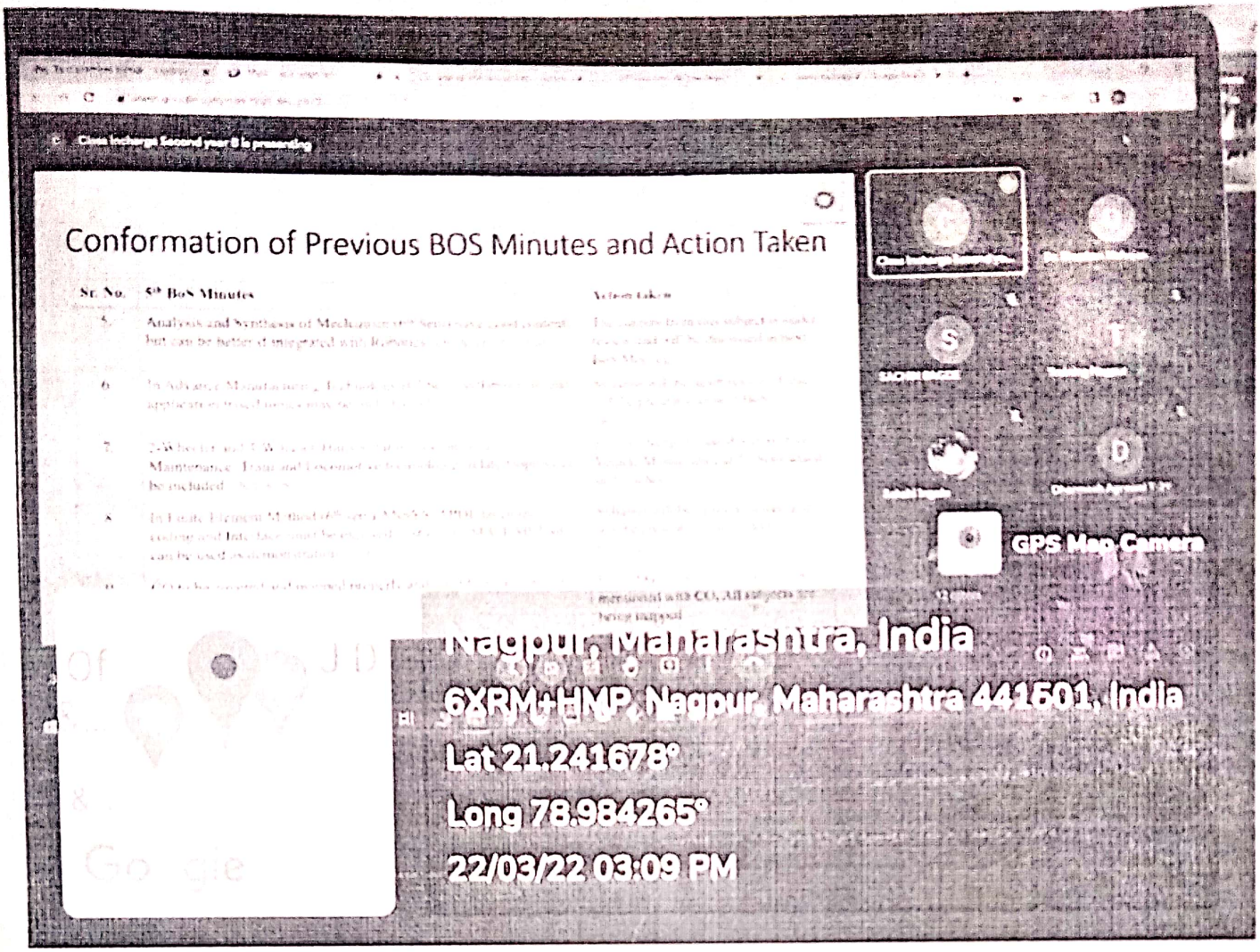
CC:
Hon' Directors, JES
Respected Principal, JDCOEM
Respected Vice- Principal & Dean Admin
Dean (Academics /Student/Capacity Building/Development, A&P)
All concerned faculty members.
Pictures from Meeting:

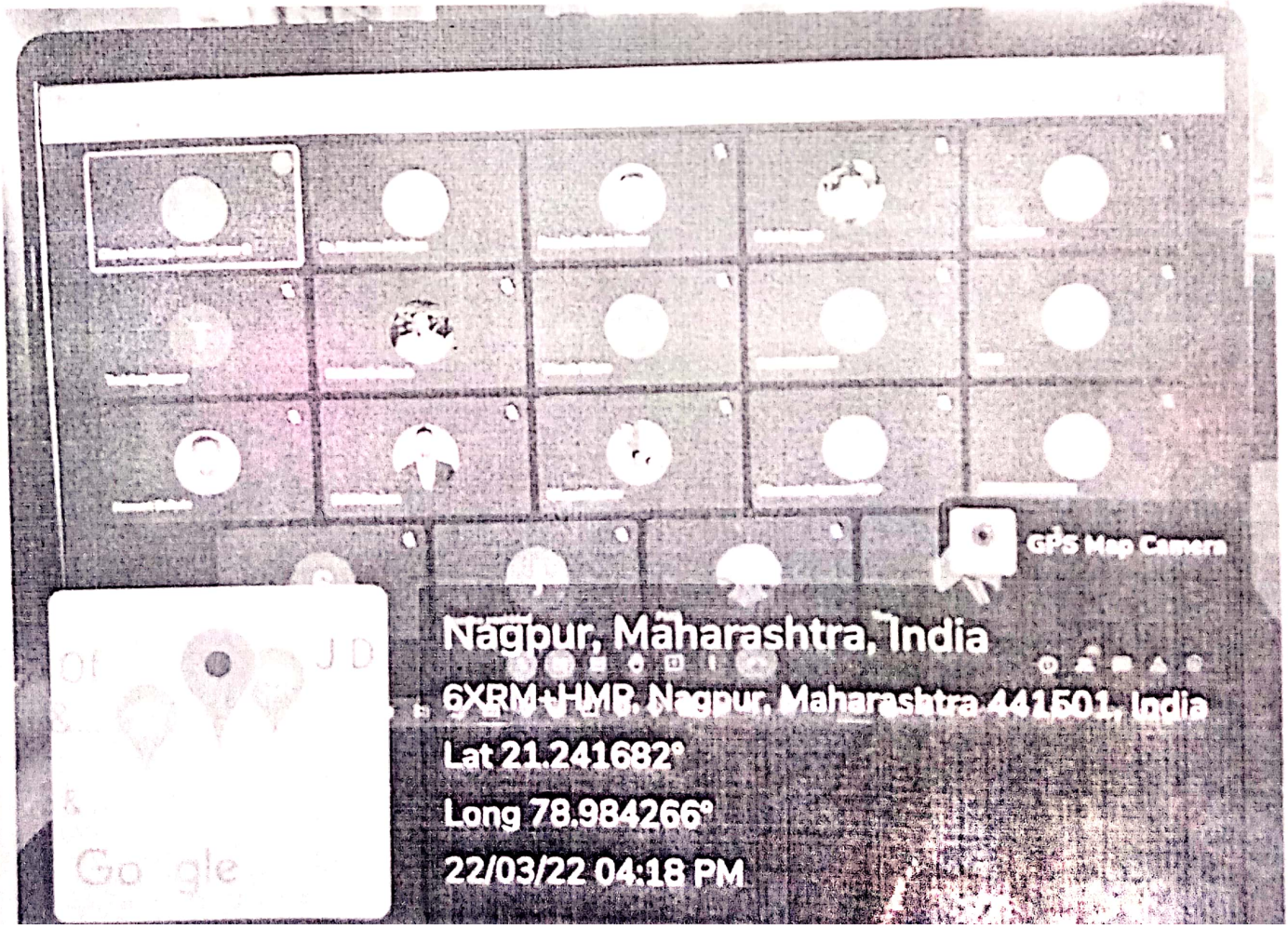












Education to Eternity

J D COLLEGE OF ENGINEERING AND MANAGEMENT
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	Computer Aided Design & Manufacturing	ME7TE03B	7th	25%	CAE topic added
2	Lean Production System	ME7TE03C	7th	10%	Industry Visit added in subject
3	Design of Mechanical Drives	ME7TE04B	7th	15%	Added Design of Clutches & Brakes, Removed Design of I C Engine Components, Included Design of Gear Box
4	Project Evaluation & Management	ME7O003B	7th	20%	Reduced to 4 Units From 6 Units
5	Value Engineering	ME8O004B	8th	10%	Reduced to 4 Units
6	Robotics and Subtractive Manufacturing	ME8O004A	8th	10%	Added NPTEL Based Courses
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					

B.O.S Secretraty

B.O.S Chairmam

Note: All documents should be duly signed and sealed

Education to Eternity

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	Gas Turbine and Jet Propulsion	ME7TE03A	7th	2022
2	Computer Aided Design & Manufacturing	ME7TE03B	7th	2022
3	Lean Production System	ME7TE03C	7th	2022
4	Power Generation Engineering	ME7O003A	7th	2022
5	Project Evaluation & Management	ME7O003B	7th	2022
6	Refrigeration & Cryogenics	ME7TE04A	7th	2022
7	Design of Mechanical Drives	ME7TE04B	7th	2022
8	World Class Manufacturing	ME7TE04C	7th	2022
9	Introduction to CFD	ME8TE05A	8th	2022
10	Design Practice	ME8TE05B	8th	2022
11	Manufacturing Quality Design & Control	ME8TE05C	8th	2022
12	Robotics and Subtractive Manufacturing	ME8O004A	8th	2022
13	Value Engineering	ME8O004B	8th	2022
14				
15				
16				

B.O.S Secretraty

B.O.S Chairmam

Note: All documents should be duly signed and sealed

7th 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	PEC	ME7TE01	Elective-III	3	0	0	20	20	60	100	3
2	PEC	ME7TE02	Elective IV	3	0	0	20	20	60	100	3
4	OEC	ME7O003	Open Elective III	4	0	0	20	20	60	100	4
5	PCC	ME7L001	Mechanical Engineering Lab	0	0	2	60	0	40	100	1
6	PROJECT	ME7F007	Industrial Visit	0	0	0	0	0	50	50	1
7	PROJECT	ME7P003	Project Phase-I	0	0	4	75	0	75	150	5
8	MC	ME7T004	Intellectual property rights	2	0	0	10	15	25	50	Audit
				12	**0**	**6**	**205**	**75**	**370**	**650**	**17**

8th 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	PEC	ME8TE01	Elective V	3	0	0	20	20	60	100	3
2	OEC	ME8O004	Open Elective IV	4	0	0	20	20	60	100	4
3	PROJECT	ME8P001	Project Phase-II	0	0	3	50	0	50	100	3
4	MC	ME8T001	MOOCS -II							50	2
				7	0	3	90	40	170	350	12

OR

1	PROJECT	ME8P002	Six month Industry Internship.	0	0	0	150		150	300	10
	MC	ME8T001	MOOCS -II							50	2
											10

350 | 12

Power to implement

Head of Department
Mechanical Engineering
J D College of Engineering & Management
Nagpur

5th Semester Mechanical Engineering

Sr. N	Category of Subject	Course Code	Course Name	Teaching Scheme				Evaluation Scheme				
				L	T	P	A	CA	MSE	ESE	Total	Credit
1	PCC	ME5T001	Heat Transfer	2	1	0	1	20	20	60	100	3
2	PCC	ME5T002	Theory Of Machines-II	2	1	0	1	20	20	60	100	3
3	PCC	ME5T003	Measurement and Quality Control	2	1	0	1	20	20	60	100	3
4	PEC	ME5TE01	Elective-I	3	0	0	1	20	20	60	100	3
5	OEC	ME5O001	Open elective I	3	1	0	1	20	20	60	100	4
6	PCC	ME5L001	Heat Transfer Lab	0	0	2	0	60	0	40	100	1
7	PCC	ME5L002	Theory Of Machines-II Lab	0	0	2	0	60	0	40	100	1
8	PCC	ME5L003	Measurement and Quality Control Lab	0	0	2	0	60	0	40	100	1
9	PROJECT	ME5P004	Mini Project	0	0	0	0	0	0	50	50	1
10	MC	ME5T005	Consumer Affair	2	0	0	0	10	15	25	50	Audit
11	PCC	ME5L004	Basics of python & SQL			2		60		40	100	1
				14	4	8	5	350	115	535	1000	21

6th Semester Mechanical Engineering

Sr. N	Category of Subject	Course Code	Course Name	Teaching Scheme				Evaluation Scheme				
				L	T	P	A	CA	MSE	ESE	Total	Credit
1	HSMC	ME6T001	Operation Research	3	0	0	1	20	20	60	100	3
2	PCC	ME6T002	Applied Thermodynamics	2	1	0	1	20	20	60	100	3
3	PCC	ME6T003	Design of Machine Element	2	1	0	1	20	20	60	100	3
4	PEC	ME6TE01	Elective-II	3	0	0	1	20	20	60	100	3
5	OEC	ME6O002	Open elective II	3	1	0	1	20	20	60	100	4
6	PCC	ME6L002	Applied Thermodynamics Lab	0	0	2	0	60	0	40	100	1
7	PCC	ME6L003	Design of Machine Element Lab	0	0	2	0	60	0	40	100	1
8	ESC	ME6L004	Computer Graphics Lab	1	0	2	0	60	0	40	100	2
9	PROJECT	ME6P005	Campus Recruitment Training	0	0	2	0	50	0	0	50	1
10	PROJECT	ME6P006	Skill Development	0	0	2	0	15	0	35	50	1
11	PROJECT	ME6P007	Mini Project	0	0	0	0	30	0	20	50	1
12	MC	ME6T008	Research Methodology	2	0	0	0	10	15	25	50	Audit
				16	3	10	5	385	115	500	1000	23

Head of Department
Mechanical Engineering
J D College of Engineering & Management
Nagpur

JAIDEV EDUCATION SOCIETY'S
J D COLLEGE OF ENGINEERING AND MANAGEMENT
An Autonomous Institute, with NAAC "A" Grade
KATOL ROAD, NAGPUR
SESSION 2022-23

Education to Eternity

After 7th BOS. (15/12/22). To Be implimented on Batch 22-23 in First year.

3rd 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	BSC	ME3T001	Applied Maths-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

4th 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	BSC	ME4T001	Numerical Method	3	1	0	20	20	60	100	4
2	ESC	ME4T002	Basic Electronic Engineering	3	1	0	20	20	60	100	3
3	ESC	ME4T003	Product Design and Development	2	0	0	20	20	60	100	2
4	PCC	ME4T004	Manufacturing Engineering-II	3	0	0	20	20	60	100	3
5	PCC	ME4T005	Strength Of Materials ✓	3	0	0	20	20	60	100	4
6	PCC	ME4T006	Fluid Mechanics & Fluid Machines	3	0	0	20	20	60	100	3
7	PCC	ME4L004	Manufacturing Engineering Lab	0	0	2	60	0	40	100	1
8	PCC	ME4L005	Strength Of Materials Lab	0	0	2	60	0	40	100	1
9	PCC	ME4L006	Fluid Mechanics & Fluid Machines Lab	0	0	2	60	0	40	100	1
10	PROJECT	ME4F007	Industrial visit	0	0	0	0	0	50	50	1
11	MC	ME4T008	Innovation and Entrepreneurship Development	2	0	0	10	15	25	50	Audit
12	MC	ME4T009	MOOCS I							50	2
				19	2	6	310	135	555	1050	25

Venue:TS-205,DOME,JDCOEM

The 7th Meeting of the Board of Studies was held on Thursday, 15th December, 2022 at 2:30 P.M. Three Experts and Departmental BoS Members and Faculties are present physically.

Thefollowingmemberswerepresent:

1.	Mr.SuhasA.Rewatkar, MechanicalDepartment	Chairman
2.	Mr.PravinM.Gupta,AssistantProfessor,DOME	Member
3.	Mr.AmirR.Sayed,AssistantProfessor,DOME	Member
4.	Mr.DharmeshAgrawal, AssistantProfessor,DOME	Secretary
5.	Mr.SidharthGhosh,AssistantProfessor,DOME	Member
6.	Mr.RohitSharma,AssistantProfessor,DOME	Member
7.	Mr.DineshYelure,AssistantProfessor,DOME	Member
8.	Mr.Rakesh Bandana,AssistantProfessor,DOME	Member
9.	Mr.Rajendra Dhandre,AssistantProfessor,DOME	Member

ThefollowingExperts wereinvitedto attendthe meeting:

1.	Dr. S. A.Ambade,Academic Expert,YCC,Nagpur	Invitee
2.	Mr.Imranul Haque, IndustryExpert,IGTR,GOI,Nagpur	Invitee
3.	Ms.Sakshi Ingole, Alumni 2021-22,JDCOEM, Nagpur.	Invitee

The following members were Absent in the meeting-

1. Mr.VinodSaboo – CEO Saboo plastics Pvt.Ltd,Nagpur - Invitee Expert
2. Prof.PrafulUlhe – Faculty Member-DOME
3.Prof,GauravGohane-Faculty Member-DOME

VinodSaboo was unavailable due to busy schedule in his Industry while
f.PrafulUlhe&Prof,GauravGohane was on leave with prior permission from head office

ItemNo. 1& 2.	Reviewof thePreviousMeeting.

The Secretary welcomed the Chairman of Board of Studies, Subject Expert Dr. S. A.Ambade, Professor, YCC, Nagpur,Industry Expert Mr.Imranul Haque, Ms. Sakshi Ingole,AlumniMechanical Department and all members of BoS and faculties ofdepartment. Prof. S.S. Ghosh presented agenda of the meeting through power point presentation.Further, the Action taken report from the previous meeting were presented and discussed one byonepoint in thepresenceof themembers.Followingarethe points:

Sr. No.	6thBoSMeetings	ActionTakenReport
1.	AlumnitobeincludedinBoSMeeting here onwards –Mr. Saboo Sir.	Ms. Sakshi Ingole from session 2021-22 has become part of BOS now.
2.	Gauges Design should be added in precise manner in course content. *Suggested by Dr. A. B. Deoghare.*	The content has been added in the subject MQC and will be further discussed in BOS meeting.
3.	Some part of Thermodynamics syllabus from unit 3 can be skipped. *Suggested by Saboo Sir.*	Contents has been modified accordingly, is under review and will be discussed in BOS meeting.
4.	Smart Manufacturing should be part of Manufacturing syllabus. *Suggested by Imran Sir.*	Content has been added in AMT subject 5th Semester and is under review and will be discussed in BOS.

ItemNo. 3	Updation in scheme of 2nd ,3rd and Final Year.

Chairman Sir begin the main agenda of the meeting i.e. Updation in Schemeof all semester Mechanical Engineering. Later he asked experts for any suggestions in the Scheme.Following were the suggestions given by the experts.

1. In4th **semester** scheme, Category of subject and course code were asked to add for **MOOCS I** byImran Sir
2. Imran Sir again suggested that in 5th semester scheme name of newly added lab name should be changed from 'Python' to 'Basics of python and SQL'.
3. Same corrections for MOOCS-II should be reflected in 8th semester scheme suggested by Imran Sir.

ItemNo. 4	Updation in the syllabus of 2nd ,3rd and Final Year.

Chairman requested the concerned subject teachers those have updated their respective subject syllabus to present in front of experts. Total updation in six subjects were discussed.

Following are the key highlightofthe agenda:

1. Prof. Rohit Sharma presented the syllabus of **EngineeringThermodynamics of 3rd** semester, as pe the previous BOS suggestions some part of the syllabus were skipped. Experts were satisfied with th updated syllabus.

2. Prof. SuhasRewatkar presented the syllabus of **Strength of material of 4th** semester, as per the previous BOS suggestions some part of the syllabus were skipped. Experts were satisfied with the updated syllabus.

3. Prof. Rajendra Dhandre presented the syllabus of **Material Science of 3rd** semester. Our experts, Dr. SachinAmbade, suggested some changes in the syllabus as follows

- Critical temperature in iron carbon diagram should be added.
- Plasma hardening should be removed.
- Some part of the syllabus can be skipped in place of which Powder metallurgy should be add in unit IV.

4. Prof. Siddharth Ghosh presented the syllabus of **Metrology & Quality Control of 5th** semester, as p the previous BOS suggestions some part of the syllabus were skipped. Experts were satisfied with t updated syllabus.

5. Prof. Dinesh Yelure presented the syllabus of Open elective subject **Automobile Engineering of** semester, as per the previous BOS suggestions some part of the syllabus were skipped. Experts we satisfied with the updated syllabus.

6. Prof. Siddharth Ghosh presented the syllabus of Professional elective subject Siddharth Ghosh Siddha Ghosh Advance Manufacturing Technology of 5th semester, as per the previous BOS suggestions- advan manufacturing part is been added in the last unit. Experts were satisfied with the updated syllabus.

ItemNo.5	Rubrics of CA Evaluation.

Chairman of BOS presented rubrics of CA evaluation and discussed all nine activities involved Continuous Assessment for students. Later Prof. Dinesh Yelure presented rubrics for mini and maj projects.
Experts were satisfied with the all rubrics finalized by higher authorities of JDCOEM.

ItemNo.6	Internship Guidelines for 8 Semester Students

Prof. Pravin Gupta presented the **Internship Guidelines for 8 Semester Students**.
Experts were satisfied with the Internship Guidelines.

ItemNo.7 & 8	**Revised Guidelines regarding MOOCS&Award of Major Degree to the Student**

Prof. Rohit Sharma discussed the revised Guidelines regarding MOOCS&Major Degree criteria. H declared that one student from mechanical department name Vaibhav Dhuvare is now eligible for the a of major degree.

Experts appreciated the effort taken by the management authorities and faculty members.

ItemNo.9	**Anyother matterwiththepermission oftheChair.**

Chairman asked all the experts for their kind suggestions. Ms Sakshi Ingole suggested that Moc interviews of the students should be regular practice in the department.
Nootherissuewasraisedbyanymembersthemeetingwasconcludedwithvoteofthanks.

No.	Nameofthe BoSMembers	Designation	Sign
1.	Mr.DharmeshAgrawal, AssistantProfessor,DOME	Secretary	
2.	Mr.DineshYelure,AssistantProfessor,DOME	Faculty	
3.	Mr.RohitSharma,AssistantProfessor,DOME	Faculty	
4.	Mr.HemantBaitule,AssistantProfessor,DOME	Faculty	
5.	Mr.SidharthGhosh,AssistantProfessor,DOME	Member	
6.	Mr.AamirR.Sayed,AssistantProfessor,DOME	Member	
7.	Mr.PravinM.Gupta,AssistantProfessor,DOME	Member	
8.	Ms.SakshiIngole,DOME	Alumni DOME	
9.	Mr.ImranulKhan, IGTR,Nagpur	IndustryExpert	
10.	Dr.SachinBagde,AssistantProfessor,YCCE,Nagpur	SubjectExpert	
11.	Mr.SuhasA.Rewatkar ,HoD, Mechanical Department	Chairman	

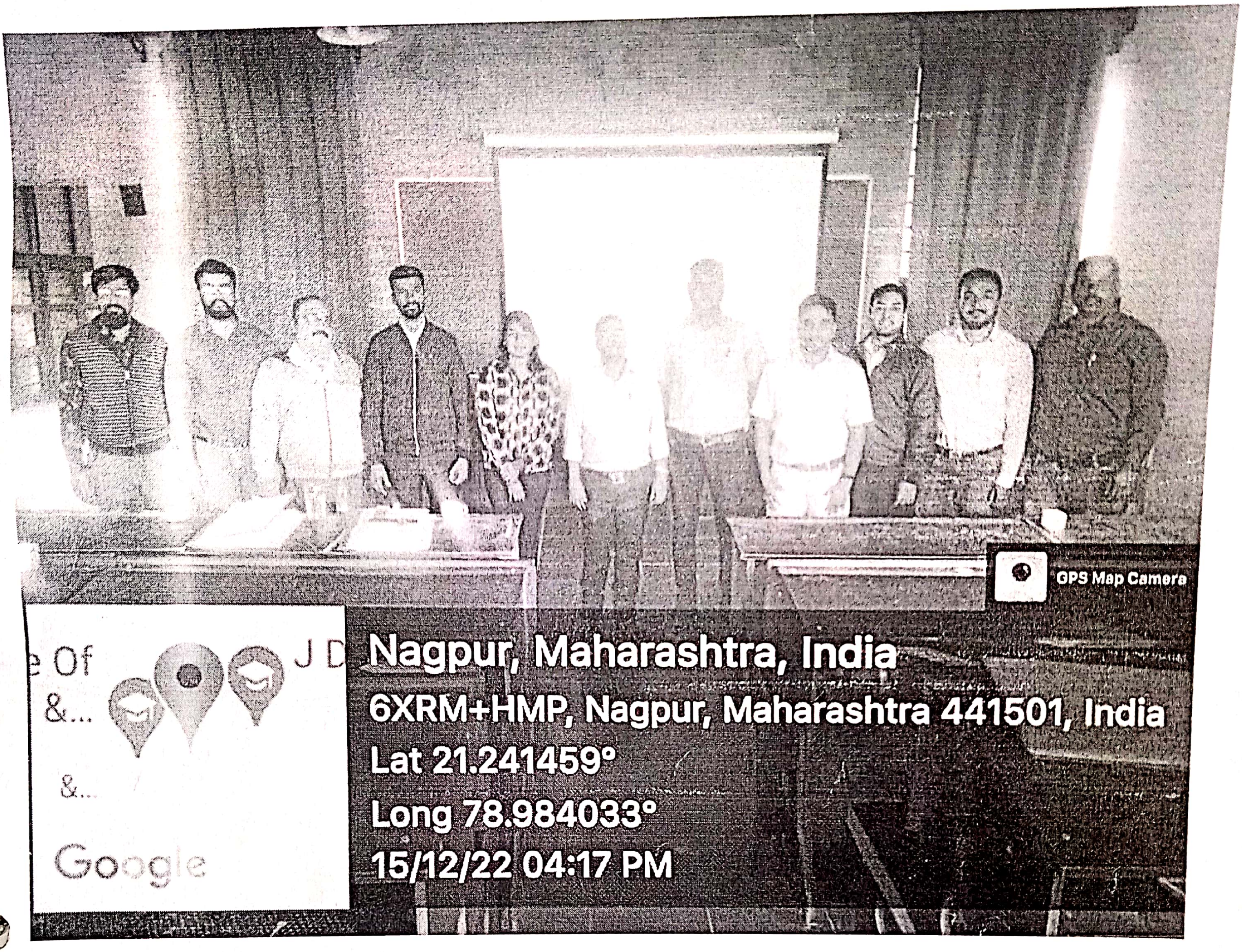
Followingmemberscould notattend themeetingas leaveof absencewasgranted tothem.

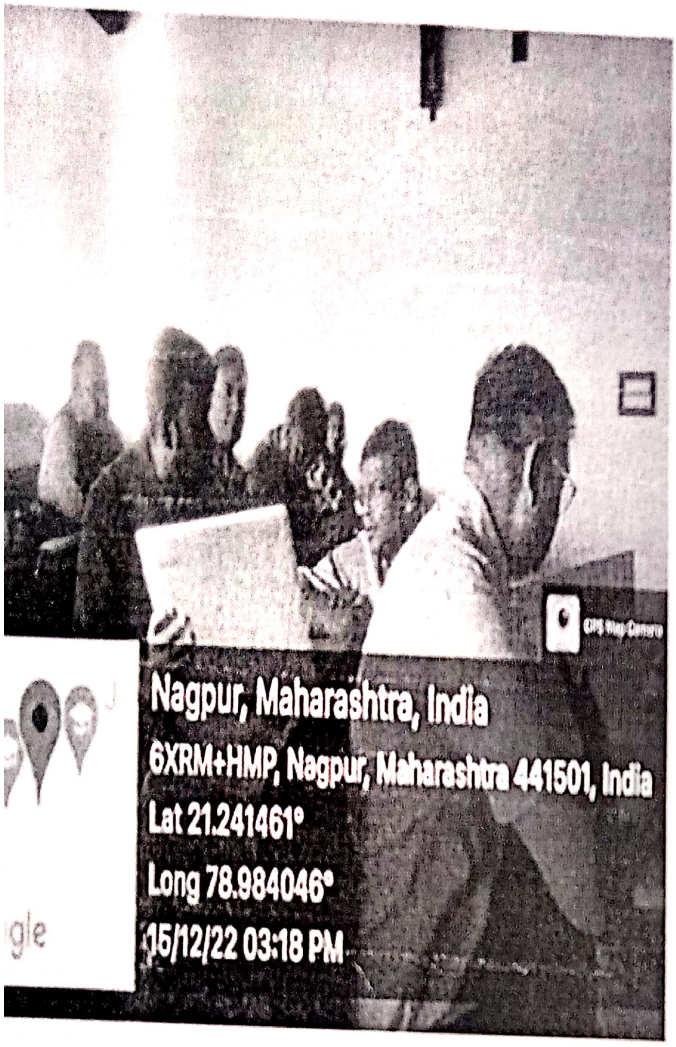
Sr.No.	Nameofthe BoSMembers	Designation
1.	Mr.VinodSaboo – CEO Saboo plastics Pvt.Ltd,Nagpur	Industry Expert

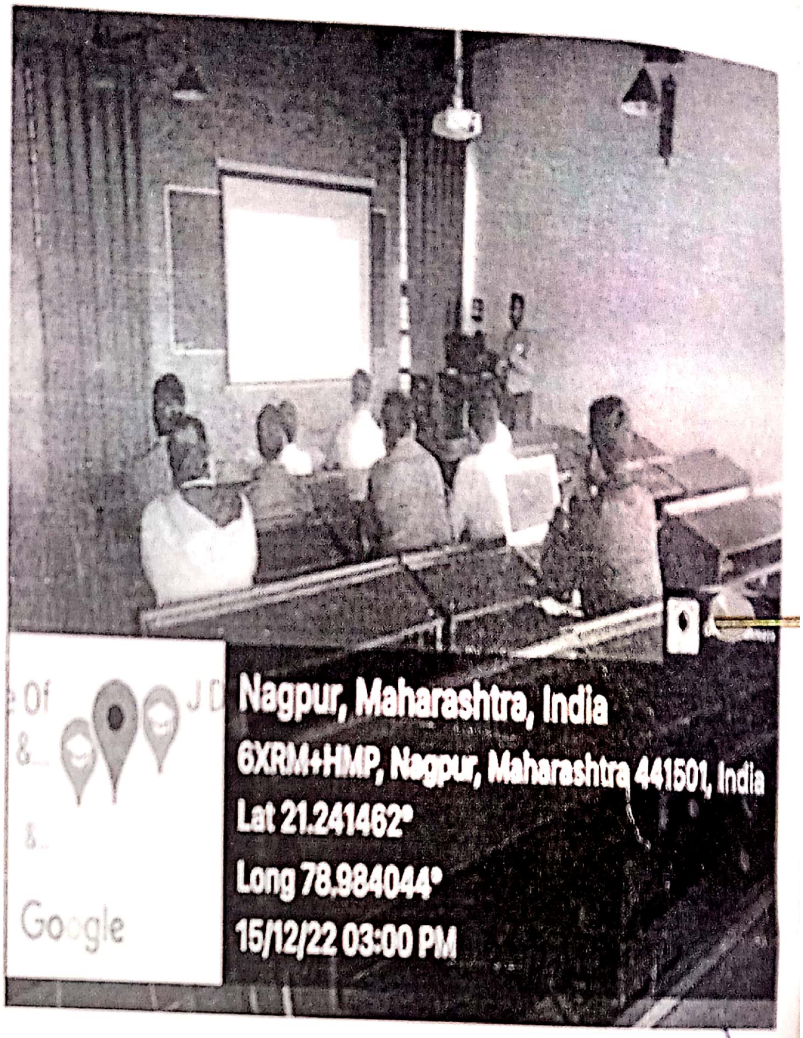
CC:
Hon'Directors,JES
Respected Principal,JDCOEM
RespectedVice-Principal&DeanAdmin
Dean(Academics/Student/CapacityBuilding/Development,A&P)
Allconcernedfacultymembers.

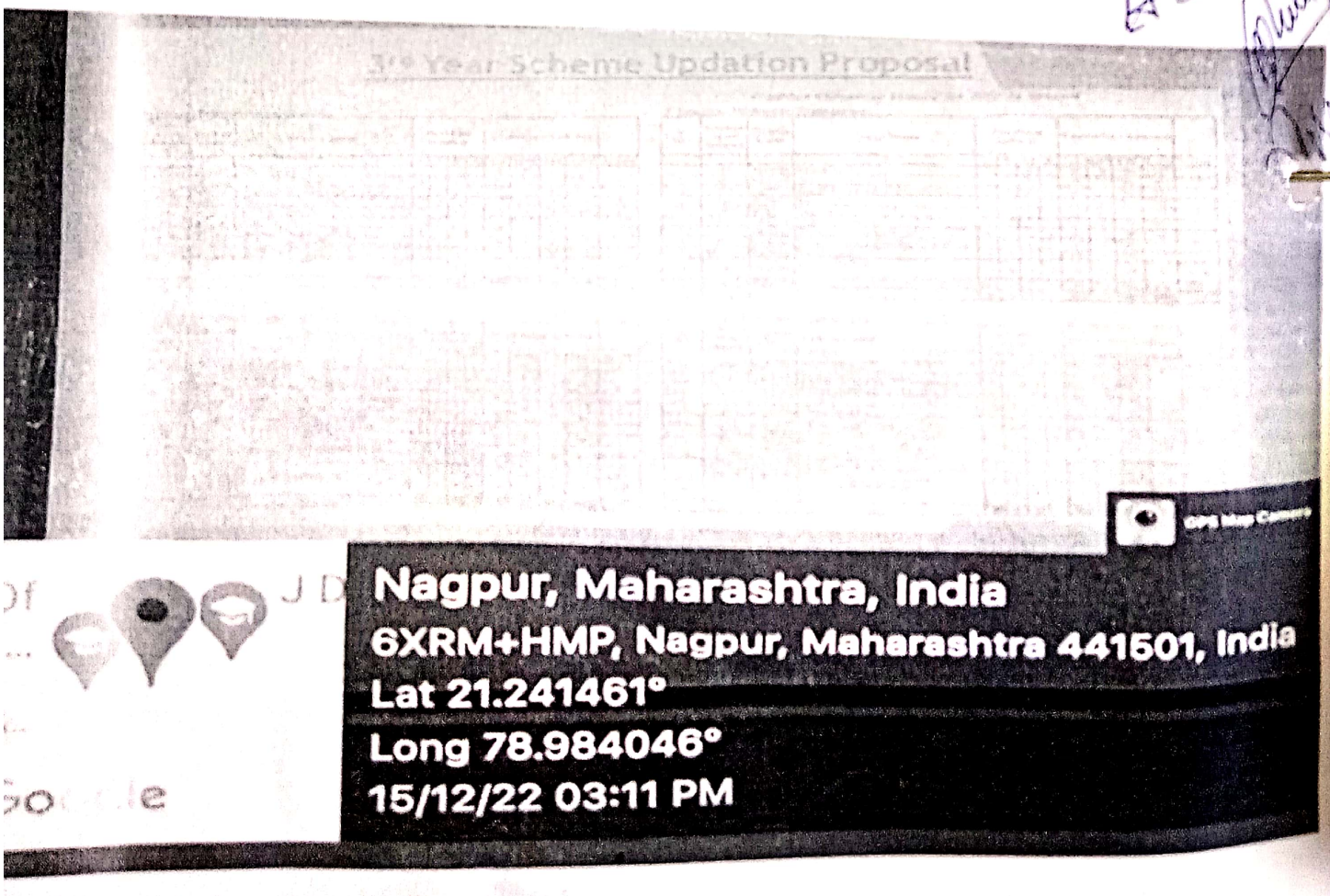
JDCOEM

Picturesfrom Meeting:









A VENTURE OF GOYAL GROUP

Education to Eternity

JAIDEV EDUCATION SOCIETY

J D College of Engineering & Management

JDCOEM/BoS/ME/2022-23/

Date: 10th December 2022

To,

Mr.Imranul Haque
Incharge-IGTR
Nagpur Center

Sub: Invitation for Board of Studies Meeting as External Expert Member on 15.12.2022 (Thursday)

Sir/Madam,

Warm Greetings of Season!!!!

We take privilege in inviting you for the Board of Studies Meeting in Faculty of Engineering & Technology of J.D. College of Engineering and Management, Nagpur as an External Expert Member for Mechanical Engineering which will be conducted on 15.12.2022 at 2.30 P.M. through offline Mode in J.D College of Engineering and Management, Nagpur. Kindly accept our invitation and confirm your visit for attending the Board of Studies meeting.

The agenda of meeting is already mailed to you.

Thanking you,

With Regards,

Department of Mech. Engg. JDCOEM

Prof.Suhas A.Rewatkar
Chairman BOS
Mechanical Engineering
JDCOEM

Head of Department
Mechanical Engineering
J.D. College of Engineering & Management
Nagpur

J D COLLEGE OF ENGINEERING & MANAGEMENT

An Autonomous College, Affiliated to DBATU, Lonere

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

Department of Mechanical Engineering

Session 2022-23

JDCOEM/BoS/ME/2022-23/ Date:- 15/12/2022

To,

Mr. Imranul Haque
Incharge-IGTR
Nagpur Center

Sir,

Greetings from J. D. College of Engineering and Management.

We are really grateful to you for your participation and contribution as Board of Studies-Expert of Mechanical Engineering. Your contribution enabled us to accomplish so much Your contribution has helped us to successfully implement various policies and the curriculum. All your efforts have been appreciated by all stake holders. We're proud of what we have been able to do and we could not have done it without your participation and support.

In our constant efforts to impart quality and value based education, we wish to introduce more practices which would help our students to be industry ready.

Looking forward for many more mutually beneficial interactions, we express our gratitude to you and your kind involvement in our endeavors.

Thanking you
With warm regards

Rec.

Department of Mech. JDCOEM

Chairman, BoS & HOD-DOME
Mechanical Engineering Board
College of Engineering & Management
Nagpur

J D COLLEGE OF ENGINEERING & MANAGEMENT

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

Department of Mechanical Engineering

Session 2022-23

JDCOEM/BoS/ME/2022-23/ Date: 15 / 12/2022

To,

Dr. SachinAmbade
YCCE,Nagpur

Sir,

Greetings from J. D. College of Engineering and Management.

We are really grateful to you for your participation and contribution as Board of Studies-Expert of Mechanical Engineering. Your contribution enabled us to accomplish so much Your contribution has helped us to successfully implement various policies and the curriculum. All your efforts have been appreciated by all stake holders. We're proud of what we have been able to do and we could not have done it without your participation and support.

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Thanking you
With warm regards

Department of Mech. JDCOEM

Head of Department
Mechanical Engineering

Chairman, BoS & HOD-DOME
Mechanical Engineering Board

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Education to Eternity

JAIDEV EDUCATION SOCIETY

J D College of Engineering & Management

JDCOEM/BoS/ME/2022-23/

Date: 10th December 2022

To,

Dr.Sachin Ambade
YCCE,Nagpur

Sub: Invitation for Board of Studies Meeting as External Expert Member on 15.12.2022 (Thursday)

Sir/Madam,

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With Regards,

Department of Mech. Engg. JDCOEM

Prof.Suhas A.Rewatkar
Chairman ,BOS
Mechanical Engineering
JDCOEM

Mechanical Engineering
College of Engineering & Management
Nagpur

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AGENDA FOR 07TH BOARD OF STUDIES MEETING NO. BOS/DOME/12/2022 **15/12/2022**

Venue: Room TS-205, Department of Mechanical Engineering, JDCOEM, Nagpur

The **07th** meeting of the **Board of Studies** will be held on **15th** ~~July~~ Dec, **2022** at **2.30 p.m.** at **Room TS-205, 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	**Updation in scheme of 2nd ,3rd and Final Year**

To approve, discuss and finalizethe scheme of 2nd ,3rd and Final Year

Item No. 4	**Updation in the syllabus of 2nd ,3rd and Final Year**

To discuss the revised syllabus of some subjects, approve and finalize.

Item No. 5	**Rubrics of CA Evaluation**

To discuss the rubrics of continuous assessment, approve and finalize it.

Item No. 6	**Internship Guidelines for 8 Semester Students**

To discuss internship guidelines, approve and finalize it.

Item No. 7	**To Discuss Revised Guidelines regarding MOOCS**

To approve, discuss and finalizethe guidelines for MOOCS

Item No. 8	**To Discuss -Award of Major Degree to the Student**

To Discuss the criteria for Major and Minor degree and to announce Major degree achievement by the departmental student.

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

Mr. Dharmesh A.Agrawal
Secretary, Board of Studies,
Asst. Prof., Deptt. of Mech. Engg.
JDCOEM, Nagpur.

Item No. :- I & Item No. :- II

S.N	6th BOS Meeting	Action Taken Report
1	Alumni from recent batch should be a part of BOS – Saboo Sir	Ms. Sarashi Ingole from batch – has become part of BOS now
2	Gauges design should be added in precise manner as course content- Dr.A.B.Deoghare	The content has been added in a subject MQC, is under review and will be discussed in BOS
3	Some part of thermodynamic syllabus content can be skipped from 3rd Unit -Saboo sir	Contents has been modified accordingly, is under review and will be discussed in BOS
4	Smart Manufacturing should be a part of Manufacturing syllabus – Imran Sir	Contents has been added in AMT , 5thsem , is under review and will be discussed in BOS

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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	ENGINEERING THERMODYNAMICS	ME3T004	3RD	15%	Few topics removed from subject
2	STRENGTH OF MATERIAL	ME4T005	4TH	10%	Some part of subject removed
3	MATERIAL SCIENCE	ME3T003	3RD	20%	Critical Temperature Iron Carbon diagram Added, Plasma Hardening removed, Powder metallurgy added
4	MEASUREMENT AND QUALITY CONTROL	ME5T003	5TH	10%	Some part of subject removed
5	AUTOMOBILE ENGINEERING	ME6TE02B	6TH	10%	Few topics removed from subject
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					

B.O.S Secretraty

B.O.S Chairmam

Note: All documents should be duly signed and sealed

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MINUTES OF MEETING FOR 6TH BOARD OF STUDIES (EE) MEETING NO. BOS/EE/06/2020-21 23/03/2022

Venue: Online Google Meet Meeting

The 6th meeting of the Board of Studies (Electrical) was held on **23rd March 2022** 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. S.V. Jethani	Member
8	Prof. M.S.Isasare	Member
9	Prof. P.V. Ambade	Member
10	Prof.S.A.Harne	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 09/07/2021 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 09/07/2021 and discussed it in front of the members. Following were the ATR of the previous BOS Meeting.

1. As per suggestions received from Prof. J. Joshi sir regarding power electronics course outcomes terminology should be based on Blooms Taxonomy.:
Action Taken: Power electronics course outcomes terminology is based on Blooms Taxonomy.
2. Dr. Tarnekar sir suggested that notes should be available with the students the only the course will be completed within given hours.
Action Taken: Notes and study material are available with students for the subjects.
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).
Action Taken: Number of lectures per week or the subject Control System is (3+1).
4. Electrical Utilization and Practice (V Sem): Prof. J. Joshi suggested LED lamp should be included in Unit 3.
Action Taken: LED lamp was included in Unit 3 of the subject.
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.
Action Taken: Unit 1 was divided in part A and B , Design of PCC and MCC was included and no of hrs is 8.
6. Energy Safety and Management (Open Elective):

- Open Elective should not be more than 3 credits
- Consumer Affair: Audit Course should be satisfactory /unsatisfactory instead of credits.

Action taken: Hon.Dean (Academics) were informed regarding credit suggestion by BOS experts.

Item No. 3	**Scheme and syllabus for 7th and 8th Sem including Open Electives**

7^{th} and 8^{th} Sem along with open elective syllabus was presented by Member Secretary for suggestions and approval. Following are the suggestions:

1. Prof. J. Joshi sir suggested that one additional book should be included in the syllabus of subject 'FACTS'.The name of the book is Flexible AC Transmission System (FACTS) by K.R.Padiyar(New Age Publications).
2. Dr.S.G.Tarnekar sir suggested that first unit of subject HVE should be reduced from point of view of allotted credits.
3. Dr.N.D.Ghawghawe sir suggested that prerequisite of subject HVDC should be added in syllabus of subject HVE in unit no.1.
4. Prof. J. Joshi sir suggested that in subject Switchgear and protection ,Schemes should be separate from protective relaying and circuit breakers should be last unit.More focus should be on Numerical relays.
5. Prof. J. Joshi sir suggested that nnumber of hours for subject Utilization of Electrical Energy and Traction should be 40.
6. Dr.N.D.Ghawghawe sir suggested that topic 'Roof top solar PV systems' to be included in syllabus of subject 'Introduction to green Energy.

Item No. 4	Modifications in syllabus of subjects of previous semesters

Modifications in syllabus of subject 'Advanced control systems' of sixth semester to was approved by BOS experts.

Item No. 5	Inclusion and Confirmation of new members

Mr. Y.P.Mundhada was replaced by Mr. S.A.Harne in Board of Studies (EE).

Item No. 6	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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VISION	MISSION
To be a well-known center for shaping professional leaders of Global Standards in Civil Engin	Provide quality education and excellent learning Environment for overall development of students. Making Sustainable efforts for integrating academics with Industry.

Teaching Scheme

Branch: Civil Engineering **Branch Code: CE**

III 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	CE3T001	Civil Engineering - Societal & Global Impact	2	0	0	20	20	60	100	2
2	BSC	CE3T002	Engineering Mathematics-III	2	1	0	20	20	60	100	3
3	ESC	CE3T003	Building Drawing and Drafting	2	1	0	20	20	60	100	3
4	ESC	CE3T004	Mechanics of Rigid bodies	2	1	0	20	20	60	100	3
5	ESC	CE3T005	Energy Science and Engineering	3	0	0	20	20	60	100	3
6	PCC	CE3T006	Basic Geology and Geotechnical Engineering	3	0	0	20	20	60	100	3
7	MC	CE3T007	Universal Human Values	3	0	0	20	20	60	100	3
8	ESC	CE3L001	Building Drawing and Drafting Lab	0	0	4	60	0	40	100	2
9	ESC	CE3L002	Mechanics of Rigid Bodies Lab	0	0	2	60	0	40	100	1
10	PCC	CE3L003	Basic Geology and Geotechnical Engineering Lab	0	0	2	60	0	40	100	1
11	PROJECT	CE3F004	Field Visit I	0	0	0	0	0	50	50	1
				17	**3**	**8**					**25**

IV 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	BSC	CE4T001	Life Science	2	0	0	20	20	60	100	2
2	PCC	CE4T002	Hydrology & Water Resource Engineering	2	1	0	20	20	60	100	3
3	PCC	CE4T003	Concrete Technology & Design of RCC Building Elements	2	1	0	20	20	60	100	3
4	PCC	CE4T004	Solid Mechanics	2	1	0	20	20	60	100	3
5	PCC	CE4T005	Surveying and Geomatics	2	0	0	20	20	60	100	2
6	PCC	CE4T006	Materials, Testing & Evaluation	2	0	0	20	20	60	100	2
7	PCC	CE4L001	Concrete Technology & Design of RCC Building Elements Lab	0	0	2	60	0	40	100	1
8	PCC	CE4L002	Solid Mechanics Lab	0	0	2	60	0	40	100	1
9	PCC	CE4L003	Surveying and Geomatics Lab	0	0	4	60	0	40	100	2
10	PROJECT	CE4F004	Field Visit	0	0	0	0	0	50	50	1
11	MC	CE4T007	Innovation and Entrepreneurship Development	2	0	0	10	15	25	50	AU
				14	**3**	**8**					**20**

V 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	CE5T001	Professional Practice, Law & Ethics	2	0	0	20	20	60	100	2
2	PCC	CE5T002	Fluid Mechanics	2	1	0	20	20	60	100	3
3	PCC	CE5T003	Structural Analysis	2	1	0	20	20	60	100	3
4	PCC	CE5T004	Transportation Engineering	3	0	0	20	20	60	100	3
5	OEC	CEOEC1	Open Elective-I	4	0	0	20	20	60	100	4
6	PCC	CE5L001	Fluid Mechanics Lab	0	0	2	60	0	40	100	1
7	PCC	CE5L002	Structural Analysis Lab	0	0	2	60	0	40	100	1
8	PCC	CE5L003	Transportation Engineering Lab	0	0	2	60	0	40	100	1
9	PROJECT	CE5P004	Mini Project & Seminar	0	0	2	60	0	40	100	1
10	PROJECT	CE5F005	Field Visit III	0	0	0	60	0	40	100	1
11	MC	CE5T005	Consumer Affair	2	0	0	20	20	60	100	3
				15	**2**	**8**					**23**

VI 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	PCC	CE6T001	Design of Steel Structures	2	1	0	20	20	60	100	3
2	PCC	CE6T002	Environmental Engineering	3	0	0	20	20	60	100	3
3	PEC	CE5TE01	Professional Elective I	3	0	0	20	20	60	100	3
4	PEC	CE6TE02	Professional Elective-II	3	0	0	20	20	60	100	3
5	OEC	CEOEC2	Open Elective-II	4	0	0	20	20	60	100	4
6	PCC	CE6L001	Design of Steel Structures Lab	0	0	2	60	0	40	100	1
7	PCC	CE6L002	Environmental Engineering Lab	0	0	2	60	0	40	100	1
8	PROJECT	CE6P003	Mini Project & Seminar	0	0	2	30	0	20	50	1
9		CE6P004	Campus Recruitment Training (CRT)	0	0	2	50	0	0	50	1
		CE6P005	Skill Development	0	0	2	15	0	35	50	1
10	MC	CE6T004	Research Methodology	2	0	0	10	15	25	50	AU
				17	**1**	**10**					**21**

VII 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	PCC	CE7T001	Engineering Economics, Estimating and Costing	3	0	0	20	20	60	100	3
2	PEC	CE7TE01	Professional Elective III	2	1	0	20	20	60	100	3
3	PEC	CE7TE02	Professional Elective IV	2	1	0	20	20	60	100	3
4	PEC	CE8TE01	Professional Elective V	3	0	-	20	20	60	100	3
5	OEC	CEOEC3	Open Elective-III	4	0	0	20	20	60	100	4
6	PCC	CE7L001	Engineering Economics, Estimation and Costing Lab	0	0	2	60	0	40	100	1
7	PROJECT	CE7P002	Project-1	0	0	6	75	0	75	150	5
8	MC	CE7T002	IPR (Intellectual Property Rights)	2	0	0	10	15	25	50	AU
				16	**2**	**8**					**22**

NOTE: Introduction of VII & VIII Scheme in session 2022-23

VIII 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	PEC	CE8TE01	Professional Elective VI	3	0	-	20	20	60	100	3
2	OEC	CEOEC4	Open Elective-IV	4	0	-	20	20	60	100	4
3	PROJECT	CE8P001	Project-2	0	0	4	50	0	50	100	3
OR											
4	PROJECT	CE8P002	Internship (Full Semester)	0	0	0	225	-	75	300	10
				7	**0**	**4**					**10**

BoS, Chairman,
Civil Engineering,
JDCOEM, Nagpur

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Teaching Scheme

Branch: Civil Engineering **Branch Code: CE**

III 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	CE3T001	Civil Engineering - Societal & Global Impact	2	0	0	20	20	60	100	2
2	BSC	CE3T002	Engineering Mathematics-III	2	1	0	20	20	60	100	3
3	ESC	CE3T003	Building Drawing and Drafting	2	1	0	20	20	60	100	3
4	ESC	CE3T004	Mechanics of Rigid bodies	2	1	0	20	20	60	100	3
5	ESC	CE3T005	Energy Science and Engineering	3	0	0	20	20	60	100	3
6	PCC	CE3T006	Basic Geology and Geotechnical Engineering	3	0	0	20	20	60	100	3
7	MC	CE3T007	Universal Human Values	3	0	0	20	20	60	100	3
8	ESC	CE3L001	Building Drawing and Drafting Lab	0	0	4	60	0	40	100	2
9	ESC	CE3L002	Mechanics of Rigid Bodies Lab	0	0	2	60	0	40	100	1
10	PCC	CE3L003	Basic Geology and Geotechnical Engineering Lab	0	0	2	60	0	40	100	1
11	PROJECT	CE3F004	Field Visit I	0	0	0	0	0	50	50	1
				17	**3**	**8**					**25**

IV 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	BSC	CE4T001	Life Science	2	0	0	20	20	60	100	2
2	PCC	CE4T002	Hydrology & Water Resource Engineering	2	1	0	20	20	60	100	3
3	PCC	CE4T003	Concrete Technology & Design of RCC Building Elements	2	1	0	20	20	60	100	3
4	PCC	CE4T004	Solid Mechanics	2	1	0	20	20	60	100	3
5	PCC	CE4T005	Surveying and Geomatics	2	0	0	20	20	60	100	2
6	PCC	CE4T006	Materials, Testing & Evaluation	2	0	0	20	20	60	100	2
7	PCC	CE4L001	Concrete Technology & Design of RCC Building Elements Lab	0	0	2	60	0	40	100	1
8	PCC	CE4L002	Solid Mechanics Lab	0	0	2	60	0	40	100	1
9	PCC	CE4L003	Surveying and Geomatics Lab	0	0	4	60	0	40	100	2
10	PROJECT	CE4F004	Field Visit	0	0	0	0	0	50	50	1
11	MC	CE4T007	Innovation and Entrepreneurship Development	2	0	0	10	15	25	50	AU
				14	**3**	**8**					**20**

V 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	CE5T001	Professional Practice, Law & Ethics	2	0	0	20	20	60	100	2
2	PCC	CE5T002	Fluid Mechanics	2	1	0	20	20	60	100	3
3	PCC	CE5T003	Structural Analysis	2	1	0	20	20	60	100	3
4	PCC	CE5T004	Transportation Engineering	3	0	0	20	20	60	100	3
5	OEC	CEOEC1	Open Elective-I	4	0	0	20	20	60	100	4
6	PCC	CE5L001	Fluid Mechanics Lab	0	0	2	60	0	40	100	1
7	PCC	CE5L002	Structural Analysis Lab	0	0	2	60	0	40	100	1
8	PCC	CE5L003	Transportation Engineering Lab	0	0	2	60	0	40	100	1
9	PROJECT	CE5P004	Mini Project & Seminar	0	0	2	60	0	40	100	1
10	PROJECT	CE5F005	Field Visit III	0	0	0	60	0	40	100	1
11	MC	CE5T005	Consumer Affair	2	0	0	20	20	60	100	3
				15	**2**	**8**					**23**

VI 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	PCC	CE6T001	Design of Steel Structures	2	1	0	20	20	60	100	3
2	PCC	CE6T002	Environmental Engineering	3	0	0	20	20	60	100	3
3	PEC	CE5TE01	Professional Elective I	3	0	0	20	20	60	100	3
4	PEC	CE6TE02	Professional Elective-II	3	0	0	20	20	60	100	3
5	OEC	CEOEC2	Open Elective-II	4	0	0	20	20	60	100	4
6	PCC	CE6L001	Design of Steel Structures Lab	0	0	2	60	0	40	100	1
7	PCC	CE6L002	Environmental Engineering Lab	0	0	2	60	0	40	100	1
8	PROJECT	CE6P003	Mini Project & Seminar	0	0	2	30	0	20	50	1
9		CE6P004	Campus Recruitment Training (CRT)	0	0	2	50	0	0	50	1
		CE6P005	Skill Development	0	0	2	15	0	35	50	1
10	MC	CE6T004	Research Methodology	2	0	0	10	15	25	50	AU
				17	**1**	**10**					**21**

VII 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	PCC	CE7T001	Engineering Economics, Estimating and Costing	3	0	0	20	20	60	100	3
2	PEC	CE7TE01	Professional Elective III	2	1	0	20	20	60	100	3
3	PEC	CE7TE02	Professional Elective IV	2	1	0	20	20	60	100	3
4	PEC	CE8TE01	Professional Elective V	3	0	-	20	20	60	100	3
5	OEC	CEOEC3	Open Elective-III	4	0	0	20	20	60	100	4
6	PCC	CE7L001	Engineering Economics, Estimation and Costing Lab	0	0	2	60	0	40	100	1
7	PROJECT	CE7P002	Project-1	0	0	6	75	0	75	150	5
8	MC	CE7T002	IPR (Intellectual Property Rights)	2	0	0	10	15	25	50	AU
				16	**2**	**8**					**22**

NOTE: Introduction of VII & VIII Scheme in session 2022-23

VIII 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	PEC	CE8TE01	Professional Elective VI	3	0	-	20	20	60	100	3
2	OEC	CEOEC4	Open Elective-IV	4	0	-	20	20	60	100	4
3	PROJECT	CE8P001	Project-2	0	0	4	50	0	50	100	3
OR											
4	PROJECT	CE8P002	Internship (Full Semester)	0	0	0	225	-	75	300	10
				7	**0**	**4**					**10**

BoS, Chairman,
Civil Engineering,
JDCOEM, Nagpur

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 Computer Science & Engineering

"A Place to Learn, A Chance to Grow"

Session: 2022-23

COURSE STRUCTURE & SYLLABUS (AUTONOMOUS)

For

B. Tech. Computer Science & Engineering

JAIDEV EDUCATION SOCIETY'S

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INDEX

VISION AND MISSION OF INSTITUTE

VISION

To be a center 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 Computer Science & Engineering 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. Computer Science & Engineering Program

Curriculum for Semester- I & II [First Year]

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	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**

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	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**

Course Structure and Syllabus

For

B. Tech. Computer Science & Engineering Program

Curriculum for Semester- III & IV [Second Year]

III Semester

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				
				L	T	P	CA	MSE	ESE	Total	Credit
1	HSMC	CS3T001	Organizational Behaviour	2	0	0	20	20	60	100	2
2	BSC	CS3T002	Mathematics-III	2	1	0	20	20	60	100	3
3	ESC	CS3T003	Programming for Problem Solving	3	0	0	20	20	60	100	3
4	HSMC	CS3T004	Universal Human Values(UHV)	2	1	0	20	20	60	100	3
5	PCC	CS3T005	Data structure & Algorithms	3	0	0	20	20	60	100	3
6	PCC	CS3T006	Operating System	3	0	0	20	20	60	100	3
7	PCC	CS3L007	Digital Elecytronics & Computer Organization	3	0	0	20	20	60	100	3
8	PCC	CS3L008	Python Programming(Lab)	0	0	2	60	0	40	100	1
9	PCC	CS3L009	Data structure & Algorithms(Lab)	0	0	2	60	0	40	100	1
10	PCC	CS3L010	Web Designing (Lab)	0	0	2	60	0	40	100	1
				18	**2**	**6**	**320**	**140**	**540**	**1000**	**23**

IV Semester

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				
				L	T	P	CA	MSE	ESE	Total	Credit
1	PCC	CS4T001	Java Programming	3	0	0	20	20	60	100	3
2	PCC	CS4T002	FLAT	2	1	0	20	20	60	100	3
3	PCC	CS4T003	Computer Network	3	0	0	20	20	60	100	3
4	PCC	CS4T004	Database Management Systems	3	0	0	20	20	60	100	3
5	PCC	CS4T005	Discrete Mathematics & Graph Structures	3	0	0	20	20	60	100	3
6	PCC	CS4T006	JAVA(Lab)	0	0	2	60	0	40	100	1
7	PCC	CS4T007	Computer Networks(Lab)	0	0	2	60	0	40	100	1
8	PCC	CS4T008	DBMS(Lab)	0	0	2	60	0	40	100	1
9	MC	CS4T009	Consumer Affairs	2	0	0	15	10	25	50	Audit
10	PROJECT	CS4T010	Field Training/ Industrial Visit	0	0	0	30	0	20	50	1
11	PCC	CS4T011	NPTEL	0	0	0	0	0	100	100	2
				16	**1**	**6**	**325**	**110**	**565**	**1000**	**21**

Course Structure and Syllabus

For

B. Tech. Computer Science & Engineering Program

Curriculum for Semester- V & VI [Third Year]

V Semester

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				Credit
				L	T	P	CA	MSE	ESE	Total	
1	ESC	CS5T001	Internet Of Things	3	0	0	20	20	60	100	3
2	PCC	CS5T002	TCP/IP	3	0	0	20	20	60	100	3
3	PCC	CS5T003	Design and Analysis of Algorithm	2	1	0	20	20	60	100	3
4	PCC	CS5O001	Open Elective-1	3	1	0	20	20	60	100	4
5	PEC	CS5TE01	Elective -I	3	0	0	20	20	60	100	3
6	ESC	CS5L004	Internet Of Things (Lab)	0	0	2	60	0	40	100	1
7	PCC	CS5L005	TCP/IP(Lab)	0	0	2	60	0	40	100	1
8	PCC	CS5L006	Design and Analysis of Algorithm(Lab)	0	0	2	60	0	40	100	1
9	PROJECT	CS5P007	Mini Project	0	0	0	30	0	20	50	1
10	PROJECT	CS5P008	Field Training/ Industrial Visit	0	0	0	30	0	20	50	1
10	MC	CS5T009	Innovation and Enterpreneurship Development	2	0	0	15	10	25	50	Audit
				16	**2**	**6**	**355**	**110**	**485**	**950**	**21**

Open Elective-1 : OSOS (Open Source Operating System)

VI Semester

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				Credit
				L	T	P	CA	MSE	ESE	Total	
1	PCC	CS6T001	Artificial Intelligence & Robotics	3	0	0	20	20	60	100	3
2	PCC	CS6T002	Neural Networks and Machine Learning	3	0	0	20	20	60	100	3
3	PEC	CS6TE02	Elective -II	3	0	0	20	20	60	100	3
4	PEC	CS6TE03	Elective-III	3	0	0	20	20	60	100	3
5	OEC	CS6O002	Open Elective-2	3	1	0	20	20	60	100	4
6	PCC	CS6L003	Neural Networks and Machine Learning(Lab)	0	0	2	60	0	40	100	1
7	PCC	CS6L004	Full Stack Development(Lab)	0	0	2	60	0	40	100	1
8	PCC	CS6L005	Advance Java Programming(LAB)	0	0	2	60	0	40	100	1
9	PROJECT	CS6P006	Mini Project	0	0	2	30	0	20	50	1
10	PROJECT	CS6P007	CRT(Campus Recruitment Training)	0	0	2	50	0	0	50	1
11	PROJECT	CS6P008	Skill Development	0	0	2	15	0	35	50	1
12	MC	CS6T009	Intellectual Property Rights	2	0	0	15	10	25	50	Audit
				17	**1**	**12**	**390**	**110**	**500**	**1000**	**22**

Open Elective-2 : PL/SQL Programming

Course Structure and Syllabus

For

B. Tech. Computer Science & Engineering Program

Curriculum for Semester- VII & VIII [Fourth Year]

VII Semester

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				Credit
				L	T	P	CA	MSE	ESE	Total	
1	ESC	CS7T001	Data Science	2	1	0	20	20	60	100	3
2	PEC	CS7TE04	Elective-IV	3	0	0	20	20	60	100	3
3	PEC	CS7TE05	Elective -V	3	0	0	20	20	60	100	3
4	OEC	CS7T002	Cyber Security & Cryptography	2	1	0	20	20	60	100	3
5	OEC	CS7O003	Open Elective -3	3	1	0	20	20	60	100	4
6	ESC	CS7L002	Cyber Security & Cryptography(Lab)	0	0	2	60	0	40	100	1
7	PCC	CS7L003	Data Science using R(Lab)	0	0	2	60	0	40	100	1
8	PROJECT	CS7P004	Project Phase I	0	0	6	50	0	50	100	3
9	MC	CS7T005	Research Methodology	2	0	0	15	10	25	50	Audit
				15	**3**	**10**	**285**	**110**	**455**	**850**	**21**

Open Elective-3 : PHP Development

VIII Semester

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				
				L	T	P	CA	MSE	ESE	Total	Credit
1	PEC	CS8TE06	Elective –VI	3	0	0	20	20	60	100	3
2	OEC	CS8O004	Open Elective -4	3	1	0	20	20	60	100	4
4	PROJECT	CS8P001	Project Phase II	0	0	4	75	0	75	150	5
5	PCC		NPTEL	0	0	0	0	0	100	100	2
				6	**1**	**4**	**115**	**40**	**195**	**450**	**14**

Open Elective-4 : Ethical Hacking

Course Structure and Syllabus

For

B. Tech. Computer Science & Engineering Program

Curriculum for Semester- III & IV [Second Year]

III Semester

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				
				L	T	P	CA	MSE	ESE	Total	Credit
1	HSMC	CS3T001	Organizational Behaviour	2	0	0	20	20	60	100	2
2	BSC	CS3T002	Mathematics-III	2	1	0	20	20	60	100	3
3	ESC	CS3T003	Programming for Problem Solving	3	0	0	20	20	60	100	3
4	HSMC	CS3T004	Universal Human Values(UHV)	2	1	0	20	20	60	100	3
5	PCC	CS3T005	Data structure & Algorithms	3	0	0	20	20	60	100	3
6	PCC	CS3T006	Operating System	3	0	0	20	20	60	100	3
7	PCC	CS3L007	Digital Elecytronics & Computer Organization	3	0	0	20	20	60	100	3
8	PCC	CS3L008	Python Programming(Lab)	0	0	2	60	0	40	100	1
9	PCC	CS3L009	Data structure & Algorithms(Lab)	0	0	2	60	0	40	100	1
10	PCC	CS3L010	Web Designing (Lab)	0	0	2	60	0	40	100	1
				18	2	6	320	140	540	1000	23

CS3T001	Organizational Behaviour	2 Credit

Course Objectives:

1. To help the students to develop cognizance of the importance of human behavior.
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 behavior and improve results.
5. To learn and appreciate different cultures and diversity in the workplace.

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, mis-behavior 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. 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 [5 Hrs]

Meaning, Fundamental concepts, Definition, Approaches to OB, Characteristics and limitations of OB, Models of OB, Impact of technology on organizational behaviour. **Organization Culture:** Meaning and dimensions, Types of organizational cultures.

Unit 2: Organizational Design, Change And Innovation [5 Hrs]

Designing an organizational structure, Division of labour, Delegation of authority, 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, Interpersonal communication, Multicultural communication, Barriers to effective communication, **Technical Report Writing :** Characteristics of Technical Communication, Types of Technical Documents, Technical Writing Process.

Unit 3: Personality [5 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 – Nature and dimensions of attitude – Developing the right attitude, ABC model of Attitude, Managerial Implications of Attitude

Unit 4: Groups and Organizations [5 Hrs]

Groups and Teams, Group Dynamics - Groups versus teams, Nature and types of groups and teams, five stages of group/team development,**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,

Unit 5: Motivation [5 Hrs]

Power and purpose of motivation, Theories of motivation - Locke's goal setting theory, Vroom's expectancy theory, Porter and Lawler's model, Motivational Techniques **Power and Politics**: The concept of power, Sources of power, Interdepartmental power, Illusion of power, Political strategies and tactics, Ethics, power and politics, **Empowerment and Participation**: The nature of empowerment and participation, How participation works, Programs for participation, Important considerations in participation.

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.

CS3T002	Mathematics-III	4 Credits

COURSE OBJECTIVES:

1. To understand the concept of Laplace Transform , Inverse Laplace Transform ,Fourier transform, complex variables Numerical Linear algebra and Stochastic calculus.
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, Inverse Laplace Transform, Fourier transform, complex variables, Numerical Linear Algebra and Stochastic calculus.
2. Illustrate the concept of Laplace Transform, Inverse Laplace Transform, Fourier transform, complex variables, Numerical Linear Algebra and Stochastic calculus.
3. Apply the concept of Laplace Transform, Inverse Laplace Transform, Fourier transform, complex variables, Numerical Linear Algebra and Stochastic calculus.
4. Analyze the problem by using the concept of Laplace Transform, Inverse Laplace Transform, Fourier transform, complex variables, Numerical Linear Algebra and Stochastic calculus.
5. Evaluate the problem base on the concept of Laplace Transform, Inverse Laplace Transform, Fourier transform, complex variables, Numerical Linear Algebra and Stochastic calculus.
6. Create the new concept by using the theory of Laplace Transform, Inverse Laplace Transform, Fourier transform, complex variables, Numerical Linear Algebra and Stochastic calculus.

COURSE CONTENTS:

UNIT I: Laplace Transform [8 Hrs]

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

UNIT II : Inverse Laplace Transform [8 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 III Fourier transform [6 Hrs]

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.

Unit IV: Functions of complex variables [6Hrs]

Analytic functions; Harmonic functions in Cartesian form; fundamental theorem of algebra; Cauchy's integral theorem; Cauchy's integral formula; Residues; Cauchy's residue theorem.

Unit V: Numerical linear algebra and Stochastic calculus [6Hrs]

Introduction to linear algebra; Characteristics equation, Eigen values and Eigen vectors, Statement and Verification of Cayley Hamilton Theorem,Definition and classification of random processes; Discrete-time Markov chains; Poisson process; Stochastic integration, Itôintegral , Itôformula. Stochastic differential equations.

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.

CS3T003	Programming for Problem Solving	3 Credit

COURSE OBJECTIVES:

1. To learn the fundamentals of computers.
2. To understand the various steps in program development.
3. To learn the syntax and semantics of C programming language.
4. To learn the usage of structured programming approach in solving problems

COURSE OUTCOMES:

At the end of this course,

1. 1.Student shall be able to learn and understand to formulate simple algorithms for arithmetic and logical problems
2. 2.Student shall be able to translate the algorithms to programs (in C language).
3. 3.Student shall be able to test and execute the programs and correct syntax and logical errors
4. 4.Student shall be able to implement conditional branching, iteration and recursion
5. 5.Student shall be able to decompose a problem into functions and synthesize a complete program using divide
6. Student shall be able to formulate simple algorithms for arithmetic and logical problems

Course Contents:

Unit 1 **[6 Hrs]**

Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.), Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudocode with examples. From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code

Unit 2 **[6 Hrs]**

Conditional Branching and Loops, Writing and evaluation of conditionals and consequent branching, Iteration and loops

Unit 3 **[6 Hrs]**

Arrays (1-D, 2-D), Character arrays and Strings, Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

Unit 4 **[6 Hrs]**

Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference, Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

Unit 5 **[6 Hrs]**

Structures, defining structures and Array of Structures, Pointers**,** Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list

Text Books:

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill

CS3T004	Universal Human Value	3 Credit

Course Objective:

1. The objective of the course is fourfold:
2. Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
3. Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
4. Strengthening of self-reflection.
5. Development of commitment and courage to act.

Course Contents:

Module 1: [6 Hrs]

Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

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 fulfill 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: [6 Hrs]

Understanding Harmony in the Human Being - Harmony in Myself!

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 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: **[6 Hrs]**

Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship

Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfillment 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, 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 fearlessness (trust) and co-existence as comprehensive Human Goals.

Module 4: **[6 Hrs]**

Understanding Harmony in the Nature and Existence - Whole existence as Coexistence

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: **[6 Hrs]**

Implications of the above Holistic Understanding of Harmony on Professional Ethics

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 foraugmenting 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. 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)

CS3T006	Data Structure & Algorithms	4 Credit

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. Student shall be able to Implement abstract data types for linear data structures.
2. Student shall be able to apply the different linear and non-linear data structures to problem solutions
3. Student shall be able to critically analyze the various sorting algorithm.

Course Contents:

Unit 1 **[9 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.

Unit 2 **[9 Hrs]**

ADT Array-Searching and sorting on arrays: Linear search, binary search on a sorted array. Bubble sort, Insertion sort, merge sort and analysis; Counting sort, Radix sort, and bucket sort

Unit 3 **[9 Hrs]**

Stacks and Queues: Abstract data types, sequential and linked implementations, exception handling in classes, representative applications such as parenthesis matching, simulation of queuing systems.

Unit 4 **[9 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.

Unit 5 **[9 Hrs]**

Trees & Graphs : 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, 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.

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, SartajSahni, Susan Anderson-Freed, ―Fundamentals of Data Structures in C, Second Edition, University Press, 2008.

CS3T007	Operating System	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 the file system.

6 Students should understand the data structures and algorithms used to implement an OS.

Course Outcomes:

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 **[7 Hrs]**

Introduction: Evolution of OS, Types of OS, Basic h/w support necessary for modern operating systems, services provided by OS, system programs and system calls, system design and implementation, UNIX system introduction and commands.

Unit 2 **[8 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 **[7 Hrs]**

Process Synchronization and Deadlocks: Synchronization Background, The Critical-Section Problem, Synchronization Hardware, Semaphores, Classic Problems of Synchronization, Critical Regions, Monitors, OS Synchronization, Deadlock definition, Prevention, Avoidance, Detection and recovery.

Unit 4 **[7 Hrs]**

Memory Management: Memory Management Background, Swapping, Contiguous Memory Allocation, Paging, Segmentation, Segmentation with Paging, Basics of Virtual Memory – Hardware and control structures – Locality of reference, Paging: Principle of operation, Demand Paging, Process Creation, Page Replacement, Allocation of Frames, Thrashing.

Unit 5 **[7 Hrs]**

File systems and Disk Management: File concept, Access methods, Disk space management and Allocation methods strategies, Directory structures, Recovery, Log-structured File System, Disk arm scheduling strategies**.**

Textbook:

1. Abraham Silberschatz, Peter B. Galvin and Greg Gagne, *Operating System Concepts*, Wiley Publication, 8th Edition, 2008.
2. Andrew S. Tanenbaum, *Modern Operating System*, PHI Publication, 4thEdition, 2015
3. 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, 2ndEdition, 1996.
2. Garry Nutt, *Operating Systems Concepts*, Pearson Publication, 3rd Edition, 2003.
3. Harvey M. Deitel, *An Introduction to Operating Systems*, Addison-Wesley Publication, 2nd Edition, 1990.
4. Thomas W. Doeppner, Operating System in Depth: Design and Programming, Wiley
5. M. J. Bach. Design of the Unix Operating System, Prentice Hall of India, 1986.Publication, 2011.

CS3T007	Digital Electronics & Computer Organization	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 [7 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 II: Combinational Digital Circuits [7 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

Unit III: **Sequential circuits and systems [8 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.

Unit IV: Memory System and Fundamentals of Microprocessor [7 Hrs]

Some Basic Concepts, Semiconductor RAM Memories, Memory system considerations, Semiconductor ROM Memories, Memory interleaving, Cache Memory, Mapping techniques, Virtual memory, Memory Management requirements. Fundamentals of Microprocessor,. 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 V: 8086 Instruction Set and Programming [7 Hrs]

Memory Interfacing. I/O Interfacing. Direct Memory Access. (DMA). Interrupts in 8086. 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

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.

CS3L009	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

CS3L010	Web Designing Lab	1 Credit

Course Objectives:

1. To learn the basics in web designing using HTML, CSS, and XML.
2. To develop web applications using JSP, servlet, PHP, and Net Beans.

Course Outcomes:

1.To Develop web pages using HTML, CSS, and XML

2.To Deploy real world applications using client side and server-side scripting languages.

3.To Design web applications in Net Beans Environment

4.To Perform the Database Connectivity with MySQL using Java Servlets, JSP, and PHP.

List of Experiments

1. Designing static web pages using basics and important tags in HTML.
2. Designing dynamic web pages using different cascading style sheets.
3. Design an XML document to store information about a patient in a hospital. Information contains first name, middle name, last name, aadhar no., age, address etc. Create CSS for the above XML document.
4. Write a JavaScript to design a simple calculator to perform various arithmetic operations.
5. Programs using Java servlets and JSP.
6. Designing web applications using PHP.
7. File handling using PHP: Design a page to save the user input details to a text file and display its contents.
8. Write a PHP code to display the number of visitors visiting the web page.
9. Designing web applications in Net Beans Environment.
10. Database Connectivity with MySQL using Java Servlets, JSP, and PHP.

Course Structure and Syllabus

For

B. Tech. Computer Science & Engineering Program

Curriculum for Semester- III & IV [Second Year]

IV Semester

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				
				L	T	P	CA	MSE	ESE	Total	Credit
1	PCC	CS4T001	Java Programming	3	0	0	20	20	60	100	3
2	PCC	CS4T002	FLAT	2	1	0	20	20	60	100	3
3	PCC	CS4T003	Computer Network	3	0	0	20	20	60	100	3
4	PCC	CS4T004	Database Management Systems	3	0	0	20	20	60	100	3
5	PCC	CS4T005	Discrete Mathematics & Graph Structures	3	0	0	20	20	60	100	3
6	PCC	CS4T006	JAVA(Lab)	0	0	2	60	0	40	100	1
7	PCC	CS4T007	Computer Networks(Lab)	0	0	2	60	0	40	100	1
8	PCC	CS4T008	DBMS(Lab)	0	0	2	60	0	40	100	1
9	MC	CS4T009	Consumer Affairs	2	0	0	15	10	25	50	Audit
10	PROJECT	CS4T010	Field Training/ Industrial Visit	0	0	0	30	0	20	50	1
11	PCC	CS4T011	NPTEL	0	0	0	0	0	100	100	2
				16	**1**	**6**	**325**	**110**	**565**	**1000**	**21**

CS4T001	Java Programming	3 Credit

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.

Course Contents:

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

Unit II **[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 III **[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 IV **[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 V **[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

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

CS4T002	FLAT (Formal Language and Automata Theory)	4 Credit

COURSE OBJECTIVES

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

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 toChoose and design appropriate automata for the different requirements outlined by theoretical computer science
5	Students shall able toIdentify the different computational problems and their associated complexity.

Course Contents:

Unit 1 **[8 Hrs]**

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 II **[7 Hrs]**

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 III **[6 Hrs]**

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 IV **[6 Hrs]**

Turing Machine : 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 V **[7 Hrs]**

Computability Theory : 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.

CS4T003	Computer Network	3 Credit

OURSE OBJECTIVES

1	Acquire the computer networking knowledge as well as the existing connectivity technologies and the required infrastructure which comprises the key steps involved in the communication process.
2	Identify the key issues for the realization of the LAN/WAN/MAN network
3	Establish a solid knowledge of the layered approach that makes design, implementation and operation of extensive networks possible. To learn the 7-layer OSI network model (each layer and its responsibilities) and understand the TCP/IP suite of protocols and the networked applications supported by it.
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
6	Acquire the computer networking knowledge as well as the existing connectivity technologies and the required infrastructure which comprises the key steps involved in the communication process.

COURSE OUTCOMES

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.

Course Contents:

Unit 1 **[6 Hrs]**

Data and Signal: Define data, signal. Time domain and frequency domain representation of signal, bandwidth of a signal and medium, Sources of impairment, Attenuation, distortion, noise, data rate Limits and Nyquist bit rate, FDM and TDM, synchronous and asynchronous TDM.

Unit II **[6 Hrs]**

Introduction of LAN; MAN; WAN; PAN, Ad-hoc Network, Network Architectures: Client-Server; Peer to Peer; OSI Model, TCP/IP Model, Topologies, Data Link Layer: Data Link Layer Design Issues: Service provided to network layer Framing, Error Control, Flow Control, Error Detection and Correction, Data Link Control, Multiple Access.

Unit III **[6 Hrs]**

Network Layer: 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 IV **[6 Hrs]**

Transport Layer: UDP, TCP, Connection establishment and termination, sliding window revisited, flow and congestion control, timers, retransmission, TCP extensions, etc.

Unit V **[6 Hrs]**

Application Layer: Application protocols for email, ftp, web, DNS

Textbook:

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 Book:

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.

CS4T004	Database Management Systems	3 Credit

COURSE OBJECTIVES

1 To Eliminate redundant data.

2 To Make access to the data easy for the user.

3 To Provide for mass storage of relevant data.

4 To Make the latest modifications to the data base available immediately.

5 To Protect data from physical harm and un-authorised systems.

6 To Allow multiple users to be active at one time.

COURSE OUTCOMES

1 Student shall be able to learn and understand fundamentals of database management system

2 Student shall be able to exhibit the query development knowledge

3 Student shall be able to learn modeling and normalization of databases.

4 Student shall be able to learn query processing and optimization techniques.

5 Students shall be able to exhibit to File Organization, Indexing and Hashing

6 Student shall be able to exhibit the knowledge of transaction and concurrency control.

Course Contents:

Unit 1 **[6 Hrs]**

Introduction to Database Systems: 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.

Unit II **[6 Hrs]**

Relational query languages: Relational algebra, Tuple and domain relational calculus, SQL3, DDL and DML constructs, Open source and Commercial DBMS – MYSQL, ORACLE, DB2, SQL server.

Unit III **[6 Hrs]**

Relational database design: Normalization of Database Tables: Need and Significance, Domain and data dependency, Armstrong's axioms, Normal forms, Dependency preservation, Lossless design.

Unit IV **[6 Hrs]**

Query processing: Evaluation of relational algebra expressions, Query equivalence, Joinstrategies.

Unit V **[6 Hrs]**

File Organization and Indexing: Indices, B-trees, hashing.

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. RaghuRamakrishnan, Johannes Gehrke, *Database Management Systems*, McGraw-Hill Publication, 3rd Edition, 2003.

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.

CS4T005	Discrete Mathematics & Graph Structures	3 Credit

Unit 1 **[6 Hrs]**

Set Theory: Basic concepts of Set theory, Power set, some operations on Sets, Venn diagram, some basic set identities, Cartesian products. Properties of binary relation in a set, Inclusion& equality of set, Power Set, Ordered Pairs and n-tuples, Operations on Sets**.**

Mathematical Logic: Statement and notations, connectives, Negation, conjunction, disjunction, conditional & bi-conditional, statement formulas & truth tables. Tautologies, equivalence of formulas, Duality law, Tautological implications, Arguments and validity.

Unit II **[6 Hrs]**

Relations and Functions: Relation and Ordering, Properties of Binary in a set, Relation Matrix and Graphs, Partition and Covering of a set, Equivalence relation, Partial ordering, Partially Ordered sets, Function (Definition and Introduction), Composition of functions, Inverse Functions, Characteristics function of a set.

Unit III **[6 Hrs]**

Algebraic structures: Semi groups, monoids definition and examples, Group definitions and examples, cyclic group, permutation groups, subgroups and homomorphism, co-sets, Lagrange's theorem and Normal Subgroups.

Unit IV **[6 Hrs]**

Introduction to graphs: Graphs and their basic properties - degree, path, cycle, subgraphs, isomorphism, Eulerian and Hamiltonian walks, graph coloring, planar graphs, trees.

Unit V **[6 Hrs]**

Introduction to counting: Basic counting techniques - inclusion and exclusion, pigeon-hole principle, permutation, combination, summations. Introduction to recurrence relation and generating function.

Textbooks:

1. Discrete and Combinatorial Mathematics, Ralph P. Grimaldi& B. V. Ramana, 5thEdition, PHI/Pearson education.
2. "Discrete Mathematical structures", Dr D. S. Chandrashekariah, Prism 2005.
3. S. C. Gupta, Fundamentals of Statistics, Himalaya Publishing House, 7thRevied and
4. Enlarged Edition, 2016.

CS4L006	JAVA(Lab)	1Credit

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

CS4L007	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).

CS4L008	DBMS (Lab)	1

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. 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.
11. Distributed data base Management, creating web-page interfaces for database applications using servlet.

CS4T009	Consumer Affairs	Audit

Course Objectives:

1. To familiarise the students with of their rights as a consumer, the social framework of consumer rights and legal framework of protecting consumer rights.
2. To provide an understanding of the procedure of redress of consumer complaints, and the role of different agencies in establishing product and service standards.

Course Outcomes:

The student should be able to

1. Remember the basic terminology related to Consumer Affairs
2. Understand the different approaches applied in different aspects of consumption, customer protection and consumer awareness and their evolution.
3. Apply the knowledge in different aspects of consumption, customer protection and consumer awareness.
4. Comprehend the business firms' interface with consumers and the consumer related regulatory and business environment.
5. Analyse: the norms applicable to different consumption patterns.
6. Evaluating the functioning of Consumer Protection mechanism in India.

Course Contents:

Unit I: **An Introduction to Consumer Affairs [6 hrs]**

An Introduction to History and Development of Consumer Movement; An introduction to International Organizations and Agreements; Product Liabilities Including Tortious Liabilities; Role of Non Government Organizations (NGOs)and Voluntary Consumer Organizations (VCOs);Importance

Unit II: Grievance Redress Mechanism under the Consumer Protection Act [6 hrs]

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 to be provided; Temporary Injunction, Enforcement of order, Appeal, frivolous and vexatious complaints; Offences and penalties. Globalization and its Consequences; Unfair Trade Practice;

Unit III: Legislation [6 hrs]

Features and Aim of Consumer Protection Act; Consumer Protection Act; Comparison between Pre and Post Legislation Period; Land Mark Judgements

Unit IV: Understanding Consumption and Consumer Values [6 hrs]

Customer Awareness Importance, Companies' Behaviour and Customer Awareness Relevance, Understanding the Market and Companies' Behaviour, Companies' Practices Requiring Consumers' Protection, Customer Awareness Relevance and Strategies

Unit V: Project Work [4 hrs]

Leading Cases decided under Consumer Protection Act: Medical Negligence; Banking; Insurance; Housing & Real Estate; Electricity, Water, and Telecom Services; Education; Defective Product; Presenting a comprehensive solution to a selected case study.

Text Books:

1. Khanna, Sri Ram, Savita Hanspal, Sheetal Kapoor, and H.K. Awasthi. "Consumer Affairs" (2007) Delhi University Publication

2. Aggarwal, V. K. (2003). Consumer Protection: Law and Practice. 5th Ed. Bharat Law House, Delhi

3. Girimaji, Pushpa (2002). Consumer Right for Everyone Penguin Books.

4. Nader, Ralph (1973). The Consumer and Corporate Accountability. USA, Harcourt Brace Jovanovich, Inc.

5. Sharma, Deepa (2011).Consumer Protection and Grievance-Redress in India: A Study of Insurance Industry(LAP LAMBERT Academic Publishing GmbH & Co.KG, Saarbrucken, Germany

Reference Books:

1. Empowering Consumers e-book, www.consumeraffairs.nic.in

2. EBook www.bis.org8. The Consumer Protection Act, 1986 Consumer Protection Judgments (CPJ) (Relevant cases reported in various issues)

3. Recent issues of magazines: Insight, published by CERC, Ahmedabad 'Consumer Voice', Published by VOICE Society, New Delhi.

4. Upbhokta Jagran, Ministry of Consumer Affairs, Govt, of India, New Delhi

Websites:

1. www.ncdrc.nic.in
2. www.fcamin.nic.in
3. www.consumeraffairs.nic.in
4. www.iso.org.in
5. www.bis.org
6. www.ascionline.org.in
7. www.trai.gov.in

Course Structure and Syllabus

For

B. Tech. Computer Science & Engineering Program

Curriculum for Semester- V & VI [Third Year]

V Semester

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				
				L	T	P	CA	MSE	ESE	Total	Credit
1	ESC	CS5T001	Internet Of Things	3	0	0	20	20	60	100	3
2	PCC	CS5T002	TCP/IP	3	0	0	20	20	60	100	3
3	PCC	CS5T003	Design and Analysis of Algorithm	2	1	0	20	20	60	100	3
4	PCC	CS5O001	Open Elective-1	3	1	0	20	20	60	100	4
5	PEC	CS5TE01	Elective -I	3	0	0	20	20	60	100	3
6	ESC	CS5L004	Internet Of Things (Lab)	0	0	2	60	0	40	100	1
7	PCC	CS5L005	TCP/IP(Lab)	0	0	2	60	0	40	100	1
8	PCC	CS5L006	Design and Analysis of Algorithm(Lab)	0	0	2	60	0	40	100	1
9	PROJECT	CS5P007	Mini Project	0	0	0	30	0	20	50	1
10	PROJECT	CS5P008	Field Training/ Industrial Visit	0	0	0	30	0	20	50	1
10	MC	CS5T009	Innovation and Enterpreneurship Development	2	0	0	15	10	25	50	Audit
				16	**2**	**6**	**355**	**110**	**485**	**950**	**21**

Open Elective-1 : OSOS (Open Source Operating System)

CS5T001	Internet of Things	3 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 IOT Applications in different areas.

COURSE OUTCOMES:

Students will able to:

1. Apply the concept 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

Course Contents:

UNIT I: IoT Introduction [6 Hrs]

Origin of IoT, IoT and Digitization, IoT Impact, Convergence of IT and IoT, IoTchallenges, Need of IoT ,IoT features, Bulding blocks of IoT , IoT Network Architecture and Design, Drivers Behind New Network Architectures, Comparing IoT Architectures, The Core IoT Functional Stack, IoT Data Management and Compute Stack. IoT Things : Sensors and Actuators

UNIT II : IoT Ecosystem [6 Hrs]

Three layered architecture, five layer architecture, cloud computing , fog computing, IoT taxonomy. Connectivity Terminology : IoT LAN , IoT WAN, IoT Node, IoT Gateway IoT Proxy.

UNIT III : IoT Protocols [6 Hrs]

IoT Networking protocols : MQTT, SMQTT, CoAP, XMPP, AMQP. IoT Communication protocols : IEEE 802.15.4, Zigbee, 6LoWPAN, Wireless HART, Z-Wave, Bluetooth, NFC, RFID, RFID.

UNIT IV : Data Analytics for IoT [6 Hrs]

An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology, Edge Streaming Analytics, Network Analytics, Securing IoT, A Brief History of IoT Security, Common

Challenges in IoT Security, Formal Risk Analysis Structures: OCTAVE and FAIR, The Phased Application of Security in an Operational Environment.

UNIT V: Implementation of IoT with Arduino and Raspberry Pi [7 Hrs]

Introduction to Arduino , Integration of sensors and actuators with Arduino, IDE programming , Introduction to RaspberryPi, About the RaspberryPi Board: Hardware Layout, Operating Systems on RaspberryPi, Configuring RaspberryPi, Programming RaspberryPi with Python, Wireless Temperature Monitoring System Temperature Sensor, Connecting Raspberry Pi via SSH, Accessing Temperature from sensors, Remote access to RaspberryPi.

TEXT BOOKS

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry,"IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", 1 st Edition, Pearson Education
2. Srinivasa K G, "Internet of Things", CENGAGE Leaning India, 2017.
3. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)", 1 stEdition, VPT,2014.

REFERENCE BOOK:

1. Raj Kamal, "Internet of Things: Architecture and Design Principles", 1st Edition, McGraw Hill Education, 2017.
2. Analytics for the Internet of Things (IoT): Intelligent analytics for your intelligent devices", by Andrew Minteer
3. "Internet of Things: Architectures, Protocols and Standards", by Simone Cirani, Gianluigi Ferrari, Marco Picone, and Luca Veltri

CS5T002	TCP/IP	3 Credit

COURSE OBJECTIVES:

1. To understand the basic concepts of TCP/IP Architecture.
2. To Understand Network Layer and Applications.
3. To learn UDP and TCP applications.
4. To learn Transport Layer Reliability.

COURSE OUTCOMES:

1. To compare and contrast TCP and UDP in terms of the application that uses them.
2. To design network-based applications using the socket mechanism.
3. To work with IPv4 addresses in terms of subnetting and supernetting.
4. To setup a host and network in terms of IP addressing.

Course Contents:

UNIT-I: **[6 Hrs]**

Network architecture-Standards, TCP/IP Model Overview, Networking Technologies: LANS, WANS, Connecting Devices. Internetworking concept, Internet Backbones, NAP, ISPs, RFCs and Internet Standards.

UNIT-II:- **[6 Hrs]**

Classful Internet address, CIDR-Subnetting and Supernetting, ARP, RARP, OOTP, DHCP.

UNIT-III: **[6 Hrs]**

IP Datagram- IP Package- IP forwarding and routing algorithms, computing paths, RIPOSPF, ICMP, IGMP.

UNIT-IV : **[6 Hrs]**

TCP header, services, Connection establishment and termination, Interactive data flow, Bulk data flow, Flow control and Retransmission, TCP timers, Urgent Data processing, Congestion control, Extension headers.

UNIT-V : **[6 Hrs]**

Switching technology, MPLS fundamentals, signaling protocols, LDP, IP traffic engineering, ECMP, SBR, Routing extensions for traffic engineering, Traffic engineering limitations and future developments.

Text Books:

1. TCP/IP Network Administration, Craig Haut, 3rd Edition, Shroff Publications, 2002.

2. Internetworking with TCP/IP - Principles, Protocols, and Architecture, Douglas E. Comer, 5th edition Volume-1, Prentice Hall, 2006.

3. The Internet and its Protocols- A Comparative approach, Adrian Farrel, Morgan Kaufmann, 2004. 9

4. TCP/IP Illustrated - the Protocols, W. Richard Stevens, Volume I, Pearson Education, 2003.

5. TCP/IP Protocol Suite, Behrouz A. Forouzan, 3rd edition, Tata McGraw Hill, 2006.

Reference Books:

1. IPv6 Theory, Protocol and Practice, Pete Loshin, 2nd edition, Morgan Kaufmann, 2003.

2. Internetworking TCP/IP, Comer D.E and Stevens D.L, Volume III, Prentice Hall of India, 1997.

CS5T003	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.
5. Apply important algorithmic design paradigms and methods of analysis.
6. Synthesize efficient algorithms in common engineering design situations

COURSE OUTCOMES:

1. After learning the course the students should be able:
2. Develop efficient algorithms for simple computational tasks.
3. Gain understanding of concepts of time and space complexity, worst case, average case and best case complexities and the big-O notation.
4. Design standard algorithms such as sorting, searching, and problems involving graphs.
5. 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 II [8 Hrs]

Introduction to Divide and Conquer, Binary Search, Merge Sort, Quick Sort, Strassen's Matrix Multiplication, Finding median, Closest Pair, Convex Hulls Problem.

Unit III [8 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 IV **[8 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 V **[8 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..

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.

CS5O001	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 the basic 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 [8 Hrs]

Introduction to Internet, World Wide Web Communication & Markup Language, HTTP Request / Response, The HTTP Request Circle.

Unit 2 -HTML Basic Tags [8 Hrs]

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]

JAVA Script Implementation, Syntax Basics 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, Ricardo Zea.

Reference Website:

2. Reference Website: W3 School web Developemt: https://www.w3schools.com/whatis/whatis_icons.asp

CS5O001	Open Elective –I Open Source Operating System	4

Course Outcomes:-

1. Understand Linux Architecture, different Linux installation and Linux commands.
2. Effectively use Linux Environment using shell, file system, scripts, filters &program development tools
3. Perform file I/O management through commands and perform package management, storage management and failure recovery.
4. Create backup and do recovery using tools like Rsync and Bacula
5. Automate tasks and write simple programs using scripts
6. Configure important services like FTP, DNS, MAIL and WEB.

Course Contents:

Unit I **[8Hrs]**

History of Linux OS, Architecture of Linux OS, Linux Distributions, Installation of Linux OS

Unit II **[8Hrs]**

Introduction to terminal, Basic commands, File system, File handling commands, process and process management commands, VI editor.

Unit III **[8Hrs]**

Users and Group management- Creation, Updating, Deletion of user and group, Commands – passwd, Shadow, useradd, usermod, userdel, groupadd, groupmod, groupdel.

Unit IV **[8Hrs]**

Package Management - Introduction to package manager, function of package manager, Package management commands – rpm, yum.

Unit V **[8Hrs]**

Storage management- Types of storages, creating partitions using fdisk command, Logical volume management (LVM), Creating file system, mounting file system.

Unit VI **[8Hrs]**

Shell and Shell script. Text Book 1. Unix and Shell Programming – B. M. Harwani, OXFORD University Press.

Reference Books

1. Linux Administration : A Beginner’s Guide – Wale Soyinka , McGraw Hill Publication
2. Unix Concepts and Applications – Sumitabha Das, McGraw Hill Publication

CS5TE01A	Elective –I (Augmented Reality)	3 Credit

COURSE OBJECTIVES:

1. To make students know the basic concept and framework of virtual reality.
2. To introduce students the technology for multimodal user interaction and perception in VR, in particular the visual, audial and haptic interface and behavior.
3. To aware students the technology for managing large scale VR environment in real time.
4. To provide students with an introduction to the VR system framework and development tools.
5. To expose learners to the basic of AR/VR technology and devices.
6. Implement applications on AR/VR technology.

COURSE OUTCOMES: After completion of the course, student will be able to

1. To understand the basic concept and framework of virtual reality
2. To understand the technology for multimodal user interaction and perception in VR
3. Decide & Apply algorithmic strategies to solve a given problem
4. To apply VR Tools in real time environment.
5. To understand augmented reality
6. To implement application of AR/VR technology with hands on experience through more informative and practical exploration.

Course Contents:

Unit 1 **[6 Hrs]**

Introduction - VR and AR Fundamentals, Differences between AR/VR Selection of technology AR or VR AR/VR characteristics Hardware and Software for AR/VR introduction. Requirements for VR/AR. Benefits and Applications of AR/VR. AR and VR case study.

Unit II Visual Computation in Virtual Reality **[6 Hrs]**

Fundamentals of Computer Graphics; Real time rendering technology; Principles of Stereoscopic Display; Software and Hardware Technology on Stereoscopic Display

Unit III Software Technologies **[6 Hrs]**

Database - World Space, World Coordinate, World Environment, Objects - Geometry, Position / Orientation, Hierarchy, Bounding Volume, Scripts and other attributes, VR Environment - VR Database, Tessellated Data, LODs, Cullers and Occluders, Lights and Cameras, Scripts, Interaction - Simple, Feedback, Graphical User Interface, Control Panel, 2D Controls, Hardware Controls, Room / Stage / Area Descriptions, World Authoring and Playback, VR toolkits, Available software in the market (Unity and Vuforia based) - Case Studies in AR, VR - Industrial applications.

Unit IV Environment Modeling in Virtual Reality [6 Hrs]

Geometric Modeling; Behavior Simulation; Physically Based Simulation

Unit V Haptic & Force Interaction in Virtual Reality [6 Hrs]

Concept of haptic interaction; Principles of touch feedback and force feedback; Typical structure andprinciples of touch/force feedback facilities in applications

Text Books:

1. Burdea, G. C. and P. Coffet. Virtual Reality Technology, Second Edition. Wiley-IEEE Press, 2003/2006.

2. Alan B Craig, William R Sherman and Jeffrey D Will, Developing Virtual Reality Applications: Foundations of Effective Design, Morgan Kaufmann, 2009.

3. Gerard Jounghyun Kim, Designing Virtual Systems: The Structured Approach, 2005.

Reference Books:

1. Doug A Bowman, Ernest Kuijff, Joseph J LaViola, Jr and Ivan Poupyrev, 3D User Interfaces, Theory and Practice, Addison Wesley, USA, 2005.

2. Oliver Bimber and Ramesh Raskar, Spatial Augmented Reality: Meging Real and Virtual Worlds, 2005.

3. Burdea, Grigore C and Philippe Coiffet, Virtual Reality Technology, Wiley Interscience, India, 2003.

CS5TE01B	Elective –I(Block Chain)	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 build a applications based on blockchain technology

Course Outcome:

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

CO5: To designapplications based on blockchain technology for E-Governance, Land Registration, Medical Information Systems, and others

Course Contents:

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: [7 Hrs]

Crypto Primitives, Permissioned Blockchain, Consensus mechanism ,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 Bitcoin Blockchain, Transactions, Bitcoin limitations, Bitcoin Consensus, Proof of Work (PoW)- Hashcash PoW , Bitcoin PoW, 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, Ethereum blockchain, Elements of the Ethereum blockchain, 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

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.
4. Mastering Blockchain - Distributed ledgers, decentralization and smart contracts explained, Author- Imran Bashir, Packt Publishing Ltd, Second Edition, ISBN 978-1- 78712-544-5, 2017

Reference Books

1. Nicola Atzei, Massimo Bartoletti, and TizianaCimoli, A survey of attacks on Ethereum smart contracts
2. Joseph Bonneau et al, SoK: Research perspectives and challenges for Bitcoin and cryptocurrency, IEEE Symposium on security and Privacy, 2015.
3. Nakamoto, Satoshi, Bitcoin: A peer-to-peer electronic cash system, Research Paper

CS5TE01C	Elective –I (3D Printing & Design)	3 Credit

COURSE OBJECTIVES:

1. To gain knowledge and skills related to 3D printing technologies.
2. To learn the selection of material, equipment and development of a product for Industry 4.0 environment.
3. To understand the various software tools, process and techniques for digital manufacturing.
4. To apply these techniques into various applications.

COURSE OUTCOMES:

1. Develop CAD models for 3D printing. Import and Export CAD data and generate .stl file.
2. Select a specific material for the given application.
3. Select a 3D printing process for an application.
4. Produce a product using 3D Printing or Additive Manufacturing (AM).

Course Contents:

Unit 1 3D Printing (Additive Manufacturing) [6 Hrs]

Introduction, Process, Classifications, Advantages, Additive v/s Conventional Manufacturing processes, Applications.

Unit II CAD for Additive Manufacturing [4 Hrs]

CAD Data formats, Data translation, Data loss, STL format.

Unit III Additive Manufacturing Techniques [8 Hrs]

Stereo- Lithography, LOM, FDM, SLS, SLM, Binder Jet technology. Process, Process parameter, Process Selection for various applications. Additive Manufacturing Application Domains: Aerospace, Electronics, Health Care, Defence, Automotive, Construction, Food Processing, Machine Tools.

Unit IV Materials [6Hrs]

Polymers, Metals, Non-Metals, Ceramics Process, Process parameter, Process Selection for various applications. Various forms of raw material- Liquid, Solid, Wire, Powder; Powder Preparation and their desired properties, Polymers and their properties. 4.3 Support Materials

Unit V Additive Manufacturing Equipment [6Hrs]

Process Equipment- Design and process parameters, Governing Bonding Mechanism, Common faults and troubleshooting , Process Design

Text Books:

1. Lan Gibson, David W. Rosen and Brent Stucker, "Additive Manufacturing Technologies:• Rapid Prototyping to Direct Digital Manufacturing", Springer, 2010.
2. Andreas Gebhardt, "Understanding Additive Manufacturing: Rapid Prototyping, Rapid Tooling, Rapid Manufacturing", Hanser Publisher, 2011.
3. Khanna Editorial, "3D Printing and Design", Khanna Publishing House, Delhi.
4. CK Chua, Kah Fai Leong, "3D Printing and Rapid Prototyping- Principles and Applications", World Scientific, 2017.
5. J.D. Majumdar and I. Manna, "Laser-Assisted Fabrication of Materials", Springer Series in Material Science, 2013.
6. L. Lu, J. Fuh and Y.S. Wong, "Laser-Induced Materials and Processes for Rapid Prototyping", Kulwer Academic Press, 2001.
7. Zhiqiang Fan And Frank Liou, "Numerical Modelling of the Additive Manufacturing (AM) Processes of Titanium Alloy", InTech, 2012.

CS5L005	Internet of Things (Lab)	1 Credit

Course Objectives:

1. To understand the technologies in Internet of Things.
2. Students should get the knowledge of Arduino board and Raspberry-Pi board
3. Students should get the knowledge about the different components of IoT such as LED, LCD, different sensors, actuators etc..
4. To Analyze, design and develop parts of Internet of Things solution.
5. To understand the concept of IoT and can able to build the IoT applications.

Course Outcomes:

Students will able to;

1. Identify and adopt knowledge of the terminology, application, requirements and constraints of IoT development.
2. Explain development of hardware and software in real-time environment via advanced automated designing and testing tools.
3. Design and implementation of IoT with advanced microcontroller and interfaces.
4. Testing of complex and critical real world IoT, interfaced to digital hardware in real world situation.
5. Evaluate a real-time. IoT industrial control system using an embedded microcontroller with associated interface and communication devices.

List of Experiments:

1. Control a LED with push button using Arduino board.
2. Traffic light controller using Arduino.
3. Fire alarm system by interfacing Arduino with temperature and gas sensors
4. Interfacing 4x4 keypad with Arduino and print on LCD 16x2
5. Design password protected door lock system using Arduino.
6. Interfacing servo motor with Raspberry-Pi .
7. Interfacing stepper motor with Raspberry-Pi
8. Controlling LED using Raspberry-Pi using web server.
9. Mini project on home automation.
10. Case study on smart city.

CS5L006	TCP/IP (Lab)	1 Credit

COURSE OBJECTIVES:

1. To understand the basic concepts of TCP/IP Architecture.
2. To Understand Network Layer and Applications.
3. To learn UDP and TCP applications.
4. To learn Transport Layer Reliability.

COURSE OUTCOMES:

1. To compare and contrast TCP and UDP in terms of the application that uses them.
2. To design network-based applications using the socket mechanism.
3. To work with IPv4 addresses in terms of subnetting and supernetting.
4. To setup a host and network in terms of IP addressing.

Course Contents:

1) To study the of different types of network cables and practically implement the crossed wired cable, straight through cable and roll over cable using clamping tool
2) To study of network devices in detail.
3) Connect the computers in local area network (star topology, pear to pear network)
4) To study of basic network command and network configuration command
5) To study ipv4 Addressing to give IP addresses of diffrent classes in different network id
6) To study ipv4 subnetting to give ip addresses of diffrent class in given network id at subnet
7) Decode header fields of IP datagram
8) Decode header fields from TCP header
9) To Study implement TCP/IP socket communication
10) To study configure a DNS server/ FTP server

CS5L007	Python Programming(Lab)	1 Credit

Course Objectives:

1. Develop a basic understanding of programming and the Python programming language.
2. To acquire programming skills in core Python.
3. To acquire Object Oriented Skills in Python
4. To develop the skill of designing Graphical user Interfaces in Python.
5. To develop the ability to write database applications in Python

Course Outcome: At the end of the course, the student will be able to

1. Explain basic principles of Python programming language
2. Implement object oriented concepts
3. Implement database and GUI applications.

List of Experiments:

1. Write a Python program to print all the Even/Odd numbers between 1 and 100.
2. Write a Python class to implement pow(x, n).
3. Write a recursive function to calculate the sum of numbers from 0 to 10.
4. Arrange string characters such that lowercase letters should come first.
5. Create a child class Bus that will inherit all of the variables and methods of the Vehicle class
6. Python Program to Remove the ith Occurrence of the Given Word in a List where Words can Repeat.
7. Python Program to Remove All Tuples in a List of Tuples with the USN Outside the Given Range
8. Python Program to Count the Occurrences of Each Word in a Given String Sentence
9. Python Program to Count the Frequency of Words Appearing in a String Using a Dictionary.
10. Python Program to Map Two Lists into a Dictionary

CS5T009	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.

Unit 1: Innovation [6 Hrs]

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 II: Entrepreneurship [6 Hrs]

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 III: Role of Entrepreneurial Bodies [6 Hrs]

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 IV: Role of Entrepreneurial Support [6 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.

Unit V: Entrepreneurial Thermodynamics, Entrepreneurship and Employment, Start-up Case Studies.

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. Computer Science & Engineering Program

Curriculum for Semester- V & VI [Third Year]

VI Semester

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				Credit
				L	T	P	CA	MSE	ESE	Total	
1	PCC	CS6T001	Artificial Intelligence & Robotics	3	0	0	20	20	60	100	3
2	PCC	CS6T002	Neural Networks and Machine Learning	3	0	0	20	20	60	100	3
3	PEC	CS6TE02	Elective -II	3	0	0	20	20	60	100	3
4	PEC	CS6TE03	Elective-III	3	0	0	20	20	60	100	3
5	OEC	CS6O002	Open Elective-2	3	1	0	20	20	60	100	4
6	PCC	CS6L003	Neural Networks and Machine Learning(Lab)	0	0	2	60	0	40	100	1
7	PCC	CS6L004	Full Stack Development(Lab)	0	0	2	60	0	40	100	1
8	PCC	CS6L005	Advance Java Programming(LAB)	0	0	2	60	0	40	100	1
9	PROJECT	CS6P006	Mini Project	0	0	2	30	0	20	50	1
10	PROJECT	CS6P007	CRT(Campus Recruitment Training)	0	0	2	50	0	0	50	1
11	PROJECT	CS6P008	Skill Development	0	0	2	15	0	35	50	1
12	MC	CS6T009	Intellectual Property Rights	2	0	0	15	10	25	50	Audit
				17	**1**	**12**	**390**	**110**	**500**	**1000**	**22**

Open Elective-2 : PL/SQL Programming

Course Structure and Syllabus

For

B. Tech. Computer Science & Engineering Program

Curriculum for Semester- VII & VIII [Fourth Year]

VII Semester

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				Credit
				L	T	P	CA	MSE	ESE	Total	
1	ESC	CS7T001	Data Science	2	1	0	20	20	60	100	3
2	PEC	CS7TE04	Elective-IV	3	0	0	20	20	60	100	3
3	PEC	CS7TE05	Elective -V	3	0	0	20	20	60	100	3
4	OEC	CS7T002	Cyber Security & Cryptography	2	1	0	20	20	60	100	3
5	OEC	CS7O003	Open Elective -3	3	1	0	20	20	60	100	4
6	ESC	CS7L002	Cyber Security & Cryptography(Lab)	0	0	2	60	0	40	100	1
7	PCC	CS7L003	Data Science using R(Lab)	0	0	2	60	0	40	100	1
8	PROJECT	CS7P004	Project Phase I	0	0	6	50	0	50	100	3
9	MC	CS7T005	Research Methodology	2	0	0	15	10	25	50	Audit
				15	**3**	**10**	**285**	**110**	**455**	**850**	**21**

Open Elective-3 : PHP Development

VIII Semester

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				
				L	T	P	CA	MSE	ESE	Total	Credit
1	PEC	CS8TE06	Elective –VI	3	0	0	20	20	60	100	3
2	OEC	CS8O004	Open Elective -4	3	1	0	20	20	60	100	4
4	PROJECT	CS8P001	Project Phase II	0	0	4	75	0	75	150	5
5	PCC		NPTEL	0	0	0	0	0	100	100	2
				6	**1**	**4**	**115**	**40**	**195**	**450**	**14**

Open Elective-4 : Ethical Hacking

Course Structure and Syllabus

For

B. Tech. Computer Science & Engineering Program

Curriculum for Semester- VII & VIII [Fourth Year]

VIII Semester

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				
				L	T	P	CA	MSE	ESE	Total	Credit
1	PEC	CS8TE06	Elective –VI	3	0	0	20	20	60	100	3
2	OEC	CS8O004	Open Elective -4	3	1	0	20	20	60	100	4
4	PROJECT	CS8P001	Project Phase II	0	0	4	75	0	75	150	5
5	PCC		NPTEL	0	0	0	0	0	100	100	2
				6	1	4	115	40	195	450	14

Open Elective-4 : Ethical Hacking

CS7T001	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 I **[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 II **[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 III **[7 Hrs]**

Exploratory Data Analytics : Descriptive Statistics, Mean, Standard Deviation, Skewness and Kurtosis, Box Plots, Pivot Table, Heat Map, Correlation Statistics.

Unit IV **[7 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 V **[8Hrs]**

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. 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.

CS7TE04A	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.

Course Contents:

Unit I: Semantic Web Vision: [7 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: [7Hrs]

Introduction, RDF: Basic Ideas,RDF: XML-Based Syntax,RDF serialization, RDF Schema: Basic Ideas,RDF Schema: The Language ,RDF and RDF Schema

Unit III: Logic and Inference Rules: [7 Hrs]

Introduction, Monotonic Rules syntax, semantics & examples, Nonmonotonic rules – syntax & examples, Encoding in XML

Unit IV: Ontology Engineering [7 Hrs]

Introduction, Manual construction of Ontology, Reusing existing ontology, using Semi-automatic methods, Knowledge semantic web architecture

Unit V: SPARQL, Ontology Language [8 Hrs]

SPARQL simple Graph Patterns, Complex Graph Patterns, Group Patterns, Queries with Data Values, Filters OWL Formal Semantics. SchemaWeb Ontology Language: Introduction, OWL language, Examples, OWL in OWL, Future extensions.

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. Semantic Web programming, John Hebler et.el, Wiley

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.

3. John Davies, Dieter Fensel and Frank Van Harmelen, "Towards the Semantic Web: Ontology- Driven Knowledge Management", John Wiley and Sons, 2003.

CS7TE04B	Big Data Analytic Technique	(3 Credit)

Course Objectives:

1. To provide an overview of an exciting growing field of big data analytics.
2. To introduce the tools required to manage and analyze big data like Hadoop, NoSql Map-Reduce.
3. To teach the fundamental techniques and principles in achieving big data analytics with scalability and streaming capability.
4. 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 a student will be able to:

CO 1. Understand the key issues in big data management and its associated applications in intelligent business and scientific computing.

CO 2 Acquire fundamental enabling techniques and scalable algorithms like Hadoop, Map Reduce and NO SQL in big data analytics

CO 3 Interpret business models and scientific computing paradigms, and apply software tools for big data analytics.

CO 4 Achieve adequate perspectives of big data analytics in various applications like recommender systems, social media applications etc.

Course Contents:

Unit 1 Introduction to Big Data: [7Hrs]

Introduction to Big Introduction to Big Data, Big Data characteristics, types From 0-3 Data of Big Data, Traditional vs. Big Data business approach, Ref. Case Study of Big Data Solutions.

Unit II Introduction to Hadoop : **[7Hrs]**

What is Hadoop? Core Hadoop Components; Hadoop Ecosystem; Physical Architecture; Hadoop limitations.

Unit III NoSQL [7Hrs]

What is NoSQL? NoSQL business drivers;NoSQL case studies;

NoSQL data architecture patterns: Key-value stores, Graph stores, Column family (Bigtable) stores, Document stores, Variations of NoSQL architectural patterns; Using NoSQL to manage big data: What is a big data NoSQL solution? Understanding the types of big data problems; analyzing big data with a shared-nothing architecture; choosing distribution models: master-slave versus peer-to-peer; four ways that NoSQL systems handle big data problems

Unit IV Map Reduce and the New Software [8Hrs]

Distributed File Systems: Physical Organization of Compute Nodes, Large-Scale File-System Organization. MapReduce: The Map Tasks, Grouping by Key, The Reduce Tasks, Combiners, Details of MapReduce Execution, Coping With Node Failures. Algorithms Using MapReduce: Matrix-Vector Multiplication by MapReduce, Relational-Algebra Operations, Computing Selections by MapReduce, Computing Projections by MapReduce, Union, Intersection, and Difference by MapReduce, Computing Natural Join by MapReduce, Grouping and Aggregation by MapReduce, Matrix Multiplication, Matrix Multiplication with One MapReduce Step.

Unit V Finding Similar Item [7Hrs]

Applications of Near-Neighbor Search, Jaccard Similarity of Sets, Similarity of Documents, Collaborative Filtering as a Similar-Sets Problem .

Text Books:

1. Anand Rajaraman and Jeff Ullman “Mining of Massive Datasets”, Cambridge University Press,

2. Alex Holmes “Hadoop in Practice”, Manning Press, Dreamtech Press.

3. Dan McCreary and Ann Kelly “Making Sense of NoSQL” – A guide for managers and the rest of us, Manning Press.

References:

1. Bill Franks , “Taming The Big Data Tidal Wave: Finding Opportunities In Huge Data Streams With Advanced Analytics”, Wiley

2. Chuck Lam, “Hadoop in Action”, Dreamtech Press

3. Judith Hurwitz, Alan Nugent, Dr. Fern Halper, Marcia Kaufman, “Big Data for Dummies”, Wiley India

4. Michael Minelli, Michele Chambers, Ambiga Dhiraj, “Big Data Big Analytics: Emerging Business Intelligence And Analytic Trends For Today's Businesses”, Wiley India

5. Phil Simon, “Too Big To Ignore: The Business Case For Big Data”, Wiley India

6. Paul Zikopoulos, Chris Eaton, “Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data’, McGraw Hill Education.

7. Boris Lublinsky, Kevin T. Smith, Alexey Yakubovich, “Professional Hadoop Solutions”, Wiley India.

CS7TE04C	Digital Image Processing	(3 Credit)

Course Objectives:

1. To study the image fundamentals and mathematical transforms necessary for image processing.
2. To study the image enhancement techniques
3. To study image restoration procedures.
4. To study the image compression procedures.

Course Outcomes (COs) :

CO1: Review the fundamental concepts of a digital image processing system.

CO2 : Analyze images in the frequency domain using various transforms

CO3 : Evaluate the techniques for image enhancement and image restoration.

CO4 : Categorize various compression techniques.

CO5: Interpret Image compression standards. CO6 : Interpret image segmentation and representation techniques.

Course Contents:

Unit 1 **[7Hrs]**

Introduction to Digital Image Processing: Fundamentals of Elements of Digital Image, Image As Data, Pixels, Components Of Digital Image, Types Of Image Representation, Measures Of Image, Neighbors of pixel adjacency connectivity, regions and boundaries, Distance measures,, Application Of Digital Image Processing.

Unit II **[7Hrs]**

Matlab Basics: Introduction to Data Types, Operators, Matrices, File, I/O, Image Processing Toolbox

Unit III **[7Hrs]**

Image Enhancement Techniques: In spatial domain: Basic gray level transformations, Histogram processing, using arithmetic/Logic operations, smoothing spatial filters, Sharpening spatial filters. In Frequency domain: Introduction to the Fourier transform and frequency domain concepts, smoothing frequency-domain filters, Sharpening frequency domain filters.

Unit IV **[8Hrs]**

Image Filtering Techniques: Low Pass Filters – Smoothing, High Pass Filters - Edge Detection, Sharpening; Image Restoration: Noise Models, Model of Image Degradation/Restoration Process, Noise Reduction, Inverse Filtering, M Minimum Mean Square Error (Weiner) Filtering.

Unit V **[7Hrs]**

Colour Image processing: Colour fundamentals, Colour models, Representation of Color in Images, Colour transformation, Smoothing and Sharpening, Colour segmentation. Image Morphology: Different Morphological Algorithm, Morphological Measures

Text Books:

1. Rafael C. Gonzalez, Richard E. Woods, Digital Image Processing, Pearson Education, Third Edition, 2008.

2. Anil K. Jain, Fundamentals of Digital Image Processing', Pearson 2002.

Gonzalez & Woods - Digital Image Processing Using Matlab

3. Bhabatosh Chanda and Dwijesh Majumder - Digital Image Processing

Reference Books:

1. Kenneth R. Castleman, Digital Image Processing, Pearson, 2006

2. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins,' Digital Image Processing using MATLAB', Pearson Education, Inc., 2004.

3. D. E. Dudgeon and RM. Mersereau, Multidimensional Digital Signal Processing', Prentice Hall Professional Technical Reference, 1990.

4. William K. Pratt, Digital Image Processing' , John Wiley, New York, 2002

5. Milan Sonka etaI, 'IMAGE PROCESSING, ANALYSIS AND MACHINE VISION', Brookes/Cole, Vikas Publishing House, 2nd edition, 1999.

CS7TE04D	Randomized Algorithms	(3 Credit)

Course Objectives:

1.Understand the principles of random signals and methods of characterizing systems having random input signals.

2.Understand the elementary aspects of probability theory.

3.Understand the relative frequency definition of probability and also the axiomatic definition.

Course Outcomes (COs) :

CO1: Students have the basics of probability, events and random experiments.

CO2: They can analyze that the random variable is always a numerical quantity.

CO3: Students can use the multiple random variables and relate through examples to real problems.

CO4: They have the concept of random processes in both deterministic and non deterministic types.

CO5: Use the Power density spectrum and its properties and the types of noise

Course Contents:

Unit 1 **[7Hrs]**

Introduction to Randomized Algorithms: Review of Basic Probability, Polynomial Identity Testing, Schwartz - Zippel Lemma, Reduction from Perfect Bipartite Matching to PIT, Randomized Quick sort, Markov, Chebyshev, and Chernoff bounds, Tossing coins, coupon collector problem, birthday paradox, Balls and bins, Two point sampling.

Unit II **[7Hrs]**

Randomized rounding: Multi-commodity flow, Introduction to Markov chain, randomized algorithm for 2SAT, stationary distribution, Irreducible and aperiodic Markov chain, fundamental theorem of Markov chain (statement only), coupling and Random walk.

Unit III **[7Hrs]**

Metropolis Algorithm: Mixing time of Random Walk on Cycles, Proof of the fundamental Theorem of Markov chains, Finishing proof of the fundamental Theorem of Markov chains, hitting time, commute time, cover time, Monte Carlo Method, FPRAS for DNF Counting, FPRAS for Independent Set Counting using Monte Carlo Method.

Unit IV **[7Hrs]**

Introduction to Probabilistic Methods: Probabilistic method of expectation, alteration; Lovasz Local Lemma and its application, Method of Conditional Expectation for De-randomization, Overview of path coupling.

Unit V **[8Hrs]**

Introduction to Universal Hash Family: Perfect Hashing, Cuckoo Hashing, Bloom Filter, Count Min Sketch, Construction of Universal Hash Family, Locality Sensitive Hashing (LSH), Nearest Neighbor

Search (NNS), Point Location in Equal Balls (PLEB), Johnson Lindenstrauss Lemma Sub-Gaussian Random Variables.

Text Books:

1. Randomized Algorithms: Rajeev Motwani, Prabhakar Raghavan, Cambridge University Press.
2. Probability and Computing: Randomization and Probabilistic Techniques in Algorithms and Data Analysis by Eli Upfal and Michael Mitzenmacher

Reference Books:

1. Computational Geometry: Algorithms and Applications, by Mark de Berg, Otfried Cheong, Marc van Kreveld, and Mark Overmars, 3rd edition, Springer-Verlag, 2008.
2. Algorithmic and Analysis Techniques in Property Testing, by Dana Ron. Found. Trends Theor. Comput. Sci. 5, 2 (February 2010), 73-205.

CS7TE05A	Natural Language Processing	3 Credit

Course 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

Course Contents:

Unit 1: Introduction to NLP [7Hrs]

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 II: Text Preprocessing and Morphology [7Hrs]

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 III: Language Modelling [7Hrs]

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 IV: Word Sense Disambiguation [7Hrs]

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 V: Markov Model and POS Tagging [8Hrs]

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.

CS7TE05B	Advanced Computer Vision	3 Credit

Course 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

Course Contents:

Unit 1 **[7Hrs]**

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 II **[7Hrs]**

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 III **[7Hrs]**

High level vision- Geometric methods- Model based vision- Obtaining hypothesis by pose consistency, pose clustering and using Invariants, Verification.

Unit IV **[8Hrs]**

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 V **[7Hrs]**

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.

CS7TE05C	AI In Wireless Communication	3 Credit

Course Objectives:

1. To introduce the basics of AI as applied to Wireless communication and familiarize the 5G technology in that perspective to B-tech level students.
2. Familiar with basic principles of AI
3. Capable of using heuristic searches.
4. To provide basic understanding of Cognitive radio
5. To Introduction to 5G (Network of networks)
6. Introduction to the trends in Machine Learning (ML)

Course Outcomes: After completing the course, the students will be able to

Discuss the evolution of artificial intelligence in wireless communication

CO1 : Identify and describe the various components used in Cognitive Radio

CO2 : Interpret various Cognitive Radio Networks

CO3 : Produce optimized solution in wireless communication for using Artificial Intelligence

Course Contents:

Unit 1 **[8Hrs]**

Fundamentals of Artificial Intelligence Introduction, A.I. Representation, Non-AI &AI Techniques, Representation of Knowledge, Knowledge Base Systems, State Space Search, Production Systems, Problem Characteristics, types of production systems, Intelligent Agents and Environments, concept of rationality, the nature of environments, structure of agents, problem solving agents, problem formulation

Unit II: Artificial Intelligence In Wireless Communications **[7Hrs]**

Introduction to Cognitive Radio - Cognitive Radio Design - Cognitive Engine Design Component Descriptions, Artificial Intelligence Techniques

Unit III **[7Hrs]**

Introduction to generic wireless channels, databases, feature extraction, classification and decision. Artificial Intelligence (AI) in the digital era and the role of network intelligence in mobile applications (APPs), digital assistants and autonomous vehicles.

Unit IV **[7Hrs]**

Introduction to 5G (Network of networks) covering devices, systems, things/machines and big data. Overview of technology enablers in 5G architecture, system Design and framework for the 5G edge supporting massive IoT devices/cyber physical systems.

Unit V **[7Hrs]**

Introduction to the trends in Machine Learning (ML) and Analytics in the 5G network management and evolution to Zero-Touch Networks (ZTN) framework. Application of ML (supervised learning, unsupervised learning and reinforcement learning) in the 5G ZTN including principle of 5G user analytics at the cell site, cell edge and core network.

Text Book

1. Thomas W. Rondeau, Charles W. Bostian, "Artificial Intelligence in Wireless Communications", Artech house, 2009.

2. Elaine Rich and Kevin Knight: "Artificial Intelligence." Tata McGraw Hill

2. Stuart Russell & Peter Norvig : "Artificial Intelligence : A ModernApproach", Pearson Education, 2nd Edition.

4. Erik Dhalman et al., “5G NR: The next generation wireless access network technology”, 2018

5. Devaki Chandramouli et al., “5G for the Connected World”, Wiley, 2019 Evaluation

References

1. Ivan Bratko : "Prolog Programming For Artificial Intelligence" , 2nd Edition Addison Wesley, 1440.
2. Eugene, Charniak, Drew Mcdermott: "Introduction to Artificial Intelligence.", Addison Wesley
3. Patterson: ―Introduction to AI and Expert Systems‖, PHI

CS7TE05D	Biomedical Informatics	(3 credit)

Course Objectives

This course will enable you to:

1. Become familiar with the basic definitions, key concepts, terminology, and historical context of Health Informatics.
2. Understand fundamental characteristics of data, information, and knowledge in the Health Informatics domain.
3. Become familiar with common algorithms for health applications and IT components in representative clinical processes.
4 .Develop understanding of population health and precision medicine.
5 .Understand basic principles of knowledge management systems in biomedicine.
6. Develop understanding of various aspects of Health Information Technology standards

Course Outline

CO1: This course is presented as a series of weekly modules.

CO2: The course material is grouped in six modules.

CO3: The seventh module represents the week of the Final Examination.

CO4: There is also a term project to access the students' ability to understanding and implement simple Health Informatics solutions.

Unit I

Clinical informatics [7 hours]

Nursing (nursing informatics), dentistry (dental informatics), pathology (pathology informatics), Health information management (HIM), Health Information Analysis.

Unit II

Bioinformatics [7 hours]

Domain-based definitions, Concept-oriented definitions, domain oriented definitions, formulating a definition of informatics based on data, information and knowledge, bioinformatics vs. biomedical informatics.

Unit III [7 hours]

Imaging informatics: PACS systems, biological science, clinical services, science, medical / biomedical engineering ,cognitive science , applications.

Unit IV [8 hours]

Consumer health informatics: Consumer health Informatics, Patient-Focused Informatics, Health Literacy, Various types and application of Consumer health Informatics, Consumer Education, Sharing

and distribution of the content of EHRs and personal health data between professionals,Component of consumer health informatics

Unit V **[7 hours]**

Bio Health informatics –

Introduction to health informatics and its significance Definitions and key concepts in health informatics Background disciplines, historical overview, and future challenges.

Text Books:

1. *AHIMA facts.* 2007. [cited 2007 December 17]; Available from: http://www.ahima.org/about/about.asp.
2. Ledley RS, Lusted LB. Reasoning foundation of medical diagnosis. *Science.* 1959;130(3366):9–21. [PubMed] [Google Scholar]

Reference

1. Collen MF. Health care information systems: a personal historic review; Proceedings of ACM conference on History of medical informatics; Bethesda, MD: Association for Computing Machinery. 1987. [Google Scholar

CS7T002	Cyber Security & Cryptography	3 Credit

COURSE OBJECTIVES:

1. To understand the basic of Cyber Security
2. To exhibit knowledge for securing corrupted systems, protect personal data, and securing computer networks in an Organization
3. To learn about maintaining confidentially, Integrity and Availability of data through cryptographic algorithms
4. To understand various Authentication algorithms.
5. To understand key terms and concepts in Cryptography, Governance and Compliance.

COURSE OUTCOMES

After learning the course the student will be able:

CO1 Understand basic concepts of Cyber security.

CO2 Apply security principles to system design and Symmetric Encryption algorithms to provide confidentiality

CO3 Compare and apply various authentication Techniques and different cryptographic operations of public key cryptography.

CO4 Evaluate and Communicate the human role in security systems with an emphasis on ethics, social engineering vulnerabilities and training

CO5 Select and apply appropriate Intrusion detection and prevention techniques and to examine various security algorithms to Interpret security incidents

Course Contents:

Unit 1: Introduction to Cyber Security [7Hrs]

Overview of cyber security , Internet Governance-Challenges and constraints,Cyber threats:-Cyber Warfare-Cyber Crime-Cyber terrorism ,Cyber Espionage, Need for comprehensive cyber security policy, need for nodal authority, Cyber security regulations, Roles of international law.

Unit II: Cryptography and Block Ciphers principles. [7Hrs]

Introduction, Security approaches, Principles of security, Types of Security attacks, Security services, Security Mechanisms, A model for Network Security, Substitution and Transposition techniques, Symmetric and Asymmetric key cryptography, Steganography, Cryptographic independent dimensions. Cryptanalytic attack and brute force attack, Symmetric key Ciphers: Block Cipher principles, DES.

UNIT III Public Key Cryptosystems and Authentication Requirements. [7Hrs]

Principles of public key cryptosystems, RSA algorithm, Diffie-Hellman Key Exchange, introductory idea of Elliptic curve cryptography. Cryptographic Hash Functions: Message Authentication, Secure Hash Algorithm (SHA-512) Message authentication codes: Authentication requirements, Digital signature

UNIT IV Key Management ,Distribution and Cyber Security Vulnerabilities [7Hrs]

Distribution of Public Keys, Kerberos, X.509 Authentication Service, PGP, SSL, IPSEC. Cyber Security Vulnerabilities-Overview, vulnerabilities in software, System administration, Complex Network Architectures, Weak Authentication, Poor Cyber Security Awareness. Cyber Security Safeguards-Overview, Access control, Audit, Authentication, Ethical Hacking.

Unit V: Securing Web Application Services, Servers and cyber forensics. [8Hrs]

Basic security for HTTP Applications and Services, Basic Security for SOAP Services, Identity Management and Web Services, Security Considerations, Challenges, Intrusion detection and Prevention Techniques, System Integrity Validation, Honey pots, password management. Introduction to Cyber Forensics.

Video Lectures

1. http://nptel.ac.in/courses/106105031/lecture by Dr.DebdeepMukhopadhyay IITKharagpur
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.

CS7L002	Cyber Security & Cryptography	(Lab)	1 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: After completing the course, the students will be able to

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, **CO4:** social engineering vulnerabilities and training.
CO5: Examine various Security algorithms.
CO6: Interpret and forensically investigate security incidents.

List of Practicals

1. Study of steps to protect your personal computer system by creating User Accounts with Passwords and types of User Accounts for safety and security
2. Study the steps to protect a Microsoft Word Document of different version with different operating system.
3. Study the steps to remove Passwords from Microsoft Word
4. Study various methods of protecting and securing databases.
5. Study “How to make strong passwords” and “passwords cracking techniques”
6. Implement RSA Algorithm using HTML and JavaScript
7. Implement the Diffie-Hellman Key Exchange algorithm for a given problem.
8. Calculate the message digest of a text using the SHA-1 algorithm
9. Implement the SIGNATURE SCHEME - Digital Signature Standard
10. Apply DES algorithm for practical applications

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.

CS7L003	Data Science using R(Lab)	1 Credit

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. RAS 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

CS7P004	Project & Seminar	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%).

CS7T005	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.

Course Contents:

Unit I [7Hrs]

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 [7Hrs]

Types of Research; Pure research, applied research, Exploratory Research, Descriptive research, Diagnostic research, Quantitative and Qualitative research etc.

Unit III [7Hrs]

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 [8Hrs]

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 **[7Hrs]**

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:

1. The Science of Education Research, Eurasia Publishing House, New Delhi by George J. (1964),
2. Advanced focus Group Research, Sage Publication, India Ltd, New Delhi by Fern Edward F. (2001)
3. Research Methodology in Management, Himalaya Publishing House, New Delhi by Michael V.P.

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Course Structure and Syllabus

For

B. Tech. Computer Science & Engineering Program

Curriculum for Semester- VII & VIII [Fourth Year]

VIII Semester

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				
				L	T	P	CA	MSE	ESE	Total	Credit
1	PEC	CS8TE06	Elective –VI	3	0	0	20	20	60	100	3
2	OEC	CS8O004	Open Elective -4	3	1	0	20	20	60	100	4
4	PROJECT	CS8P001	Project Phase II	0	0	4	75	0	75	150	5
5	PCC		NPTEL	0	0	0	0	0	100	100	2
				6	**1**	**4**	**115**	**40**	**195**	**450**	**14**

Open Elective-4 : Ethical Hacking

CS8TE06A High Performance Computer Architecture

Course Learning Objectives:

1. Use their learned skills, knowledge and abilities to develop computer architecture.
2. Apply basic design principles to present ideas, information, products, and services on Architecture
3. To learn about basic concepts of pipelining and dynamic Scheduling.
4. To learn objectives and applications of Memory Hierarchies
5. Apply basic design principles of Parallel and Scalable Architecture

Course Outcomes: After completing the course, the students will be able to

CO1: Students will able to develop computer architecture.

CO2: Students will know the basic concepts of parallelism

CO3: Students will become familiar with pipelining and hazards in pipeline.

CO4: Students will come to Instruction Level Parallelism and Dynamic Scheduling

CO5: Students will become familier with memory hierarchies.

Course Content

Unit 1 **[7Hrs]**

Theory of Parallelism: Parallel Computer Models, The State of Computing, Multiprocessor and Multicomputer, Multivector and SIMD Computers, PRAM and VLSI Models, Architectural Development Tracks.

Unit II **[7Hrs]**

Pipelining, Basic concepts, instruction and arithmetic pipelines, hazards in pipeline: structural, data and control hazards, overview of hazard resolution technique, Dynamic instruction scheduling, branch prediction techniques, Pipeline optimization techniques.

Unit III **[7Hrs]**

Instruction Level Parallelism: Concepts and Challenges, Basic Compiler Techniques for Exposing ILP, Reducing Branch Costs with Prediction, Dynamic Scheduling: Algorithm, Data level and Thread Level Parallelism.

Unit IV **[7Hrs]**

Memory Hierarchies: Basic concept of hierarchical memory organization, Hierarchical memory technology, main memory, Inclusion, Coherence and locality properties, cache memory design and implementation, Techniques for reducing cache misses, RAID.

Unit V **[8Hrs]**

Parallel and Scalable Architecture: Multiprocessors and Multicomputer: Multiprocessor System Interconnect, Cache Coherence and synchronization Mechanism, Multivector and SIMD Computers: Vector Processing Principles, Compound Vector Processing.

Text Books

1. John. Hennessy & David A. Patterson, "Computer Archniecture A quantitative approach", 5th Edition, Morgon Kaufmann Publiations.
2. Kai Hwang and A. Briggs, "Computer Architecture and parallel Processing", International edition McGraw-Hill.

Reference Books:

1. Kai Hwang and Naresh Jotwani, "Advanced Computer Architecture: Parallelism, Scalibility and Programmability" 2nd Edition, THM Publications
2. David A. Kular and Jasvinder Pal Singh, "Parallel Computer Architecture", Morgan Kaufmann Publications.

CS8TE06B	Full Stack Development	3 Credit

Course 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
3. Websites.
4. Apply basic programming principles to the construction of websites.
5. Effectively manage website projects using available resources.
6. Create visualizations in accordance with UI/UX theories.
7. Develop a fully functioning website and deploy on a web server.
8.

Course Outcomes: After completing the course, the students will be able to

CO1: Students will develop an understanding of the formalistic (aesthetic) aspects of design and visual communication.

CO2: Students will demonstrate cross-platform (web, mobile, broadcast, print) storytelling skills.

CO3: Students will become familiar with graphic design and/or game theory and be able to apply this theory to real world projects.

CO4: Students will develop and understanding of information design and usability as it applies to interactive media projects.

CO5: Students will 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.

CO6: Students will write at a level suitable for a public audience in an area related to interactive media

Course Content

Unit 1 Basic HTML, Advanced HTML : [7Hrs]

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 II CSS [7Hrs]

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,

Unit III Javascript Basics [8Hrs]

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, 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 IV ReactJS [7Hrs]

Introduction , Templating using JSX ,Components, State and Props , Lifecycle of 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 V PHP [7Hrs]

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

Reference Books:

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.

CS8TE06C	Advance Software testing methodology	3 Credit

Course Objectives:

1.Ability to understand and use regression testing techniques.

2. Ability to understand and use mutation testing techniques.

3.Ability to understand and use automated oracle generation techniques.

Course Outcomes: After completing the course, the students will be able to

CO1: Ability to understand software testing and verification concepts.

CO:2: Ability to understand and apply test adequacy measurements.

CO3: Ability to understand and use automated test generation techniques.

CO4: Ability to use various source code or bytecode anlaysis tools/frameworks.

CO5: Analyze to understand and apply automated debugging and repair techniques.

Course Content

Unit 1 **[7Hrs]**

Testing Process : Introduction, Test Planning, Monitoring, and Control– Test Analysis, Test Design:- Test Implementation, Test Execution, Evaluating Exit Criteria and Reporting, Test Closure Activities.

Unit II **[7Hrs]**

Test Management in Context, Risk-Based Testing and Other Approaches for Test Prioritization and Effort Allocation, Test Documentation and Other Work Products, Test Estimation, Defining and Using Test Metrics. Business Value of Testing, Distributed, Outsourced, and Insourced Testing, Managing the Application of Industry Standards.

Unit III **[7Hrs]**

Reviews & Defect Management : Introduction Reviews ,vulnerabilities in Management Reviews and Audits, Managing Reviews, Metrics for Reviews, Introduction Defect Management ,The Defect Lifecycle and the Software Development Lifecycle, Defect Report Information, Assessing Process Capability with Defect Report Information.

Unit IV **[7Hrs]**

Improving the Testing Process Introduction, Test Improvement Process, Improving the Testing Process, Improving the Testing Process with TMMi Improving the Testing Process with TPI Next, Improving the Testing Process with CTP, Improving the Testing Process with STEP

Unit V **[8Hrs]**

Test Tools and Automation Testing Tools : 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, AppiumDriver. Framework TestNG ,POM.

Text Books:

1. Advanced Software Testing - Vol. 2, 2nd Edition, 2nd Edition.

2. Learning Path Learn Selenium , O'Reilly Media, INC.

References

1. Paul C. Jorgensen, Software Testing: A Craftsman‟s Approach, 3rd Edition, CRC Press, 2007.

2. Boris Beizer, Software Testing Techniques, Dreamtech, 2009.

CS8TE06D	Advance Database System	3 Credit

Course Objectives:

1. To explain basic Advance database concepts, applications, data models, features and Types.
2. To demonstrate the use of NoSQL Database & Types.
3. Describe the basics of Advance database and construct queries .
4. To emphasize the importance of Big Data.
5. To facilitate students in Advance Database design.
6. To familiarize with Apache Cassandra.

Course Outcomes:

The students will be able to

1. Apply the basic concepts of Advance Database Systems and Applications.
2. Use of the Advance database and construct queries using SQL in database creation and interaction
3. Describe Apache Cassandra Interfaces Analyse and techniques of Cassandra Command Line Interface.
4. Apply the basic concepts of Basic operations with MongoDB shell.

Unit 1 **[6Hrs]**

Introduction to ADBS

Introduction to Advanced Database , Comparision of DBMS & ADBMS, DBMS Advanced Features and Distributes Database (Query Processing and Evaluation, Transaction Management and Recovery, Database Security and Authorisation, Distributed Databases), Types of ADBS (Network database Systems, Object-Oriented Database Systems, Hierarchical Database Systems)

Unit II **[8Hrs]**

NoSQL database concepts

Differentiate SQL and NoSQL databases. Types of NoSQL databases, NoSQL data modeling, Benefits of NoSQL, comparision between SQL and NoSQL database system. Use NoSQL database to solve given queries. NoSQL using MongoDB: Introduction to MongoDB Shell, Running the MongoDB shell, MongoDB client, Basic operations with MongoDB shell,

Unit III **[7Hrs]**

Big Data

Overview of Big Data and NoSQL Database: The 3 Vs. of Big Data, Data Evolution ,Features of Big Data ,Big Data-Use Cases , Big Data Analytics, Traditional Technology vs. Big Data Technology ,Apache Hadoop , HDFS, Map Reduce , NoSQL Databases, Approaches to NoSQL Databases-Types

Unit IV **[7Hrs]**

Apache Cassandra

Introduction to Apache Cassandra: Characteristics, History of Cassandra, Features of Cassandra ,When is Cassandra Used ? , Simple Cassandra Program, Cassandra Command Line Interface, Advantages of Cassandra, Limitations of Cassandra.

Unit V **[8Hrs]**

Apache Cassandra Interfaces

Cassandra supports Cassandra Query Language or CQL, DDL and DML Statements ,DML Statements – COPY Apache Cassandra Interfaces :Cassandra Interfaces , Cassandra Command Line Interface ,Cqlsh Options ,Cqlsh Commands ,Cqlsh Shell Commands , Querying Cassandra

Text Books:

1.Mastering Apache Cassandra - Second Edition by NishantNeeraj (Author)

2.Henry Korth, Abraham Silberschatz& S. Sudarshan, *Database System Concepts*, McGraw-Hill Publication, 6th Edition, 2011

3 Learning Apache Cassandra - Second Edition by Sandeep YarabarlaReleased April 2017 Publisher(s): Packt Publishing ISBN: 9781787127296

Reference Books:

1. Mastering Apache Cassandra 3.x: An expert guide to improving database scalability and availability without compromising performance, 3rd Edition

2. Joel Murach, Murach's Oracle SQL and PL/SQL *for Developers*, Mike Murach &Associates, 2nd Edition, 2014.

3.Wiederhold, *Database Design*, McGraw-Hill Publication, 2nd Edition, 1983.

IT8P002	Major Project	6 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.
6. *(For guide, Personal copy, Departmental library.)
7. In a presentation, the students should focus to clarify problem definition and analysis of the problem.

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Affiliated to DBATU, RTMNU & MSBTE Mumbai
Department of Electrical Engineering
"Igniting minds to illuminate the world"
AY-2022-23

VISION

"To develop competent and committed Electrical Engineers to serve the society"

MISSION

1. To impart quality education in the field of Electrical Engineering.
2. To be excellent learning center 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- I	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- II	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	2	1	0	20	20	60	100	3
4	PCC-EE	EE3T004	Network Analysis	3	0	0	20	20	60	100	3
5	PCC-EE	EE3T005	Electrical Machine I	3	1	0	20	20	60	100	4
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 training/ Industrial visit	0	0	0	0	0	50	50	1
11	HSMC	EE3T007	Universal Human Values -II	3	0	0	10	15	25	50	3
				18	**4**	**6**	**310**	**135**	**555**	**1000**	
								Total Credits			**26**

IV Semester

Sr. No.	Subject Category	Subject Code	Course Title	Teaching Scheme			Evaluation Scheme				Credits
				L	T	P	CA	MSE	ESE	**TOTAL**	
1	BSC	EE4T001	Numerical method and probability	2	1	0	20	20	60	100	3
2	ESC	EE4T002	Power Station Practice	4	0	0	20	20	60	100	4
3	PCC-EE	EE4T003	Electronic Devices and circuits	3	0	0	20	20	60	100	3
4	PCC-EE	EE4T004	Power System I	2	1	0	20	20	60	100	3
5	PCC-EE	EE4T005	Electrical Machine II	3	0	0	20	20	60	100	3
6	BSC	EE4L001	Numerical method and probability Lab	0	0	2	60	0	40	100	1
7	PCC-EE	EE4L004	Power System I Lab	0	0	2	60	0	40	100	1
8	PCC-EE	EE4L005	Electrical Machine II Lab	0	0	2	60	0	40	100	1
9	PROJ-EE	EE4P002	Field trainning/ Internship/ industrial visit	0	0	0	0	0	50	50	1
10	MC	EE4T007	Innovation and entrepreneurship Development	2	0	0	10	15	25	50	Audit
				16	**2**	**6**	**290**	**115**	**495**	**900**	
								Total Credits			**20**

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	3	1	0	20	20	60	100	4
3	PCC-EE	EE5T003	Power System II	3	0	0	20	20	60	100	3
4	PEC-EE	EE5E001	**Elective I**	3	0	0	20	20	60	100	3
5	PEC-EE	EE5E002	**Elective II**	3	0	0	20	20	60	100	3
6	OEC-EE	EE5O001	**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/Seminar (Phase I)	0	0	2	30	0	20	50	1
11	MC	EE5T004	Consumer Affairs	2	0	0	10	15	25	50	Audit
				21	**1**	**8**	**340**	**135**	**525**	**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	EE6E003	**Elective III**	3	0	0	20	20	60	100	3
4	PEC-EE	EE6E004	**Elective IV**	3	0	0	20	20	60	100	3
5	OEC-EE	EE6O002	**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	Computer Aided Design Lab	0	0	2	60	0	40	100	1
8	PROJ-EE	EE6P004	Mini Project/Seminar(phase II)	0	0	2	30	0	20	50	1
9	PROJ-EE	EE6P005	Campus Recruitment Training(CRT)	0	0	2	50	0	0	50	1
10	PROJ-EE	EE6P006	Skill Development Courses	0	0	2	15	0	35	50	1
11	MC	EE6T003	Research Methodology	2	0	0	10	15	25	50	Audit
				15	**0**	**10**	**305**	**95**	**400**	**800**	
								Total Credits			**21**

VII Semester

Sr. No.	Subject Category	Subject Code	Course Title	Teaching Scheme			Evaluation Scheme				Credits
				L	T	P	CA	MSE	ESE	TOTAL	
1	PCC-EE	EE7T001	Switch gear and protection	3	0	0	20	20	60	100	3
2	PCC-EE	EE7T002	High Voltage Engineering	3	0	0	20	20	60	100	3
3	PEC-EE	EE7E005	**Elective V**	3	0	0	20	20	60	100	3
4	OEC-EE	EE7O003	**Open Elective III**	4	0	0	20	20	60	100	4
5	PCC-EE	EE7L001	Switch gear and protection Lab	0	0	2	60	0	40	100	1
6	PCC-EE	EE7L002	High Voltage Engineering Lab	0	0	2	60	0	40	100	1
7	PROJ-EE	EE7P006	Project-I	0	0	10	0	0	50	50	5
8	MC	EE7T003	Intellectual Property Rights	2	0	0	10	15	25	50	Audit
				15	**0**	**14**	**210**	**95**	**395**	**700**	
								Total Credits			**20**

VIII Semester

Sr. No.	Subject Category	Subject Code	Course Title	Teaching Scheme			Evaluation Scheme				Credits
				L	T	P	CA	MSE	ESE	TOTAL	
	PEC-EE	EE8E006	Elective VI	3	0	0	20	20	60	100	3
	OEC-EE	EE8O004	Open Elective IV	4	0	0	20	20	60	100	4
1	PROJ-EE	EE8P007	Project-II	0	0	6	0	0	100	100	3
OR											
2	PROJ-EE	EE8P008	Internship(3 months)	0	0	0	0	0	0	20	10
				7	**0**	**6**	**40**	**40**	**220**	**320**	
								Total Credits			**10**

EE Credits		121
First Year		35
Total Credits		**156**

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Board of Studies, EE Dept

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Session: 2021-22

Course Structure and Syllabus (Autonomous)

For

B. Tech. Seventh and Eighth Semester

B. Tech Seventh Semester

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				Credit
				L	T	P	CA	MSE	ESE	Total	
1	PCC	ET7T001	Digital Communication	3	0	0	20	20	60	100	3
2	PEC	ET7E002	Professional Elective Course-III	3	0	0	20	20	60	100	3
3	PEC	ET7E003	Professional Elective Course-IV	3	0	0	20	20	60	100	3
4	PEC	ET7E004	Professional Elective Course-V	3	0	0	20	20	60	100	3
5	OEC	ET7O003	OPEN Elective Course-III	4	0	0	20	20	60	100	4
6	ESC	ET7L005	Basic Electronic Simulation Lab	0	0	2	60	0	40	100	1
7	PCC	ET7L001	Digital Communication Lab	0	0	2	60	0	40	100	1
8	Internship	ET7P001	Field Training-3	0	0	0	30	0	20	50	1
9	Project	ET7P002	Major Project Part-1	0	0	6	25	0	25	50	3
10	MC	ET7T006	Intellectual Property Rights	2	0	0	10	15	25	50	Audit
			Total	**18**	**0**	**10**	**285**	**115**	**450**	**850**	**22**

B. Tech Eighth Semester

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				Credit
				L	T	P	CA	MSE	ESE	Total	
1	PEC	ET8E001	Professional Elective Course-VI	3	0	0	20	20	60	100	3
2	OEC	ET8O004	OPEN Elective Course-IV	4	0	0	20	20	60	100	4
3	Project	ET8P001	Major Project Part-2	0	0	12	75	0	75	150	6
			Total	**7**	**0**	**12**	**115**	**40**	**195**	**350**	**13**

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ET7T001	Digital Communication	3 Credit

Prerequisites: Basic knowledge of communicating transmitter and receiver.

Course Objectives:

1. To know the principles of sampling & quantization
2. To study the various waveform coding schemes
3. To learn the various baseband transmission schemes
4. To understand the various band pass signaling schemes
5. To know the fundamentals of channel coding

Course Outcomes:

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

1. **Understand** knowledge about various techniques of digital communication Systems.
2. **Explain**the knowledge oftheory and practice related to Digital communication.
3. **Identify** andsolve engineering problems related to Mobile communication system
4. **Analyze** the spectral characteristics of band pass signaling schemes and their noise performance
5. **Design** error control coding schemes

Course Contents:

Module-1 Information Theory **[5 Hrs]**

Discrete Memoryless source, Information, Entropy, Mutual Information - Discrete Memory less channels – Binary Symmetric Channel, Channel Capacity - Hartley - Shannon law - Source coding theorem - Shannon – Fano & Huffman codes.

Module-2 Waveform Coding & Representation **[6 Hrs]**

Prediction filtering and DPCM - Delta Modulation - ADPCM & ADM principles-Linear Predictive Coding- Properties of Line codes- Power Spectral Density of Unipolar / Polar RZ & NRZ – Bipolar NRZ - Manchester

Module-3 Baseband Transmission & Reception **[6 Hrs]**

ISI – Nyquist criterion for distortion less transmission – Pulse shaping – Correlative coding - Eye pattern – Receiving Filters- Matched Filter, Correlation receiver, Adaptive Equalization

Module-4 Digital Modulation Scheme **[7 Hrs]**

Geometric Representation of signals - Generation, detection, PSD & BER of Coherent BPSK, BFSK & QPSK - QAM - Carrier Synchronization - Structure of Non-coherent Receivers - Principle of DPSK.

Module-5 Error Control Coding **[7 Hrs]**

Channel coding theorem - Linear Block codes - Hamming codes - Cyclic codes - Convolutional codes - Viterbi Decoder.

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Module-6 Mobile Communication **[6 Hrs]**

Cellular Telephone systems: Digital cellular telephone, Mobile communication system, Role of mobile communication, mobile hotspot and mobile applications related to rural development, GPS.

Text Books:

1. S. Haykin, —Digital Communicationsl, John Wiley, 2015

Reference Books:

1. B.P. Lathi and Z. Ding, "Modern Digital and Analog Communication Systems," 4th Ed., Oxford University Press, 2009.

2. U. Madhow, "Fundamentals of Digital Communication," Cambridge Univ. Press, 2008.

3. T. M. Cover and J. A. Thomas, "Elements of Information Theory," Wiley Student Edition, 1999, Reprint 2009

4. J.G Proakis, —Digital Communicationl, 4th Edition, Tata McGraw Hill Company, 2001.

E-Resources:

1. https://www.researchgate.net/publication/268508509_Types_of_E-Resources_and_its_utilities_in_Library
2. https://www.ojcmt.net/article/digital-communication-in-educational-process-development-trends-and-new-opportunities-7928
3. https://journals.ala.org/index.php/lrts/article/view/5158/6260

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Professional Elective Course-III

ET7E002A	Introduction to IOT	3 Credit

Prerequisites: Fundamentals of computer network, Network Security, internet technology.

Course Objectives:

1. Student will explore various components of Internet of things such as Sensors, internetworking and cyber space.
2. Students will able to use real IoT protocols for communication
3. Students will able to transfer IoT data to the cloud and in between cloud providers
4. In the end they will also be able to design and implement IoT circuits and solutions.

Course Outcomes:

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

1. Understand general concepts of Internet of Things (IoT).
2. Recognize various devices, sensors and applications.
3. Apply design concept to IoT solutions.
4. Analyze various M2M and IoT architectures.
5. Evaluate design issues in IoT applications.
6. Create IoT solutions using sensors, actuators and Devices.

Course Contents:

Module-1 Introduction to IoT Components **[6 Hrs]**

Sensing, Actuation, Networking basics, Communication Protocols, Sensor Networks, Machine-to-Machine Communications, IoT Definition, Characteristics. IoT Functional Blocks, Physical design of IoT, Logical design of IoT, Communication models & APIs.

Module-2 M2M to IoT **[7 Hrs]**

The Vision-Introduction, From M2M to IoT, M2M towards IoT-the global context, A use case example, Differing Characteristics. Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT,.

Module-3 M2M vs IoT an Architectural Overview **[7 Hrs]**

Building architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. Reference Architecture and Reference Model of IoT.

Module-4 IoT Reference Architecture **[6 Hrs]**

Getting Familiar with IoT Architecture, Various architectural views of IoT such as Functional, Information, Operational and Deployment. Constraints affecting design in IoT world- Introduction,

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Technical design Constraints.

Module-5 Domain Specific Applications of IoT **[5 Hrs]**

Home automation, Industry applications, Surveillance applications, Other IoT application.

Module-6 Developing IoT Solutions **[7 Hrs]**

Introduction to Python, Introduction to different IoT tools, Introduction to Arduino and Raspberry Pi Implementation of IoT with Arduino and Raspberry, Cloud Computing, Fog Computing, Connected Vehicles, Data Aggregation for the IoT in Smart Cities, Privacy and Security Issues in IoT

Text Books:

1. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Aves and, Stamatis Karnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014.

2. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on Approach)", 1st Edition, VPT, 2014.

Reference Books:

1. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, Apress Publications, 2013.

2. CunoPfister, Getting Started with the Internet of Things, O"Reilly Media, 2011, ISBN: 978-1-4493-9357-1

E-Resources:

1. https://www.udemy.com/course/internet-of-things-iot-for-beginners-getting-started/
2. https://playground.arduino.cc/Projects/Ideas/
3. https://runtimeprojects.com/
4. https://www.megunolink.com/articles/arduino-garage-door-opener/
5. https://www.willward1.com/arduino-wifi-tutorial/
6. https://www.makeuseof.com/tag/pi-overdose-heres-5-raspberry-pi-alternatives/
7. https://www.electronicshub.org/arduino-project-ideas
8. http://homeautomationserver.com/
9. https://www.youtube.com/watch?v=dC2GdEWHRxQ&list=PLy6JR9IR8VKOZBpDcETs
10. https://www.youtube.com/watch?v=kLd_JyvKV4Y
11. https://www.youtube.com/watch?v=TkA2LJctU1c

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ET7E002BC	Optical Communication Networks	3 Credits

Prerequisites: Basic knowledge of communication engineering

Course Objectives:

1. To learn the basic elements of optical fiber transmission link, fiber modes configurations and structures.
2. To understand the different kind of losses, signal distortion in optical wave guides and other signal degradation factors.
3. To learn the various optical source materials, LED structures, quantum efficiency, Laser diodes.
4. To learn the fiber optical receivers such as PIN APD diodes, noise performance in photo detector, receiver operation and configuration.
5. To learn the fiber optical network components, variety of networking aspects, FDDI, SONET/SDH and operational principles WDM.

Course Outcomes:

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

1. Explain the principles of operation of various optical fiber communication systems.
2. Analyze the performance of various digital and analogue optical fiber systems.
3. Calculate various key parameters of optical fiber systems. These include the system optical power budget and system rise time budget, receiver noise power, Q factor, bit error rate and maximum usable bit rate of a digital optical fiber system.
4. Explain/compare the factors affecting the performance of different optical fibre communication systems.
5. Communicate laboratory findings through written reports

Course Contents:

Module-1 Overview of Optical Fiber Wave Guides **[6 Hrs]**

General system, transmission link, advantage of optical fiber communication, basic structure of optical fiber waveguide, ray theory transmission, optical fiber modes and configuration, step index & graded index fiber, single mode fiber , fiber materials , fiber fabrication

Module-2 Signal Degradation in Optical Fiber **[7 Hrs]**

Introduction, attenuation, intrinsic & extrinsic absorption losses, linear & nonlinear scattering losses, bending losses, distortion in optical wave guide, intramodal and intermodal dispersion. Power launching and coupling Source to fiber power launching, power calculation, lensing schemes, fiber to fiber joints, fiber splicing technique, fiber connectors.

Module-3 Optical Sources **[6 Hrs]**

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LASER: Basic concepts of laser, Optical emission from semiconductors, Semiconductor injection laser (ILD), Injection laser characteristics.LED: power and efficiency, LED structures, LED characteristics.Optical detectors: p-n photodiodes, P-I-N photodiodes, Avalanche photodiodes, Quantum efficiency, speed of response, Phototransistor.

Module-4 Optical Receiver **[5 Hrs]**

Receiver operation, digital receiver noise, shot noise, pre-amplifier types, Digital receiver performance, introduction to analog receivers.

Module-5 Digital Transmission Systems **[7 Hrs]**

Point to point links, system considerations, link power budget, rise time budget, modulation formats for analog communication system, introduction to WDM concepts, Introduction to advanced multiplexing strategies.

Module-6 Optical Networks **[6 Hrs]**

Basic networks-SONET/ SDH-wavelength routed networks, nonlinear effects on network performance, performance of various systems (WDM, DWDM + SOA).

Text Books:

1. G.Keiser: Optical Fiber Communication – MGH
2. Jenkins & White: Fundamentals of Optics – MGH.

Reference Books:

1. Bhattacharya, Pallab / "Semiconductor Optoelectronics Devices" / Pearson Education.
2. Singh, Jasprit / "Optoelectronics An Introduction to Materials and Devices"/ McGraw-Hill
3. Khare, R.P. / "Fiber Optics & Optoelectronics" / Oxford University Press
4. Gupta, S.C. / "Text Book of Optical Fiber Communication & Its Applications"/ Prentice–Hall India
5. M. Senior: Optical Fiber Communication – PHI

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E-Resources:

1. https://nptel.ac.in/courses/108/106/108106167/
2. https://nptel.ac.in/courses/117101054

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ET7E002C	Advanced Cellular Communication	3 Credit

Prerequisites: Basic knowledge of Digital and wireless Communication System.

Course Objectives:

1. To understand the basic cellular system concepts.
2. To have an insight into the various propagation models and the speech coders used in mobile communication.
3. To understand the multiple access techniques and interference education techniques in mobile communication
4. To identify the limitations of 3G and 4G wireless mobile communication and use design of 5G and beyond mobile communication systems

Course Outcomes:

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

1. Know the concept of cellular wireless communication system
2. Understand emerging technologies required for fourth and fifth generation mobile systems such as SDR, MIMO etc
3. Knowledge of GSM mobile communication standard, its architecture, logical channels, advantages and limitations
4. Apply frequency-reuse concept in mobile communications, and to analyze its effects on interference, system capacity, handoff techniques
5. Analyze various methodologies to improve the cellular capacity
6. Compare and explain various radio access technologies for 5G networks

Course Contents:

Module-1 Introduction to Wireless communication **[4 Hrs]**

Wireless communication systems, Applications of wireless communication systems, Types of wireless communication systems, trends in mobile communication systems

Module-2 Cellular Mobile Systems **[6 Hrs]**

Basic cellular systems, Performance criteria, Uniqueness of mobile radio environment, Operation of cellular systems, analog & digital cellular systems.

Module-3 Elements of Cellular Radio System Design **[6 Hrs]**

Concept of frequency reuse channels, Co-channel interference reduction factor, Desired C/I from a normal case in an omnidirectional antenna system, Handoff mechanism, Cell splitting.

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Module-4 Interference in Cellular Mobile System **[7 Hrs]**

Co-channel interference, Design of an omnidirectional antenna system in the worst case, Design of a directional antenna system, Lowering the antenna height, Power control, Reduction in CI by tilting antenna, umbrella pattern effect Adjacent-channel interference, Near-end – far-end interference, Effect on near-end mobile units

Module-5 Frequency Management, Channel Assignment and Handoffs **[7 Hrs]**

Frequency management, Frequency-spectrum utilization, Set-up channels, Fixed channel assignment schemes, Non-fixed channel assignment schemes, Concept of handoff, Initiation of a hard handoff, Delaying a handoff, Forced handoffs, Queuing of handoffs, Power difference handoffs, Mobile assisted handoff, Soft handoffs, Cell-site handoff, Intersystem handoff, dropout calls.

Module-6 GSM System Overview Over Wireless Networks And 5G Technology **[8 Hrs]**

GSM system architecture, GSM radio subsystem, GSM channel types, Frame structure for GSM, Signal processing in GSM, GPRS and EDGE. Overview of Wi-Fi, Wi-MAX and Bluetooth technology (Basic features and physical specifications).5G architecture, D2D: from 4G to 5G – Radio Resource Management for Mobile Broadband D2D –5G radio access technologies.

Text Books:

1. Mobile Cellular Telecommunications: Analog and Digital Systems by William C. Y. Lee; Tata McGraw Hill Publication.

2. H. Labiod, H. Afifi, C. De Santis: WI-FI, BLUETOOTH , ZIGBEE and WIMAX-Springer2007

Reference Books:

1. Asif Oseiran, Jose F.Monserrat and Patrick Marsch, "5G Mobile and Wireless Communications Technology", Cambridge University Press, 2016.

2. Jonathan Rodriquez, "Fundamentals of 5G Mobile Networks", Wiley, 2015

3. Patrick Marsch, Omer Bulakci, Olav Queseth and Mauro Boldi, "5G System Design – Architectural and Functional Considerations and Long Term Research", Wiley, 2018arson

4. Wireless Communications and Networks: 3G and Beyond by ItiSahaMisra; Tata McGraw Hill Publication

5. Wireless and Digital Communications by Dr. KamiloFeher; PHI Publication

E-Resources:

1. https://crln.acrl.org/index.php/crlnews/article/view/8545/8878
2. https://eudl.eu/journal/mca
3. https://www.researchgate.net/publication/286455750_mobile_technology_in_libraries_for_discovering_e-resources_and_services

Professional Elective Course-IV

ET7E003A	Verilog HDL	3 Credit

Prerequisites: Basic knowledge of Digital Circuits, Microprocessor and Microcontroller.

Course Objectives:

1. To relate VHDL with Verilog and Understand the Digital Design with Verilog HDL.
2. To identify the various modules and ports in Digital Design with Verilog HDL.
3. To Compare the task and functions and make use of useful modeling techniques.
4. To analyze the gate level, data flow and behavioral modeling of Digital Design with Verilog HDL.
5. To design digital systems with various constraints.

Course Outcomes:

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

1. **Relate** VHDL and Verilog
2. **Understand** the Digital Design with Verilog HDL.
3. **Identify** the various modules and ports in Digital Design with Verilog HDL.
4. **Compare** the task and functions and make use of useful modeling techniques.
5. **Analyze** the gate level, data flow and behavioral modeling of Digital Design with Verilog HDL.
6. **Design** digital systems with various constraints.

Course Contents:

Module-1 Overview of Digital Design with Verilog HDL **[6 Hrs]**

Evolution of CAD, emergence of HDLs, typical HDL-based design flow, why Verilog HDL?, trends in HDLs.

Hierarchical Modeling Concepts: Top-down and bottom-up design methodology, differences between modules and module instances, parts of a simulation, design block, stimulus block.

Module-2 Modules and Ports **[5 Hrs]**

Lexical conventions, data types, system tasks, compiler directives, Module definition, port declaration, connecting ports, hierarchical name referencing.

Module-3 Gate-Level Modeling **[7 Hrs]**

Modeling using basic Verilog gate primitives, description of and/or and buf/not type gates, rise, fall and turn-off delays, min, max, and typical delays.

Module-4 Dataflow Modeling **[6 Hrs]**

Continuous assignments, delay specification, expressions, operators, operands, operator types.

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Module-5 Behavioral Modeling **[6 Hrs]**

Structured procedures, initial and always, blocking and nonblocking statements, delay control, generate statement, event control, conditional statements, multiway branching, loops, sequential and parallel blocks.

Module-6 Tasks, Functions & Useful Modeling Techniques **[7 Hrs]**

Differences between tasks and functions, declaration, invocation, automatic tasks and functions. Procedural continuous assignments, overriding parameters, conditional compilation and execution, useful system tasks.

Text Books:

1. Verilog HDL: A Guide to Digital Design and Synthesis, Second Edition, Samir Palnitkar, Prentice Hall PTR, February 21, 2003

Reference Books:

1. Steve Kilts, "Advanced FPGA Design: Architecture, Implementation and Optimization", J.Wiley and Sons, 2007.
2. Seetharaman Ramachandran, "Digital VLSI Systems Design", Springer Verlag, 2012.
3. Peter J. Ashenden, "The designer's guide top VHDL", Morgan Kaufmann, 2008.
4. Charles H. Roth Jr., "Digital Systems Design using VHDL", Cengage Learning, 2014.
5. Digital System Design–John Wakerley, McGraw Hill Publications.

E-Resources:

1. https://onlinecourses.nptel.ac.in/noc19_cs73
2. https://www.classcentral.com/course/swayam-synthesis-of-digital-systems-10067

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ET7E003B	UHF & Microwave Engineering	3 Credit

Prerequisites: Basic knowledge of Electromagnetic field and Antenna & Wave Propagation.

Course Objectives:

The Course Objectives are:

1. To study the principles of the advanced microwave engineering.
2. To study the design of passive and active microwave components and microwave circuits including Micro strip line, guided wave device
3. To study Klystron amplifier and oscillator.
4. To study magnetron & other devices.
5. To study the free space communication link and its mathematical analysis.

Course Outcomes:

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

1. Describe the use of active and passive microwave devices.
2. Demonstrate the use of different Klystrons, magnetron devices.
3. Analyze different UHF components with the help of scattering parameter.
4. Describe micro strip lines.
5. Analyze the different power distribution Tees.
6. Describe the transmission and waveguide structures and how they are used as elements in impedance matching and filter circuits.

Module-1 Microwave Active Devices (O-type) **(6 Hrs)**

Interaction of electron beam with electromagnetic field, power transfer condition. Principles of working of two cavity and Reflex Klystrons, arrival time curve and oscillation conditions in Reflex klystrons, mode-frequency characteristics, Effect of repeller voltage variation on power and frequency of output. Slow wave structures, Principle and working of TWT amplifier & BWO Oscillator.

Module-2 Microwave Active Devices (M-type) **(7 Hrs)**

Principle of working of M-type TWT, Magnetrons, Electron dynamics in planar and cylindrical Magnetrons, Cutoff magnetic field, phase focusing effect, mode operation, Mode separation techniques, Tuning of magnetron.

Module-3 Transmission Line **(6 Hrs)**

Input impedance, Standing wave distribution, Quarter Wave and Stub Matching using Smith chart, losses in Transmission lines, Planar Transmission line types, Introduction - Types of MICs and their technology, Fabrication process of MMIC, Hybrid MICs.

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Module-4 Microwave Networks and Passive Components **(8 Hrs)**

Transmission line ports of microwave network, Scattering matrix, Properties of scattering matrix of reciprocal, nonreciprocal, loss-less, Passive networks, Examples of two, three and four port networks, wave guide components like attenuator. Principle of operation and properties of E-plane, H-plane Tee junctions of wave guides, Hybrid T, Directional couplers, Microwave resonators-rectangular, Excitation of wave guide and resonators .Principles of operation of non-reciprocal devices, properties of ferrites, Gyrators, Isolators ,Circulator and phase shifters.

Module-5 Microwave Measurements **(6 Hrs)**

Function of Tuning Probes, Detector mounts and Detector diode, Slotted line section and VSWR meter, Measurement of wave-guide impedance at load port by slotted line, Measurement of scattering matrix parameters, High, Medium and low-level power measurement techniques, Characteristics of bolometer, bolometer mounts, Power measurement bridges, Calorimetric method, Microwave frequency measurement techniques, calibrated resonators (transmission and absorption type), Network Analyzer and its use in measurements.

Module-6 Microwave Solid State Devices and Application **(6 Hrs)**

PIN diodes-Properties and applications, Microwave detector diodes-detection characteristics, Varactor diodes, Parametric amplifier fundamentals-Manley-Rowe Power relation, MASERS, Transferred electron devices, Gunn effect, Various modes of operation of Gunn oscillator, IMPATT, TRAPATT and BARITT.

Text Books:

1. Samuel Y. Liao, 'Microwave Devices and Circuits', Pearson Education, 5th Edition.

Reference Books:

1. Manojit Mitra, 'Microwave engineering', 3rd edition, DhanpatRai& Company.
2. Peter A. Rizzi, 'Microwave Engineering Passive Circuits', PHI, 1999.
3. Annapurna Das, Sisir Das, 'Microwave Engineering', April 1987, Tata McGraw Hill Publication.
4. Herbert J. Reich, J.G. Skalnik, P.F. Ordung and H.L. Krauss , 'Microwave Principles',4th edition, 1998.
5. G. S. Raghuvanshi, 'Microwave Engineering', CENGAGE Learning

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Professional Elective Course-V

ET7E004A	**Machine Learning**	3 Credits

Course Objectives:

1. To understand the basic theory underlying machine learning.
2. To be able to formulate machine learning problems corresponding to different applications.
3. To understand a range of machine learning algorithms along with their strengths and weaknesses.
4. To be able to apply machine learning algorithms to solve problems of moderate complexity.
5. To apply the algorithms to a real-world problem, optimize the models learned and report on the expected accuracy that can be achieved by applying the models.

Course Outcomes:

After completing this course, the student will be able to

1. Understand a very broad collection of machine learning algorithms and problems.
2. Appreciate the importance of visualization in the data analytics solution.
3. Apply structured thinking to unstructured problems.
4. Learn algorithmic topics of machine learning and mathematically deep enough to introduce the required theory.
5. Develop an appreciation for what is involved in learning from data.

Course Contents:

Module-1 Introduction **[5 Hrs]**

Learning Problems, Perspectives and Issues, Concept Learning, Version Spaces and Candidate Eliminations, Inductive bias, Decision Tree learning, Representation, Algorithm, Heuristic Space Search.

Module-2 Neural Networks and Genetic Algorithms **[7 Hrs]**

Neural Network Representation, Problems, Perceptrons, Multilayer Networks and Back Propagation Algorithms, Advanced Topics, Genetic Algorithms, Hypothesis Space Search, Genetic Programming, Models of Evaluation and Learning.

Module-3 Bayesian and Computational Learning **[7 Hrs]**

Bayes Theorem, Concept Learning, Maximum Likelihood, Minimum Description Length Principle, Bayes Optimal Classifier, Gibbs Algorithm, Naïve Bayes Classifier, Bayesian Belief Network, EM Algorithm, Probability Learning, Sample Complexity, Finite and Infinite Hypothesis Spaces, Mistake Bound Model.

Module-4 Instant Based Learning **[6 Hrs]**

K- Nearest Neighbour Learning, Locally weighted Regression, Radial Bases Functions, and Case Based Learning.

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Module-5 Advanced Learning **[7 Hrs]**

Learning Sets of Rules, Sequential Covering Algorithm, Learning Rule Set, First Order Rules, Sets of First Order Rules, Induction on Inverted Deduction, Inverting Resolution, Analytical Learning, Perfect Domain Theories, Explanation Base Learning, FOCL Algorithm, Reinforcement Learning, Task, Q-Learning, Temporal Difference Learning. "Current Streams of Thought".

Module-6 Introduction to Cluster Analysis & Clustering Methods **[6 Hrs]**

The Clustering Task and the Requirements for Cluster Analysis, Overview of Some Basic Clustering Methods, Hierarchical Methods: Agglomerate versus Divisive Hierarchical Clustering, Distance Measures, Probabilistic Hierarchical Clustering, Multiphase Hierarchical Clustering Using Clustering

Text Books:

1. Tom M. Mitchell, —Machine Learning, McGraw-Hill Education (India) Private Limited, 2013.

2. Ethem Alpaydin, —Introduction to Machine Learning (Adaptive Computation and Machine Learning), The MIT Press 2004.

Reference Books:

1. Machine Learning Engineering, AndriyBurkov, ISBN-10 : 1999579577, True Positive Inc. (8 September 2020)

2. Stephen Marsland, —Machine Learning: An Algorithmic Perspective, CRC Press, 2009.

3. Bishop, C., Pattern Recognition and Machine Learning. Berlin: Springer-Verlag.

E-Resources:

1. https://onlinecourses.nptel.ac.in/noc22_cs29/preview
2. https://nptel.ac.in/courses/106106139

ET7E004B	Digital Image Processing	3 Credit

Prerequisites: Digital Signal Processing, Transform techniques.

Course Objectives:

1. To study the image fundamentals and mathematical transforms necessary for image processing.
2. To study the image enhancement techniques
3. To study image restoration procedures.
4. To study the image compression procedures.

Course Outcomes:

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

1. **Recall** the fundamental concepts of a digital image processing system.
2. **Understand** images in the frequency domain using various transforms.
3. **Apply** various techniques for image enhancement and image restoration.
4. **Analyze** various compression techniques.
5. **Interpret** Image compression standards.
6. **Design** image segmentation and representation techniques.

Course Contents:

Module-1 Introduction and Digital Image Fundamentals **[6 Hrs]**

Digital Image Fundamentals, Need for DIP, Fundamental steps in DIP, Human visual system, Image representation – Gray scale and Color images,Types of neighborhoods, Basic relationships between pixels, Distance Measures,

Module-2 Basic operations on Images and Color Fundamentals. **[6 Hrs]**

Image addition, subtraction, logical operations, scaling, translation, rotation, Image Histogram, Color fundamentals & models – RGB, HSI YIQ, image sampling and quantization.

Module-3 Image Enhancement and Restoration **[8 Hrs]**

Spatial domain enhancement: Point operations-Log transformation, Power-law transformation, Piecewise linear transformations, Histogram equalization. Filtering operations- Image smoothing, Image sharpening.Basic gray level Transformations, Low pass filtering, High pass filtering, Noise Models, Noise Reduction, Inverse Filtering, MMSE (Wiener) Filtering,

Module-4 Image Compression **[4 Hrs]**

Fundamentals of redundancies, Basic Compression Methods: Huffman coding, Arithmetic coding, LZW coding, JPEG Compression standard.

Module-5 Image Segmentation and Morphological Operations **[8 Hrs]**

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Image Segmentation: Point Detections, Line detection, Edge Detection-First order derivative –Prewitt and Sobel, Second order derivative – LoG, DoG, Canny, Edge linking, Hough Transform, Region Growing, Region Splitting and Merging,Dilation, Erosion, Opening, Closing, Hitor-Miss transform, Boundary Detection, Thinning, Thickening, Skeleton.

Module-6 Representation and Description **[6 Hrs]**

Representation – Chain codes, Polygonal approximation, Signatures. Boundary Descriptors – Shape numbers, Fourier Descriptors.

Text Books:

1. Gonzalez & Woods, —Digital Image Processing, 3rd ed., Pearson education, 2008

Reference Books:

1. Milan Sonka, Vaclav Hlavav, Roger Boyle, —Image Processing, Analysis and Machine Visionl, 2nd ed., Thomson Learning, 2001
2. Rangaraj M. Rangayyan, —Biomedical Image Analysisl, CRC Press, 2005
3. Pratt W.K, —Digital Image Processingl, 3rd ed., John Wiley & Sons, 2007
4. Jain Anil K., —Fundamentals Digital Image Processingl, Prentice Hall India, 2010

E-Resources:

https://nptel.ac.in/courses/117105079

https://onlinecourses.nptel.ac.in/noc19_ee55/preview

https://nptel.ac.in/courses/117105135

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ET7E004C	Advanced Digital Signal Processing	3 Credit

Prerequisites: Signals and Systems, Digital Signal Processing.

Course Objectives:

1. To study in depth knowledge of processing digital signals.
2. To study the designing of filters.
3. To study multirate digital signal processing.
4. To study the power spectral estimation.

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. **Summarize** the requirement of theoretical and practical aspects of DSP with regard to sampling and reconstruction.
3. **Apply** various techniques of filter designs for various applications.
4. **Analyze** Multi Rate Signal Processing and describe how to apply it for the wavelet transform.
5. **Comprehend** the Finite word length effects in Fixed point DSP Systems.
6. **Estimate** the power spectral estimation methods.

Course Contents:

Module-1 Multirate Digital Signal Processing **[6 Hrs]**

Introduction, Review of Decimation and Interpolation, Sampling Rate Conversion by a Rational Factor I/D, Filter Design and Implementation for sampling rate Conversion Multirate Digital Signal Processing Multistage, Implementation of Sampling Rate Conversion.

Module-2 Applications of Multirate Digital Signal Processing **[4 Hrs]**

Applications of Multirate Signal Processing, Sampling Rate Conversion of Bandpass Signals Linear Prediction and Optimum Linear

Module-3 Filters **[7 Hrs]**

Innovations Representation of a Stationary Random Process, Forward and Backward Linear Prediction, Solution of the Normal Equations, Properties of linear prediction - Error Filter, AR Lattice and ARMA Lattice-Ladder Filters.

Module-4 Power Spectral Estimation **[6 Hrs]**

Estimation of Spectra from Finite Duration Observations of a signal, the Periodogram, Use DFT in power Spectral Estimation, Bartlett, Welch and Blackman, Tukey Methods, Comparison of performance of Non-Parametric Power Spectrum Estimation Methods

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Module-5 Parametric Method of Power Spectrum Estimation **[7 Hrs]**

Parametric Methods for power spectrum estimation, Relationship between Auto-Correlation and Model Parameters, AR (Auto-Regressive) Process and Linear Prediction, Moving Average(MA) and ARMA Models Minimum Variance Method.

Module-6 Wavelet Transform **[6 Hrs]**

Window Selection, Wavelet Transform, STFT to Wavelet conversion, Basic Wavelet, Discrete time orthogonal Wavelet, Continuous Time Orthogonal Wavelets.

Text Books:

1. J. G. Proakis & D. G. Manolokis, "Digital Signal Processing – Principles, Algorithms Applications", PHI.

Reference Books:

1. S. M .Kay, "Modern spectral Estimation techniques", PHI, 1997.Emmanuel C. Ifeacher Barrie. W. Jervis, "DSP – A Practical Approach", Pearson Education.
2. Oppenheim, Alan V. Discrete-time signal processing. Pearson Education India, 1999.
3. Mitra, Sanjit Kumar, and Yonghong Kuo. Digital signal processing: a computer-based approach. Vol. 2. New York: McGraw-Hill Higher Education, 2006.

E-Resources:

https://nptel.ac.in/courses/117101001

https://onlinecourses.nptel.ac.in/noc21_ee20/preview

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ET7L005	Basic Electronic Simulation Lab	1 Credit

Course Objectives:

1. Familiarize with the CAD tool to write HDL programs.
2. Understand simulation and synthesis of digital design.
3. Program FPGAs/CPLDs to synthesize the digital designs.
4. Interface hardware to programmable ICs through I/O ports.
5. Choose either Verilog or VHDL for a given Abstraction level.

Course Outcomes:

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

1. **Develop** the Verilog/VHDL programs to simulate Combinational circuits in Dataflow, Behavioral and Gate level Abstractions.
2. **Describe** sequential circuits like flip flops and counters in Behavioral description and obtain simulation waveforms.
3. **Synthesize** Combinational and Sequential circuits on programmable ICs and test the hardware.
4. **Interface** the hardware to the programmable chips and obtain the required output

List of Experiments:

PART A

1. Develop a Verilog program for 2 to 4 decoder.
2. Develop a Verilog program for 8 to 3 encoder (without priority & with priority).
3. Develop a Verilog program for 8 to 1 multiplexer.
4. Design 4 bit binary to gray converter in Verilog.
5. Model in Verilog for a full adder and add functionality to perform logical operations of XOR, XNOR, AND and OR gates.
6. Write a Verilog code to model 32 bit ALU.
7. Write Verilog code for SR, D and JK and verify the flip flop.
8. Write Verilog code for 4-bit BCD synchronous counter.
9. Write Verilog code for counter with given input clock and check whether it works as clock divider performing division of clock by 2, 4, 8 and 16. Verify the functionality of the code.

PART-B

1. Develop a Verilog code to design a clock divider circuit that generates 1/2, 1/3rd and 1/4thclock from a given input clock. Port the design to FPGA and validate the functionality through oscilloscope.
2. Interface a DC motor to FPGA and write Verilog code to change its speed and direction.
3. Interface a Stepper motor to FPGA and write Verilog code to control the Stepper motor rotation

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which in turn may control a Robotic Arm. External switches to be used for different controls like rotate the Stepper motor

(i) +N steps if Switch no.1 of a Dip switch is closed

(ii) +N/2 steps if Switch no. 2 of a Dip switch is closed

(iii) –N steps if Switch no. 3 of a Dip switch is closed etc.

4. Interface a DAC to FPGA and write Verilog code to generate Sine wave of frequency F KHz (eg. 200 KHz) frequency. Modify the code to down sample the frequency to F/2 KHz. Display the Original and Down sampled signals by connecting them to an oscilloscope.

5. Write Verilog code using FSM to simulate elevator operation.

6. Write Verilog code to convert an analog input of a sensor to digital form and to display the same on a suitable display like set of simple LEDs, 7-segment display digits or LCD display.

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ET7L001	Digital Communication Lab	1 Credit

Prerequisites: Communication System Engineering, Digital Communications, Signals and Systems.

Course Outcomes:

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

1. Evaluate the performance of PCM, DPCM and Delta modulation schemes.
2. Implement different digital modulation schemes like FSK, PSK, and DPSK.
3. Analyze source/channel encoding & decoding methods.
4. Simulate Pulse Digital Modulation & demodulation using MATLAB.
5. Simulate digital communication techniques like ASK, FSK & PSK.

List of Experiments:

Trainer Kit Based Experiments

1. Generation and Detection of Pulse Code Modulation for both A.C and D.C signals
2. Generation and Detection of Differential Pulse Code Modulation
3. Generation and Detection of Delta Modulation
4. Generation and Detection of PSK.
5. Generation and Detection of FSK.
6. Generation and Detection of DPSK.
7. Generation and Detection of QPSK.
8. Linear Block code-Encoder and Decoder
9. Convolution code-Encoder and Decoder
10. To study the Spectrum Analyzer

Simulation Based Experiments (Open Source/Matlab/Multisim)

1. Amplitude Shift Keying
2. Phase Shift keying
3. Time Division Multiplexing
4. Pulse Code Modulation

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Professional Elective Course-VI

ET8E001A	5G Wireless Networks	3 Credit

Course Objectives:

1. Discuss and analyze the latest technologies in wireless networks including wireless components
2. Analyze different techniques and technologies required for the development of 5G Wireless Networks
3. Discuss the recent development of 5G Wireless Networks and next generation 5G protocols in current and emerging communications.

Course Outcomes:

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

1. Understanding the objectives of 5G.
2. Compare 5G Architecture with 4G Architecture.
3. Analyze the principles of Softwarization in 5G.
4. To study the concept of MEC and Fog computing.
5. Evaluate physical layer design in 5G.
6. Characterize and analyze network security aspect in 5G.

Course Contents:

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

5GPP & NGMN, 5G Design Objective Part 1, 5G Design Objective Part 2, ITU-R IMT-2020 vision for 5G, 5G Spectrum Requirements, Globally Harmonised 5G Spectrum, 5G Industry Progress, 5G Network Perspectives

Module-2 Architecture **[7 Hrs]**

5G Scenarios, 5G RAN, 5G Mobile Core and Operating System, 5G Architecture View, 5G Network Slicing, 5G Architecture Plane Part 1, 5G Architecture Plane Part 2, Logical and Functional 5G Architecture, Dynamic CRAN, 5G NR Logical Architecture

Module-3: Programmability and Softwarization **[5 Hrs]**

Network Programmability and Softwarization, Network Programmability.

Module-4 Mobile Edge Computing and FOG Computing **[6 Hrs]**

MEC Introduction, MEC Concept, MEC Architecture, MEC Benefits, Fog Computing

Module-5 Radio Access Technologies **[7 Hrs]**

Millimeter Wave Propagation, Flexible Physical Layer Design Part 1, Flexible Physical Layer Design Part 2, Distributed Massive MIMO Principles, Energy Transfer for Massive MIMO

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Module-6 Network Security **[7 Hrs]**

5G Security, 5G Security Goals, 5G New Trust Model, Diversified Identity Management, User Privacy Protection Requirement, 5G Core Security, 5G Radio Network Security

Text Books:

1. R. Vannithamby and S. Talwar, Towards 5G: Applications, Requirements and Candidate Technologies., John Willey & Sons, West Sussex, 2017.

2. Manish, M., Devendra, G., Pattanayak, P., Ha, N., 5G and Beyond Wireless Systems PHY Layer Perspective, Springer Series in Wireless Technology

Reference Books:

1. T. S. Rappaport, R. W. Heath Jr., R. C. Daniels, and J. M. Murdock,, Millimeter Wave Wireless Communication., Pearson Education, 2015.

2. M. Vaezi, Z. Ding, and H. V. Poor,, Multiple Access techniques for 5G Wireless Networks and Beyond., Springer Nature, Switzerland, 2019

E-Resources:

https://onlinecourses.nptel.ac.in/noc21_ee12/preview

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ET8E001B	Modern Digital Communication System	3 Credit

Course Objectives:

1. The course aims at understanding principles, theories and practices, which are fundamental to the successful design of a digital communication system
2. In this course students are introduced to advanced topics in digital communications and also acquire information about the latest emerging modern communication standards and underlying design principles
3. Evaluate and compare the performance of the various digital communication schemes in wired and wireless channels
4. Make Students well equipped for research or cutting edge development in Communication System

Course Outcomes:

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

1. **Recall** to possess the principles and theories required to design reliable communication link
2. **Compare** different digital communication techniques and judge their applicability and performance in different application scenarios.
3. **Apply** mathematical modeling to problems in wire line and wireless digital communications, and explain how this is used to analyze and synthesize methods and algorithms within the relevant communication standards
4. **Demonstrate** skillset to choose and optimize design parameters (e.g., power distribution, modulation, redundancy, speed) in advanced communication technologies used in the telecommunication industry
5. **Possess** fundamental grounding and sophistication needed to explore topics in Advanced and Emerging wireless communication standards like 4G, 5G and different WLAN that include MIMO, mmWave communication

Course Contents:

Module-1 Introduction **[5 Hrs]**

Introduction to Digital Communication, Elements of Digital Communication, Mathematical Models for Communication Channels and their characteristics, Review system designing and performance aspects, Networks aspects of digital interface, Historical background and developments in modern digital communication.

Module-2 Mathematical Preliminaries **[6 Hrs]**

Signals, LTI system, The Nyquist Sampling theorem, Complex envelope representation, the spectrum of bandpass signal, low pass equivalent of bandpass signal, Energy considerations, low pass equivalent of a bandpass system. Signal space representation of waveforms: Vector space concepts, Signal space concepts, Orthogonal expansions of signals, Gram-Schmidt procedure.

Module-3 Digital Modulation Schemes and Optimum Receivers for AWGN Channels **[8 Hrs]**

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BOS (Electronics)

Representation of digitally modulated signals, Multidimensional Signaling, Signaling Schemes with Memory: CPFSK, CPM. Spectral properties of various modulation schemes and their comparison, The Nyquist criterion for ISI avoidance, Optimum Receivers for AWGN Channels: Waveform and Vector Channel models, Optimum reception in AWGN, error probability of band-limited and power limited signaling, detection non-coherent detection.

Module-4 Carrier and symbol Synchronization **[7 Hrs]**

Receiver design requirements, Signal Parameter estimation: Carrier recovery and symbol synchronization in signal demodulation, Carrier Phase estimation, Symbol timing estimation, Joint estimation of Carrier Phase and Symbol timing, Performance characteristics of ML estimators.

Module-5 Information-Theoretic Limits and Channel Coding **[7 Hrs]**

The capacity of AWGN Channel: modeling and geometry, Shannon theory basics: entropy, mutual information, and divergence, channel coding theorem, the capacity of standard constellations, parallel Gaussian channels and water filling

Channel codes: Binary convolution codes, Turbo codes and iterative coding, LDPC codes, bandwidth-efficient coded modulation.

Module-6 Digital Modulation for Wireless Communication **[6 Hrs]**

Physical modeling for wireless channels, Fading and diversity, OFDM, CDMA, MIMO- linear array, Beam-steering, MIMO-OFDM, Spatial Multiplexing, Space-time coding.

Text Books:

1. John. G. Proakis, Digital Communications, McGraw Hill
2. Upamanyu Madhow, Fundamentals of Digital Communication, Cambridge University Press, 2012

Reference Books:

1. B. P. Lathi, Modern Digital and Analog Communication Systems, Oxford University Press, 4th Ed., 2009
2. J. R. Barry, E. A. Lee, and D. G. Messerschmitt, Digital Communication, Kluwer Academic Publishers, 2004
3. U. Madhow, "Fundamentals of Digital Communication," Cambridge Univ. Press, 2008.
4. Simon Haykin, "Communication Systems," John Wiley & Sons, 5th Ed., 2009.

E-Resources:

1. https://eng.uok.ac.ir/mohammadkhani/courses/AdvDigitalComm_94_2.html
2. https://www.psa.gov.in/technology-frontiers/advanced-communication-technologies/758

Open Elective Courses

ET7O003A	Advanced Controller & Applications	4 Credit

Course Objectives:

The objective of this course is to provide students with

1. Understanding of ARM architecture and its organization.
2. Interfacing and Programming concepts of ARM based microcontroller.
3. Fundamental concepts of Real Time Operating Systems (RTOS)
4. To understand the usage of Gateways, cloud service and design of IOT based embedded systems.

Course Outcomes:

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

1. Apply the knowledge of ARM architecture and organization for modern ARM Contex - M devices.
2. Utilize knowledge, techniques & skill to integrate microcontroller hardware and software component using Contex - M.
3. Apply the concepts of Embedded OS.
4. Implement OS based embedded system.
5. Understand different IoT platform for embedded applications.

Course Content:

Module-1 ARM Processor Architecture and Programming **[8 Hrs]**

ARM Processor Architecture, Pipeline Characteristics, ARM Addressing Modes, ARM Instruction Set, Programming Techniques, Exception Modes and Handling, Thumb Instructions.

Module-2 The Cortex - M processor **[9 Hrs]**

Applications, Simplified view – block diagram, programming model – Registers, Operation modes, Exceptions and Interrupts, Reset Sequence, Instruction Set, Unified Assembler Language, Pipeline, Bus, Priority, Vector Tables, Interrupt Inputs and Pending behavior, Fault Exceptions, Supervisor and Pendable Service Call, Nested Vectored Interrupt Controller.

Module-3 The Cortex - M processor Interfacing **[7 Hrs]**

SYSTICK Timer, Interrupt Sequences, Introduction to the Cortex microcontroller software interface standard (CMSIS), Interfacing of GPIOs, Timers, ADC, UART and other serial interfaces, PWM.

Module-4 Concept and Fundamentals of RTOS **[7 Hrs]**

RTOS examples, Interrupts, Handling an Interrupt, Interrupt Service Routines, Context Switching, Process States, Communication Mechanism, Scheduling Algorithm, Priority Inversion, Priority Inheritance. Inter-

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task Communication: Shared Variables, Monitors, Messages, Events, Semaphores, Priority inversion problem, Deadlocks, Starvation.

Module-5 Advanced Controller and Programming **[9 Hrs]**

Introduction to Raspberry PI and Platform Installation, Python Programming, OOP's and Modules in Python Programming, WiFi & Ethernet Setup, GPIO Programming

Module-6 Sensors Interfacing **[8 Hrs]**

Perform sensors interfacing (like PIR, pressure, DHT11, TMP35, gas sensor, Ultrasonic sensor, Accelerometer, LDR. 7- segment, LCD ,GLCD and wifi ESP8266 interfacing.

Text Books:

1. Definitive Guide to the ARM Cortex-M0 : Joseph Yiu, Elsevier , (1/E)2011
2. An Embedded Software Primer: David E Simon, Pearson education Asia, 2001

Reference Book:

1. Raspberry Pi IoT Projects: Prototyping, John C. Shovic
2. Experiments for Makers, Apress Publisher, First edition 2018
3. ARM System Developer's Guide Designing and Optimizing System Software: Andrew N. Sloss, Dominic Symes, Chris Wright, Morgan Kaufmann publications, (1/E) 2004.
4. ARM system on chip Architecture: Steve Furber, Pearson Education Addison Wesley, (2/E) 2000
5. Internet of Things with Raspberry Pi 3, Maneesh Rao, Packt Publisher, Second edition 2018

E-Resources:

1) https://developer.arm.com/ip-products/processors/cortex-m
2) https://nptel.ac.in/courses/117/106/117106111/
3) https://nptel.ac.in/courses/106/105/106105193/
4) https://www.youtube.com/watch?v=x0gH5JGNIKg
5) https://nptel.ac.in/courses/106/105/106105166/
6) https://intersog.com/blog/iot-platforms-overview-arduino-raspberry-pi-intel-galileo-and-others/
7) https://www.juit.ac.in/department/cse/IoT%20workshop%20with%20Intel%20Galileo.pdf
8) https://thingspeak.com/
8) https://ubidots.com/
10) https://www.youtube.com/watch?v=h0gWfVCSGQQ

BOS (Electronics)
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ET7O003B	Micro Electromechanical Systems	4 Credit

Course Objectives:

1. To give information of semiconductors and firm mechanics to make MEMS devices.
2. To teach on the basics of Micro manufacture techniques.
3. To pioneer a variety of sensors and actuators
4. To initiate diverse resources used for MEMS
5. To teach on the applications of MEMS to discipline away from Electrical engineering and Mechanical engineering.

Course Outcomes:

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

1. **Understand** the fundamentals of micro electromechanical systems as well as their applications and reward
2. **Identify** the use of resources in micro manufacture and
3. **Explain** the production processes as well as surface micromachining, bulk micromachining and LIGA.
4. **Examine** the input routine aspects of electromechanical transducers as well as sensors and actuators
5. **Analyze** the need of Finite Element Method
6. **Model** the Coupled Electromechanical Systems

Course Contents:

Module-1 Introduction **[7 Hrs]**

Why Miniaturization?, Microsystems versus MEMS, Why Microfabrication? Smart Materials, Structures and Systems, Integrated Microsystems, Applications of Smart Materials and Microsystems

Module-2 Micro Sensors, Actuators, Systems and Smart Materials: An Overview **[8 Hrs]**

Silicon Capacitive Accelerometer, Piezoresistive Pressure Sensor, Conductometric Gas Sensor, An Electrostatic Comb-Drive, A Magnetic Microrelay, Portable Blood Analyzer, Piezoelectric Inkjet Print Head, Micromirror Array for Video Projection, Smart Materials and Systems

Module-3 Micromachining Technologies **[8 Hrs]**

Silicon as a Material for Micromachining, Thin-Film Deposition, Lithography, Etching, Silicon Micromachining, Specialized Materials for Microsystems, Advanced Processes for Microfabrication

Module-4 Modelling of Solids in Microsystems **[10 Hrs]**

The Simplest Deformable Element: A Bar, Transversely Deformable Element: A beam, Energy Methods for Elastic Bodies, Examples and Problems, Heterogeneous Layered Beams, Bimorph Effect, Residual Stresses

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BOS (Electronics)

and Stress Gradients, Poisson Effect and the Anticlastic Curvature of Beams, Torsion of Beams and Shear Stresses, Dealing with Large Displacements, In-Plane Stresses

Module-5 Finite Element Method **[8 Hrs]**

Need for Numerical Methods for Solution of Equations, Variational Principles, Weak Form of the Governing Differential Equation, Finite Element Method, Numerical Examples, Finite Element Model for Structures with Piezoelectric Sensors and Actuators, Analysis of a Piezoelectric Bimorph Cantilever Beam

Module-6 Modelling of Coupled Electromechanical Systems **[7 Hrs]**

Electrostatics, Coupled Electromechanics: Statics, Coupled Electromechanics: Stability and Pull-In Phenomenon, Coupled Electromechanics: Dynamics, Squeezed Film Effects in Electromechanics

Text Books:

1. G.K. Ananthasuresh, K.J. Vinoy, S. Gopalakrishnan, K.N. Bhat, V.K. Aatre, Micro and Smart Systems, Wiley India, First Edition, 2010..

References Books:

1. Nadim Maluf, "An Introduction to Micro Electro Mechanical System Design", Artech House, 2000.
2. Mohamed Gad-el-Hak, editor, "The MEMS Handbook", CRC press Baco Raton, 2001.
3. Julian w. Gardner, Vijay K. Varadan, Osama O.Awadelkarim, Micro Sensors MEMS and Smart Devices, John Wiley & Son LTD, 2002.
4. James J. Allen, Micro Electro Mechanical System Design, CRC Press Publisher, 2005.
5. Thomas M.Adams and Richard A.Layton, "Introduction MEMS, Fabrication and Application," Springer, 2010.

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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

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)

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

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/

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Department of Artificial Intelligence

"A Place to Learn, A Chance to Grow"

SESSION 2022-23

VISION	MISSION
To evolve as a center that provides excellent learning and research environment for nurturing future management professionals.	**1. To develop in the students strong domain knowledge and a passion for lifelong learning.** **2. To develop managerial and leadership skills in the students along with a strong sense of ethics, social responsibilities and Professional values.**

Teaching Scheme for: Branch Code:

Semester: III

Sr. No	Category of the Subject	Course Code	CourseName	Teaching Scheme			Evaluation Scheme				Credits	Teaching mode
				L	T	P	CA	MSE	ESE/Ext.Prac	Total		
1	HSMC	AI3T001	Organization Behaviour	2	0	0	20	20	60	100	2	Offline, chalk & Talk ,PPT
2	HSMC	AI3T002	Universal Human Rights	2	1	0	20	20	60	100	3	Offline, chalk & Talk ,PPT
3	BSC	AI3T003	Linear Algebra and Transform	2	1	0	20	20	60	100	3	Offline, chalk & Talk ,PPT
4	ESC	AI3T004	Statistical Data Analysis	3	0	0	20	20	60	100	3	Offline, chalk & Talk ,PPT
5	PCC	AI3T005	Computer Architecture and Organisation	3	0	0	20	20	60	100	3	Offline, chalk & Talk ,PPT
6	PCC	AI3T006	Internet of Things	2	1	0	20	20	60	100	3	Offline, chalk & Talk ,PPT
7	PCC	AI3T007	Operating System and Virtualization	2	1	0	20	20	60	100	3	Offline, chalk & Talk ,PPT
8	ESC	AI3L008	Introduction to IoT (Lab)	0	0	2	60	0	40	100	1	Offline, chalk & Talk ,PPT
9	ESC	AI3L009	Introduction to Robotics-(Lab)	0	0	2	60	0	40	100	1	Offline, chalk & Talk ,PPT
10	ESC	AI3L010	Data Analytics (Lab)	0	0	2	60	0	40	100	1	Offline, chalk & Talk ,PPT
				16	**4**	**6**	**320**	**140**	**540**	**1000**	**23**	

Semester: IV 4th Semester Artificial Intelligence

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				Credit	Teaching mode
				L	T	P	CA	MSE	ESE	Total		
1	PCC	AI4T001	Theory of Computation	2	1	0	20	20	60	100	3	Offline, chalk & Talk ,PPT
3	PCC	AI4T002	Data Structure & Analysis of Algorithmn	3	0	0	20	20	60	100	3	Offline, chalk & Talk ,PPT
4	PCC	AI4T003	Neural Networks & Fuzzy System	3	0	0	20	20	60	100	3	Offline, chalk & Talk ,PPT

5	PCC	AI4T004	Discrete Mathematics & Graph Structures	3	0	0	20	20	60	100	3	Offline, chalk & Talk ,PPT
6	PCC	AI4T005	Database Management Systems	3	0	0	20	20	60	100	3	Offline, chalk & Talk ,PPT
7	PCC	AI4L006	DSA (Lab)	0	0	2	60	0	40	100	1	Offline, chalk & Talk ,PPT
8	PCC	AI4L008	Neural Networks & Fuzzy System(LAB)	0	0	2	60	0	40	100	1	Offline, chalk & Talk ,PPT
9	PCC	AI4L009	DBMS-(Lab)	0	0	2	60	0	40	100	1	Offline, chalk & Talk ,PPT
10	MC	AI4L010	Consumer Affairs	2	0	0	10	15	25	50	Audit	Offline, chalk & Talk ,PPT
11	PROJECT	AI4L011	Field Training/ Industrial Visit	0	0	0	30	0	20	50	1	
12	PCC	AI4T007	NPTEL	0	0	0	25	0	25	50	2	Online
				16	**1**	**6**	**345**	**115**	**490**	**950**	**21**	

5th Semester Artificial Intelligence

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				Credit	Teaching mode
				L	T	P	CA	MSE	ESE	Total		
1	PCC	AI5T001	AI & Cognitive Robotics	3	0	0	20	20	60	100	3	Offline, chalk & Talk ,PPT
2	PCC	AI5T002	Digital Image Techniques and Analysis	2	1	0	20	20	60	100	3	Offline, chalk & Talk ,PPT
3	PCC	AI5T003	Introduction to Deep Learning	2	1	0	20	20	60	100	3	Offline, chalk & Talk ,PPT
4	PCC	AI5O001	Open Elective -I	3	0	0	20	20	60	100	3	Offline, chalk & Talk ,PPT
5	PEC	AI5TE01	Elective -I	3	0	0	20	20	60	100	3	Offline, chalk & Talk ,PPT
6	PCC	AI5L004	Introduction to Deep Learning (LAB)	0	0	2	60	0	40	100	1	Offline, chalk & Talk ,PPT
7	PCC	AI5L005	Digital Image Techniques and Analysis (Lab)	0	0	2	60	0	40	100	1	Offline, chalk & Talk ,PPT
8	PCC	AI5L006	AI & Cognitive Robotics (Lab)	0	0	2	60	0	40	100	1	Offline, chalk & Talk ,PPT
9	PROJECT	AI5P007	Mini Project	0	0	2	0	0	50	50	1	Offline, chalk & Talk ,PPT
10	PROJECT	AI5P008	Field Training/ Industrial Visit	0	0	0	30	0	20	50	1	Offline, chalk & Talk ,PPT
10	IED	AI5T008	Innovation and Enterprenership Development	2	0	0	10	15	25	50	Audit	Offline, chalk & Talk ,PPT
				15	**2**	**8**	**320**	**115**	**515**	**950**	**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	Teaching mode
				L	T	P	CA	MSE	ESE	Total		
1	PCC	AI6T001	Advanced Computer Vision	2	1	0	20	20	60	100	3	Offline, chalk & Talk ,PPT
2	ESC	AI6T002	Data Science	Aq 3	1	0	20	20	60	100	3	Offline, chalk & Talk ,PPT
3	PEC	AI6TE02	Elective -II	3	0	0	20	20	60	100	3	Offline, chalk & Talk ,PPT
4	PEC	AI6TE03	Elective-III	3	0	0	20	20	60	100	3	Offline, chalk & Talk ,PPT
5	OEC	AI6O002	Open Elective-II	3	1	0	20	20	60	100	4	Offline, chalk & Talk ,PPT
6	PCC	AI6L003	Data Science using R (Lab)	0	0	2	60	0	40	100	1	Offline, chalk & Talk ,PPT
7	PCC	AI6L004	Advanced Computer Vision (Lab)	0	0	2	60	0	40	100	1	Offline, chalk & Talk ,PPT
8	PCC	AI6L005	Big Data Tools & Techniques(Lab)	0	0	2	60	0	40	100	1	Offline, chalk & Talk ,PPT
9	PROJECT	AI6P006	Mini Project	0	0	2	30	0	20	50	1	Offline, chalk & Talk ,PPT
10	PROJECT	AI6P007	CRT (Campus Recruitment Training)	0	0	2	50	0	0	50	1	Offline, chalk & Talk ,PPT
11	PROJECT	AI6P008	Skill Development	0	0	2	15	0	35	50	1	**Online**
12	IPR	AI6T007	Intellectual Property Rights	2	0	0	10	15	25	50	Audit	Offline, chalk & Talk ,PPT
				13	**3**	**12**	**385**	**115**	**500**	**1000**	**22**	

Open Elective 2: Object Oriented Methodology

7th Semester Artificial Intelligence

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				Credit	Teaching Mode
				L	T	P	CA	MSE	ESE	Total		
1	PCC	AI7T001	Cyber Security & Privacy	3	0	0	20	20	60	100	3	Offline, chalk & Talk ,PPT
2	PEC	AI7TE04	Elective-IV	3	0	0	20	20	60	100	3	Offline, chalk & Talk ,PPT
3	PEC	AI7TE05	Elective -V	3	0	0	20	20	60	100	3	Offline, chalk & Talk ,PPT
4	PCC	AI7T002	Natural Laguage Processing	3	0	0	20	20	60	100	3	Offline, chalk & Talk ,PPT
5	OEC	AI7O003	Open Elective-III	3	1	0	20	20	60	100	4	Offline, chalk & Talk ,PPT
6	PCC	AI7L003	Natural Laguage Processing(Lab)	0	0	2	60	0	40	100	1	Offline, chalk & Talk ,PPT
7	PCC	AI7L004	Cyber Security & Privacy (Lab)	0	0	2	60	0	40	100	1	Offline, chalk & Talk ,PPT
8	PROJECT	AI7P005	Project phase-I	0	0	6	50	0	50	100	5	Offline, chalk & Talk ,PPT
9	RM	AI7T006	Research Methedology	2	0	0	10	15	25	50	Audit	Offline, chalk & Talk ,PPT
				17	**1**	**10**	**280**	**115**	**455**	**850**	**23**	

8th Semester Artificial Intelligence

Sr. No.	Category of Subject	Course Code	Course Name	Teaching Scheme			Evaluation Scheme					Teaching Mode
				L	T	P	CA	MSE	ESE	Total	Credit	
1	PEC	AI8TE06	Elective –VI	3	0	0	20	20	60	100	3	Offline, chalk & Talk ,PPT
2	OEC	AI8O004	Open Elective -IV	3	1	0	20	20	60	100	4	Offline, chalk & Talk ,PPT
(Sr. No. 1, 2) OR (3)												
3	PROJECT	AI8P001	Internship	0	0	0	100	0	100	200	7	Offline, chalk & Talk ,PPT
4	PROJECT	AI8P002	Project phase-II	0	0	4	50	0	50	100	3	Offline, chalk & Talk ,PPT
5	PEC	AI8P003	NPTEL	0	0	0	25	0	25	50	2	Offline, chalk & Talk ,PPT
				6	**1**	**4**	**215**	**0**	**175**	**350**	**12**	

Note: Students will earn seven credits by selecting either professional and Open elective OR Internship

Total Credits:	I sem	18	750
	II sem	17	800
	III sem	23	1000

	IV sem	21	950
	V sem	21	950
	VI sem	22	1000
	VII sem	23	850
	VIII sem	12	350
	Total	**157**	**6650**

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
III	AI3T002	Universal Human Rights	2	1	0	3

Prerequisites for the course	
1.	Economics
2.	Civics

Prior Reading Material/useful links	
1.	https://thebusinessprofessor.com/en_US/management-leadership-organizational-behavior/organizational-economics-definition
2.	https://www.investopedia.com/terms/o/organizational-behavior.asp

Course Outcomes:

Sr. No	Course Outcome number	CO statement
1	CO1	To Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
2	CO2	To Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
3	CO3	Identify and evaluate the role of harmony in family, society and universal order.
4	CO4	To develop commitment and courage to act.
5	CO5	Evaluate coexistence of the "I" with the body.

Syllabus:

Course Contents		Hours
Unit I	**Introduction - Need, Basic Guidelines, Content and Process for Value Education** 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 fulfilment 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 **[8HRS.]**	

Unit II	**Understanding Harmony in the Human Being - Harmony in Myself!** 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 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 **[8HRS.]**
Unit III	**Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship** 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 **[8HRS.]**
Unit IV	**Understanding Harmony in the Nature and Existence - Whole existence as Coexistence** Understanding the harmony in the Nature ,Interconnectedness and mutual fulfilment 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. **[8HRS.]**
Unit V	**Implications of the above Holistic Understanding of Harmony on Professional Ethics** 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 https://www.uhv.org.in/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

	[8 HRS.]

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

Useful Links	
1.	https://www.uhv.org.in/
2.	https://www.skit.ac.in/techno-incubation-centre/universal-human-values-uhv.html

Semester	Course Code	Name of the course	L	T	P	Credits
III	**AI3T003**	Linear Algebra and Transform	2	1	0	3

Prerequisites for the course	
1.	Fourier transform, Laplace
2.	Mathematics

Prior Reading Material/useful links	
1.	https://www.youtube.com/watch?v=W6Mt_gdDiBQ
2.	https://www.youtube.com/watch?v=ldqCVtNHjsY

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.

Course Outcomes:

Sr. No	Course Outcome number	CO statement
1	CO1	Describe the concept of Laplace Transform, Fourier transform, complex variables, Numerical Linear Algebra, Stochastic calculus, Computational graph theory.
2	CO2	Illustrate the concept of Laplace Transform, Fourier transform, complex variables, Numerical Linear Algebra, Stochastic calculus, Computational graph theory by using examples.
3	CO3	Apply the concept of Laplace Transform, Fourier transform, complex variables, Numerical Linear Algebra, Stochastic calculus, Computational graph theory to solve the problem.
4	CO4	Analyze the problem by using the concept of Laplace Transform, Fourier transform, complex variables, Numerical Linear Algebra, Stochastic calculus, Computational graph theory.
5	CO5	Evaluate the problem basedon the concept of Laplace Transform, Fourier transform, complex variables, Numerical Linear Algebra, Stochastic calculus, Computational graph theory

Syllabus:

Course Contents	
Unit I	Matrices: 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]. **[8Hrs]**
Unit II	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. **[8Hrs]**
Unit III	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. **[8Hrs]**
Unit IV	Laplace Transform: Definition – conditions for existence; Properties of Laplace transforms; Transforms of some special functions- periodic function, Heaviside-unit step function. **[8Hrs]**
Unit V	Inverse Laplace Transform: 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. **[8Hrs]**

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.

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.

Useful Links	
1.	https://mathworld.wolfram.com/LaplaceTransform.html
2.	https://byjus.com/maths/laplace-transform/

Semester	Course Code	Name of the course	L	T	P	Credits
III	AI3T004	Statistical Data Analysis	3	0	0	3

Prerequisites for the course	
1.	Computer Programming
2.	Data Visualization,
3.	Statistics, Communication,

Prior Reading Material/useful links	
1.	https://www.quora.com/What-are-the-Prerequisite-to-learn-data-analytics
2.	https://www.simplilearn.com/tutorials/data-analytics-tutorial/how-to-become-a-data-analyst

Course Outcomes:

Sr. No	Course Outcome number	CO statement
1	CO1	To understand the concept of Sampling Drawing random samples from standard distributions, Distribution of a function of random variables:
2	CO2	To understand the Concept of a statistic and its sampling distribution.
3	CO3	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	CO4	To learn the Demand and Supply function, Static laws of demand and supply, price elasticity of demand, price elasticity of supply.
5	CO5	To understand the concept of Economic time series, its different components.

Syllabus:

Course Contents	
Unit I	**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 **[6 HRS.]**
Unit II	**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). **[6 HRS.]**
Unit III	**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. **[6 HRS.]**
Unit IV	**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 . **[6 HRS.]**
Unit V	**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. **[6 HRS.]**

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.	2. Hogg R. V. and Craig A. T.: Introduction to Mathematical Statistics , McMillan Publishing Company
3.	3. SudhaPurohit, GoreS.D.,Deshmukh S. R.: Statistics Using R,Narosa
4.	4. Christian S. Albright, Wayne L. Winston, Zappe Christopher J. : Decision Making using Microsoft Excel (CENGAGE Learning)
5.	5. KVS Sarma, Statistics Made Simple: Do it yourself on PC (PHI)

Useful Links	
1.	https://www.statisticssolutions.com/statistical-data-analysis/
2.	https://www.simplilearn.com/what-is-statistical-analysis-article
3.	https://www.statisticssolutions.com/statistical-data-analysis/

Semester	Course Code	Name of the course	L	T	P	Credits
III	AI3T005	Computer Architecture and Organization	3	0	0	3

Prerequisites for the course	
1.	Basic Knowledge Prior To Computer Architecture
2.	Basic Functional Units of A Computer System

Prior Reading Material/useful links	
1.	https://www.jbiet.edu.in/coursefiles/cse/HO/cse2/DLD1.pdf
2.	https://www.javatpoint.com/computer-organization-and-architecture-tutorial#:~:text=Prerequisite,of%20a%20computer%20system%2C%20etc.
3.	https://www.javatpoint.com/functional-units-of-digital-system

Course Outcomes:

Sr. No	Course Outcome number	CO statement
1	CO1	Describe the fundamental organisation of a computer system
2	CO2	Interpret the functional architecture of computing systems. (Understanding)
3	CO3	Explain addressing modes, instruction formats and program control statements
4	CO4	Distinguish the organization of various parts of a system memory hierarchy
5	CO5	Describe basic concept of parallel computing and Describe fundamentals concepts of pipeline and vector processing

Syllabus:

Course Contents	
Unit I	**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-PointNumbers and related operations Basic I/O Operations, Stacks, Queues & Subroutines. **[8 Hrs]**
Unit II	**Processing Unit:** Fundamental Concepts, Execution of a Complete Instruction, HardwiredControl, Performance Consideration, Micro-programmed Control, Microinstructions, Micro-program Sequencing, Microinstruction Pre-fetching, Emulation., Booth's Algorithm, Integer Division. **[8 Hrs]**
Unit III	I/O Organization: Accessing I/O Devices, Interrupts, Addressing Modes, Direct MemoryAccess, Bus arbitration, I/O Hardware, Processor Bus and Interfacing Circuits, Standard I/OInterfaces, SCSI Bus, Backplane Bus Standard. **[8 Hrs]**

Unit IV	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. **[8 Hrs]**
Unit V	Arithmetic: RISC philosophy, pipelining, basic concepts in pipelining, delayed branch, branch prediction, data dependency, influence of pipelining on instruction set design, multiple execution units, erformance considerations**.** **[8 Hrs]**

Text Books	
1.	V. Carl Hamacher& S. Zaky: Computer Organization, Fourth Edition, McGraw-Hill (ISE).

Reference Books	
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&KimeLogie: Computer Design Fundamentals, Second Edition, Pearson Education.

Useful Links	
1.	https://onlinecourses.nptel.ac.in/noc22_cs88/preview
2.	https://www.youtube.com/watch?v=6wz_mblxlMk

Semester	Course Code	Name of the course	L	T	P	Credits
III	AI3T006	Internet of Things	2	1	0	3

Prerequisites for the course	
1.	Basic knowledge of Programming.
2.	Basic knowledge of Mathematics.

Prior Reading Material/useful links	
1.	https://www.tutorialspoint.com/what-are-the-prerequisites-for-learning-the-internet-of-things-iot
2.	https://developer.ibm.com/articles/iot-key-concepts-skills-get-started-iot/

Course Outcomes:

Sr. No	Course Outcome number	CO statement
1	CO1	Apply the concept and application areas of IoT.
2	CO2	Identify the different technology
3	CO3	Apply IoT to different applications.
4	CO4	Analysis and evaluate protocols used in IoT
5	CO5	Design and develop smart city in IoT

Syllabus:

Course Contents	
Unit I	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 **[8Hrs]**
Unit II	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. **[8Hrs.]**
Unit III	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. **[8 Hrs.]**
Unit IV	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 **[8Hrs]**
Unit V	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 **[7Hrs.]**

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

Useful Links	
1.	https://geekflare.com/internet-of-things-iot-learning-resources/
2.	https://intellipaat.com/internet-of-things-iot-training/

Semester	Course Code	Name of the course	L	T	P	Credits
III	AI3T007	Operating System and Virtualization	2	1	0	3

Prerequisites for the course	
1.	Good knowledge of C
2.	Computer Organization and Architecture,
3.	Assembly level programming

Prior Reading Material/useful links	
1.	https://www.servermania.com/kb/articles/what-are-the-hardware-requirements-for-a-virtualization-server
2.	https://www.javatpoint.com/computer-organization-and-architecture-tutorial

Course Outcomes:

Sr. No	Course Outcome number	CO statement
1	CO1	Learn and understand the concepts, core structure of Operating Systems and basic architectural components involved in operating systems design.
2	CO2	Understand the process management policies and scheduling of processes by CPU.
3	CO3	Evaluate the requirement for process synchronization and coordination handled by operating system.
4	CO4	Describe and analyze the memory management and its allocation policies.
5	CO5	Analyse various device and resource management techniques for timesharing

Syllabus:

Course Contents		Hours
Unit I	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. **[8 HRS.]**	
Unit II	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. **[8 HRS.]**	

Unit III	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 **[8 HRS.]**
Unit IV	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, File systems Management: File concept, Access methods **[8 HRS.]**
Unit V	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. **[8 HRS.]**

Text Books	
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)

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.

Useful Links	
1.	https://www.geeksforgeeks.org/operating-system-based-virtualization/
2.	https://www.javatpoint.com/os-virtualization
3.	https://www.youtube.com/watch?v=KJzgJk1rdSs

Semester	Course Code	Name of the course	L	T	P	Credits
III	AI3L007	Internet Of Things Lab	0	0	2	1

Prerequisites for the course	
1.	Fundamentals of Operating systems

Course Outcomes:

Sr. No	Course Outcome number	CO statement
1	CO1	To understand IOT, Arduino/ Raspberry Pi, and also able to install software setup of Arduino/ Raspberry Pi
2	CO2	TO 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:

Course Contents
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

Semester	Course Code	Name of the course	L	T	P	Credits
III	AI3L010	Data Analytics (Lab)	0	0	2	1

Prerequisites for the course	
1.	Fundamentals of Mathematics

Course Outcomes:

Sr. No	Course Outcome number	CO statement
1	CO1	Understand random samples from uniform, and Normal distributions
2	CO2	Get introduced to the latest simple and weighted average of price relatives using arithmetic mean and geometric mean
3	CO3	Become an expert on series using least square method.
4	CO4	Understand the mechanics of least square method.
5	CO5	Understand base shifting of index numbers.

List of Experiments:

Course Contents
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.

Semester	Course Code	Name of the course	L	T	P	Credits
III	AI3L009	Introduction to Robotics-(Lab)	0	0	2	1

Prerequisites for the course	
1.	Fundamentals of Mathematics

Course Outcomes:

Upon Completion of the course, the students will acquire knowledge about

Sr. No	Course Outcome number	CO statement
1	CO1	Microcontroller Atmega8, Arduino Board., different sensors
2	CO2	Various types of robots .mean
3	CO3	Interfacing of Microcontroller and Arduino board with stepper motors, servo motor etc.

List of Experiments:

Course Contents
1. 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.

Program: B. Tech in Artificial Intelligence

Semester	Course Code	Name of the course	L	T	P	Credits
4rth	AI4T004	Neural Networks & Fuzzy System	3	0	0	3

Prerequisites for the course	
1	A basic Concept of AI.
2	Mathematics.

Prior Reading Material/useful links	
1	https://www.geeksforgeeks.org/difference-between-neural-network-and-fuzzy-logic/
2	https://www.tutorialspoint.com/fuzzy_logic/fuzziness_in_neural_networks.htm
3	https://aits-tpt.edu.in/wp-content/uploads/2022/05/Neural-Networks-and-Fuzzy-Logic-19APC0216-min.pdf

Course Outcomes:
Students will be able to:

Sr. No	Course outcome number	CO statement
1	CO1	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	CO2	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	CO3	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	CO4	Students will be able to understand the basics of fuzzy sets, its operations and the need for fuzzy logic.
5	CO5	Students will be able to understand fuzzy numbers, fuzzy relations and extension principle.

Syllabus:

Course Contents	
Unit I	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 **[7Hrs]**
Unit II	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**.** **[7Hrs]**
Unit III	Mathematical foundations of Discrete time Hopfield networks, Hopfield learning algorithm, clustering and similarity measures, Self-Organizing Feature Maps, Applications of artificial neural networks. **[7 Hrs]**
Unit IV	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. **[7 Hrs]**
Unit V	Fuzzy Arithmetic: fuzzy numbers, Linguistics variables, arithmetic operations on fuzzy numbers, Fuzzy relations, extension principles for fuzzy sets. **[8Hrs]**
Text Books	
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 2ndEditionD. DriankovNarosa Pub. House,
3	Artificial Neural Networks 1999 Yegnanarayana PHI
Useful links	
1	https://www.geeksforgeeks.org/difference-between-neural-network-and-fuzzy-logic/
2	https://www.tutorialspoint.com/fuzzy_logic/fuzziness_in_neural_networks.htm
3	https://www.youtube.com/watch?v=xwUKQcT1bKc

Semester	Course Code	Name of the course	L	T	P	Credits
4th	AI4T005	Discrete Mathematics & Graph Structures	2	1	0	3

Prerequisites for the course	
1	Mathematics ,probability
2	Data Structure,stack,queue

Prior Reading Material/useful links	
1	https://www.javatpoint.com/graph-theory-in-discrete-mathematics
2	https://www.youtube.com/watch?v=HkNdNpKUByM
3	https://www.youtube.com/watch?v=HipVU5vz3Q8

Course Outcomes:
Students will be able to:

Sr. No	Course outcome number	CO statement
1	CO1	Describe the concept of probability, statistics, logic and concept of set, group theory, graph theory, combinatorics.
2	CO2	Illustrate the concept of probability, statistics, logic and concept of set, group theory, graph theory, combinatorics by using examples.
3	CO3	Apply the concept of probability, statistics, logic and concept of set, group theory, graph theory, combinatorics to solve the problem.
4	CO4	Analyze the problem by using the concept of probability, statistics, logic and concept of set, group theory, graph theory, combinatorics.
5	CO5	Evaluate the problem based on the concept of probability, statistics, logic and concept of set, group theory, graph theory, combinatorics.

Syllabus:

Course Contents	
Unit I	**Numerical Methods** Error analysis, Solutions of algebraic and transcendental equations. Bisection method, Newton-Raphson method and their convergences. Solution of system of linear equations by Gauss Seidel method, Gauss elimination method, Crout's method. **[8Hrs]**
Unit II	**Mathematical Expectation** Mathematical Expectation, Variance and standard deviation ,Moments and moment generating function , Characheteristic function, Expectation and Varaince for joint distribuation and covariance, Conditional Expectation , Variance and moments. **[8Hrs]**

Unit III	**Joint Probability and Random Variable** Joint Distribution of Discerete Random Variable: Joint Probability Function of DRV,Join Distribution Function of DRV ,Marginal Probability Function of DRV, Joint Distribution of Continuous Random Variable: Joint Probability Function of CRV,Join Distribution Function of CRV ,Marginal Probability Function of CRV. **[7Hrs]**
Unit IV	**Mathematical Logic and set theory** Propositions and Logical Operation, Quantifiers, Conditional Statements and Tautologies, Method of Proof,Principle of Mathematical Induction. Basic concept of set theory, Operations on sets, The power set. **[7Hrs]**
Unit V	**Group Theory** Binary Operations , Properties , Semigroups ,Monoids, subsemigroup, Submonoid, Isomorphism and Homomorphism, Group (only definition and xamples) Subgroups and Homomorphism Cosets and Lagrange's theorem, Normal subgroups. **[7Hrs]**
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.
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**.**
Useful links	
1	https://www.youtube.com/watch?v=HipVU5vz3Q8
2	https://www.youtube.com/watch?v=HkNdNpKUByM
3	https://www.tutorialspoint.com/discrete_mathematics/graph_and_graph_models.htm

Semester	Course Code	Name of the course	L	T	P	Credits
4th	AI4T006	Database Management System	3	0	0	3

Prerequisites for the course	
1	Mathematics
2	Data Structure,stack,queue
3	Operating System.

Prior Reading Material/useful links	
1	https://www.javatpoint.com/dbms-tutorial
2	https://www.geeksforgeeks.org/introduction-of-dbms-database-management-system-set-1/
3	https://www.techtarget.com/searchdatamanagement/definition/database-management-system

Course Outcomes:

Students will be able to:

Sr. No	Course outcome number	CO statement
1	CO1	To understand the need of database management.
2	CO2	To design and implement a database schema for a given problem-domain
3	CO3	To normalize a database
4	CO4	To create and query a database using SQL DML/DDL commands, stored procedures and functions.
5	CO5	To declare and enforce integrity constraints on a database

Syllabus:

Course Contents	
Unit I	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) **[7Hrs]**
Unit II	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. **[8Hrs]**

Unit III	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). **[7Hrs]**
Unit IV	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. **[7Hrs]**
Unit V	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) . **[7Hrs]**
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.
Useful links	
1	https://www.javatpoint.com/dbms-tutorial
2	https://www.geeksforgeeks.org/introduction-of-dbms-database-management-system-set-1/
3	https://www.techtarget.com/searchdatamanagement/definition/database-management-system

Semester	Course Code	Name of the course	L	T	P	Credits
4rth	AI4L006	DSA (Lab)	0	0	2	1

Course Outcomes:

Sr. No	Course Outcome number	CO statement
1	CO1	To design and analyze the ~~time and space~~ efficiency of the data structure
2	CO2	To identity the appropriate data structure for given problem
3	CO3	To apply the knowledge of data structures and algorithm to solve the problem

Syllabus:

Course Contents
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

Semester	Course Code	Name of the course	L	T	P	Credits
4rth	AI4L008	Neural Networks & Fuzzy System(LAB)	0	0	2	1

Course Outcomes:

Sr. No	Course Outcome number	CO statement
1	CO1	Focus on the mathematical foundations of neural network theory and to understand the working of Neural Networks as pattern classifier:
2	CO2	Comprehend the neural networks as means for computational learning and to analyze the basic network architectures and algorithms
3	CO3	Effectively use existing software tools to solve real problems using a neural network approach
4	CO4	To understand the basics of fuzzy sets, its operations and the need for fuzzy logic
5	CO5	To apply fuzzy numbers, their operations and fuzzy inference techniques to model the human intelligence

Syllabus:

Course Contents
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

Semester	Course Code	Name of the course	L	T	P	Credits
4rth	AI4L009	Database Management System(Lab)	0	0	2	1

Course Outcomes:

Sr. No	Course Outcome number	CO statement
1	CO1	Apply the basic concepts of Database Systems and Applications:
2	CO2	Use the basics of SQL and construct queries using SQL in database creation and interaction
3	CO3	Design a commercial relational database system (Oracle, MySQL) by writing SQL using the system.
4	CO4	Analyze and Select storage and recovery techniques of database system

Syllabus:

0. Introduction to DBMS Lab.
1. To study DDL, DML, DCL, TCL commands.
2. To Implement Data Definition Language (Create, Alter, Drop, Truncate, and Rename).
3. To implement Data Manipulation Language commands on the database (Insert, Update, and Delete).
4. To Implement various types of integrity constraints (NOT NULL Constraint, DEFAULT Constraint, UNIQUE Constraint, PRIMARY Key, FOREIGN Key, CHECK Constraint).
5. To Implement SELECT command with different clauses (Where clause, having clause, Group by clause, Order by clause).
6. To perform set operations using DML Commands.
7. To implement Group function (AVG, MIN, MAX, SUM).
8. To Implement various types of joins (Left Join, Right Join, Outer Join, and Inner Join).

Beyond syllabus

9. To develop procedures and function for various operations.
10. To study about various DBMS tools.

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

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(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 2022-23

VISION	MISSION
To evolve as a center that provides excellent learning and research environment for nurturing future management professionals.	1. To develop in the student's strong domain knowledge anda passion for lifelong learning. 2. To develop managerial and leadership skills in the students along with a strong sense of ethics, social responsibilities and Professional values.

Program: B. Tech in Artificial Intelligence

Semester	Course Code	Name of the course	L	T	P	Credits
5th	AI5T001	AI & Cognitive Robotics	3	0	0	3

Prerequisites for the course	
1	Mathematics
2	Graphs
3	Introduction to machine learning

Prior Reading Material/useful links	
1	https://medium.datadriveninvestor.com/mathematics-behind-robotics-9d1790b33828
2	https://spectrum.ieee.org/state-of-ai-2023

Course Outcomes:
Students will be able to:

Sr. No	Course outcome number	CO statement
1	CO1	Apply the various searching techniques, constraint satisfaction problem and example problems game playing techniques
2	CO2	Analyze important historical and current trends addressing artificial intelligence.
3	CO3	Summarize the learning methods adopted in AI.
4	CO4	Design the main types of cognitive robots and their driving requirements (engineering operations, navigation, cooperation).
5	CO5	Apply advanced methods for creating highly capable cognitive robots.

Syllabus:

Course Contents	
Unit I	**Introduction of AI** AI History and applications, Overview of AI application areas, game playing, automated reasoning and theorem proving, expert systems, natural language understanding, planning and robotics, machine learning and Alan Turing Test, Intelligent Agents. **[8Hrs]**
Unit II	**AI Learning Models:** Concept of learning, learning automation, Knowledge-Based Classification Inductive Learning, Deductive Learning: Feedback Based Classification Unsupervised Learning, Supervised Learning, Semi-supervised learning and Reinforcement Learning. **[7Hrs]**
Unit III	. **Cybernetic View of Robot Cognition and Perception:** Introduction to the Model of Cognition, Visual Perception, Visual Recognition, Machine Learning, Soft Computing Tools and Robot Cognition. **[7 Hrs]**
Unit IV	**Randomized Path Planning:** Introduction, Representation of the Robot's Environment, Review of configuration spaces, Visibility Graphs, Voronoi diagrams, Potential Fields and Cell Decomposition, planning with moving obstacles, Probabilistic Roadmaps, Rapidly exploring random trees, Execution of the Quad tree-Based Path Planner Program. **[8 Hrs]**
Unit V	**Introduction to Cognitive robotics and Human Robot Interaction:** Introduction to Cognitive Robotics, Overview of robot technologies, sensors and actuators, Robot platforms, Machine learning for robotics, Developmental Robotics, Neuro-robotics, Evolutionary and swarm robotics, Social robotics and human-robot interaction, Language learning and speech interfaces, Robot tutors for hildren, Ethics for robotics and AI **[8 Hrs]**
Text Books	
1	E. Rich and K. Knight, "Artificial intelligence", TMH, 2nd ed., 1992.
2	N.J. Nilsson, "Principles of AI", Narosa Publ. House, 1990.
3	D.W. Patterson, "Introduction to AI and Expert Systems", PHI, 1992.
Reference Books	
1	R.J. Schalkoff, "Artificial Intelligence -an Engineering Approach", McGraw Hill . Ed., Singapore, 1992.
2	John J. Craig, "Introduction to Robotics Mechanics and Control", Pearson Education Inc.,
3	Artificial Intelligence: A Modern Approach, Stuart Russell and Peter Norvig, Prentice Hall, 3rd edition 2009 PGAI&ML102T: Natural Language Processing Teaching Scheme Examination Sch.,
Useful links	
1	https://www.academia.edu/41491082/Artificial_intelligence_Cognitive_Robotics_and_Human_Psychology
2	https://onlinecourses.nptel.ac.in/noc20_me92/preview

Semester	Course Code	Name of the course	L	T	P	Credits
5th	AI5T002	Digital Image Techniques and Analysis	2	1	0	3

Prerequisites for the course	
1	Mathematics
2	Signals and systems
3	Some basic programming Skills.

Prior Reading Material/useful links	
1	https://www.cis.rit.edu/class/simg718/718_DIP_notes_small_2012-01-25.pdf

Course Outcomes:
Students will be able to:

Sr. No	Course outcome number	CO statement
1	CO1	develop computer architecture.
2	CO2	Interpret image storage, sampling, and frequency domain processing operations.
3	CO3	evaluate current technologies and issues that are specific to image processing systems.
4	CO4	analyse different motion compensation techniques.
5	CO5	integrate concepts of various image processing algorithms.

Syllabus:

Course Contents	
Unit I	**Fundamentals: Need** for DIP- Fundamental steps in DIP – Elements visual perception - Image sensing and Acquisition – Image Sampling and Quantization – Imaging geometry, discrete image mathematical characterization. **[8Hrs]**
Unit II	**[Image Transforms: Two** dimensional Fourier Transform- Properties – Fast Fourier Transform – Inverse FFT, Discrete cosine transform and KL transform. -Discrete Short time Fourier Transform- Wavelet Transform- Discrete Wavelet Transform- and its application in Compression. **[8Hrs]**
Unit III	**Image Enhancement** Spatial **Domain**: Basic relationship between pixels- Basic Gray Level Transformations – Histogram Processing – Smoothing spatial filters- Sharpening spatial filters. **Frequency Domain**: Smoothing frequency domain filters- sharpening frequency domain filters Homomorphic filtering. **[7Hrs]**
Unit IV	**Image Restoration:** Overview of Degradation models –Unconstrained and constrained Restorations-Inverse Filtering, WienerFilter. **[7Hrs]**
Unit V	**Feature Extraction**: Detection of discontinuities – Edge linking and Boundary detection- Thresholding- -Edge based segmentation-Region based Segmentation-matching-Advanced optimal border and surface detection- Use of motion in segmentation. Image Morphology – Boundary descriptors- Regional descriptors. Image Reconstruction from Projections: Need- Radon Transform – Back projection operator- Projection Theorem- Inverse Radon Transform. **[7Hrs]**

Text Books	
1	Rafael C.Gonzalez & Richard E.Woods – Digital Image Processing – Pearson Education- 2/e – 2004.
2	Anil.K.Jain – Fundamentals of Digital Image Processing- Pearson Education- 2003.
Reference Books	
1	R B.Chanda & D.Dutta Majumder – Digital Image Processing and Analysis – Prentice Hall of India – 2002
2	William K. Pratt – Digital Image Processing – John Wiley & Sons-2/e, 2004
Useful links	
1	https://www.iare.ac.in/sites/default/files/lecture_notes/DIP-LECTURE_NOTES.pdf
2	https://www.mathworks.com/videos/introduction-to-matlab-with-image-processing-toolbox-90409.html

Semester	Course Code	Name of the course	L	T	P	Credits
5th	AI5T003	Introduction to Deep Learning	2	1	0	3

Prerequisites for the course	
1	Mathematics

Prior Reading Material/useful links	
1	https://www.atmos.albany.edu/facstaff/timm/ATM315spring14/R/IPSUR.pdf

Course Outcomes:
Students will be able to:

Sr. No	Course outcome number	CO statement
1	CO1	Apply the mathematical foundations of neural network models
2	CO2	Design and implement neural network systems to solve real world problems.
3	CO3	To demonstrate knowledge of the machine learning literature.
4	CO4	To describe how and why machine learning methods work.
5	CO5	To select and apply appropriate machine learning methods to a selected problem

Syllabus:

Course Contents	
Unit I	**Introduction to Machine Learning:** Machine Learning, Types of Machine Learning, Issues in Machine Learning, Application of Machine Learning, steps in developing a Machine Learning Application. **[7Hrs]**
Unit II	**Learning with Regression and trees:** Learning with Regression: Linear Regression, Logistic Regression. Learning with Trees**:** Decision Trees, Constructing Decision Trees using Gini Index, Classification and Regression Trees (CART). **[8Hrs]**
Unit III	**Learning with Classification and clustering:** **Classification:** Rule based classification, classification by Bayesian Belief networks, Hidden Markov Models. **Support Vector Machine**: Maximum Margin Linear Separators, Quadratic Programming solution to finding maximum margin separators, Kernels for learning non-linear functions. **Clustering:** Expectation Maximization Algorithm, Supervised learning after clustering, Radial Basis functions. **[8 Hrs]**
Unit IV	Basics of artificial neural networks (ANN): Artificial neurons, Computational models of neurons, Structure of neural networks, Functional units of ANN for pattern recognition tasks **[7Hrs]**
Unit V	Recurrent neural networks (RNNs): Sequence modeling using RNNs, Back propagation through time, Long Short Term Memory (LSTM), Bidirectional LSTMs, Bidirectional RNNs, Gated RNN Architecture **[7Hrs]**
Text Books	
1	Ian Goodfellow, Yoshua Bengio and Aaron Courville, Deep learning, In preparation for MIT Press, Available online: http://www.deeplearningbook.org, 2016

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 Publishin
Useful links	
1	https://www.ibm.com/cloud/watson-studio?utm_content=SRCWW&p1=Search&p4=43700075479749018&p5=e&gclid=
2	https://csedu.iiitd.ac.in/module_syllabus/Aug2022/ML%20Course%20Syllabus-Aug2022.pdf

Semester	Course Code	Name of the course	L	T	P	Credits
5th	AI5TE01A	Probability and Statistics Using R	3	0	0	3

Prerequisites for the course	
1	Mathematics ,probability,Combinotorics

Prior Reading Material/useful links	
1	https://www.atmos.albany.edu/facstaff/timm/ATM315spring14/R/IPSUR.pdf

Course Outcomes:
Students will be able to:

Sr. No	Course outcome number	CO statement
1	CO1	Knowledge about R and its basic operations-creating a vector, importing data, saving output and graphics using R.
2	CO2	Ability to represent data diagrammatically and graphically, compute correlation, regression and to fit discrete and continuous distributions using R
3	CO3	Analyze the data using ANOVA, testing for proportions and means, Able to carry out chi square test and non-parametric tests.
4	CO4	understand the central tendency, correlation and correlation coefficient and also regression
5	CO5	observe and analyze the behavior of various discrete and continuous probability distributions

Syllabus:

Course Contents	
Unit I	**Fundamentals:** Introduction, how to run R, R Sessions and Functions, Basic Math, Variables, Data Types, Vectors, Conclusion, Advanced Data Structures, Data Frames, Lists, Matrices, Arrays, Classes. **[8Hrs]**
Unit II	R Programming Structures, Control Statements, Loops, - Looping Over Nonvector Sets,- If-Else, Arithmetic and Boolean Operators and values, Default Values for Argument, Return Values, Deciding Whether to explicitly call return- Returning Complex Objects, Functions are Objective, No Pointers in R, Recursion, A Quicksort Implementation-Extended Extended Example: A Binary Search Tree**.** **[8Hrs]**
Unit III	Doing Math and Simulation in R, Math Function, Extended Example Calculating Probability- Cumulative Sums and Products-Minima and Maxima- Calculus, Functions Fir Statistical Distribution, Sorting, Linear Algebra Operation on Vectors and Matrices, Extended Example: Vector cross Product- Extended Example: Finding Stationary Distribution of Markov Chains, Set Operation, Input /out put, Accessing the Keyboard and Monitor, Reading and writer Files. **[7Hrs]**
Unit IV	Graphics, Creating Graphs, The Workhorse of R Base Graphics, the plot() Function – Customizing Graphs, Saving Graphs to Files. Probability Distributions, Normal Distribution- Binomial Distribution- Poisson Distributions Other Distribution,

	Basic Statistics, Correlation and Covariance, T-Tests,-NOVA. **[7Hrs]**
Unit V	Linear Models, Simple Linear Regression, -Multiple Regression Generalized Linear Models, Logistic Regression, - Poisson Regression- other Generalized Linear Models-Survival Analysis, Nonlinear Models, Splines- Decision- Random Forests,. **[7Hrs]**
Text Books	
1	The Art of R Programming, Norman Matloff, Cengage Learning
2	Anil.K.Jain – Fundamentals of Digital Image Processing- Pearson Education-2003.
Reference Books	
1	R Cookbook, PaulTeetor, Oreilly.
2	R in Action,Rob Kabacoff, Manning
Useful links	
1	https://www.upf.edu/documents/8055191/230954764/modernstatisticalcinR_S20.pdf/e9f939ff-f82e-9abc-4ea1-674fa068cb0c
2	https://ocw.mit.edu/courses/18-05-introduction-to-probability-and-statistics-spring-2014/pages/syllabus/

Semester	Course Code	Name of the course	L	T	P	Credits
5th	AI5TE01A	Advanced Java Programming	3	0	0	3

Prerequisites for the course	
1	Basic Java

Prior Reading Material/useful links	
1	https://www.w3schools.com/java/java_intro.asp

Course Outcomes:
Students will be able to:

Sr. No	Course outcome number	CO statement
1	CO1	Implement Networking and Data base connectivity in Java for given application
2	CO2	Implement webpage with dynamic content and server-side web application using Servlet and JSP
3	CO3	Use web application framework JSF to build user interfaces.
4	CO4	Use Object Relation Mapping using Hibernate to build database
5	CO5	Apply Model-View-Controller architecture to build complex client-server applications

Syllabus:

Course Contents	
Unit I	Java Networking Network Basics and Socket overview, TCP/IP client sockets, URL, TCP/IP server sockets, Datagrams, java.net package Socket, Server Socket, InetAddress, URL, URLConnection. **[7Hrs]**
Unit II	**[**JDBC Programming The JDBC Connectivity Model, Database Programming: Connecting to the Database, Creating a SQL Query, Getting the Results, Updating Database Data, Error Checking and the SQLException Class, The SQLWarning Class, The Statement Interface, PreparedStatement, CallableStatement The ResultSet Interface, Updatable Result Sets, JDBC Types, Executing SQL Queries, ResultSetMetaData, Executing SQL Updates, Transaction Management. **[8Hrs]**
Unit III	Servlet API and Overview Servlet Model: Overview of Servlet, Servlet Life Cycle, HTTP Methods Structure and Deployment descriptor ServletContext and ServletConfig interface, Attributes in Servelt, Request Dispacher interfaceThe Filter API: Filter, FilterChain, Filter Config Cookies and Session Management: Understanding state and session, Understanding Session Timeout and Session Tracking, URL Rewriting. **[8Hrs]**
Unit IV	Java Server Faces2.0 Introduction to JSF, JSF request processing Life cycle, JSF Expression Language, JSF Standard Component, JSF Facelets Tag, JSF Convertor Tag, JSF Validation Tag, JSF Event Handling and Database Access, JSF Libraries: PrimeFaces **[7Hrs]**
Unit V	Java Web Frameworks: Spring MVC Overview of Spring, Spring Architecture, bean life cycle, XML Configuration on Spring, Aspect – oriented Spring, Managing Database, Managing Transaction **[7Hrs]**

Text Books	
1	Black Book " Java server programming" J2EE, 1st ed., Dream Tech Publishers, 2008. 3. Kathy walrath "
2	Professional Java Server Programming by Subrahmanyam Allamaraju, Cedric Buest Wiley Publication
Reference Books	
1	Advanced Java, M. T. Savaliya, dreamtech
2	JSF2.0 CookBook, Anghel Leonard, PACKT publication
Useful links	
1	https://www.youtube.com/watch?v=Ae-r8hsbPUo
2	https://leverageedu.com/blog/advanced-java-course/

Semester	Course Code	Name of the course	L	T	P	Credits
5th	AI5TE01C	NoSQL Database	3	0	0	3

Prerequisites for the course	
1	Basic Knowledge about DBMS

Prior Reading Material/useful links	
1	https://www.w3schools.com/sql/sql_intro.asp#:~:text=SQL%20stands%

Course Outcomes:
Students will be able to:

Sr. No	Course outcome number	CO statement
1	CO1	Explain and compare different types of NoSQL Databases
2	CO2	Compare and contrast RDBMS with different NoSQL databases.
3	CO3	Demonstrate the detailed architecture and performance tune of Document-oriented NoSQL databases.
4	CO4	Explain performance tune of Key-Value Pair NoSQL databases
5	CO5	Apply Nosql development tools on different types of NoSQL Databases.

Syllabus:

Course Contents	
Unit I	Overview and History of NoSQL Databases. Definition of the Four Types of NoSQL Database, The Value of Relational Databases, Getting at Persistent Data, Concurrency, Integration, Impedance Mismatch, Application and Integration Databases, Attack of the Clusters, The Emergence of NoSQL, Key Point. **[7Hrs]**
Unit II	Comparison of relational databases to new NoSQL stores, MongoDB, Cassandra, HBASE, Neo4j use and deployment, Application, RDBMS approach, Challenges NoSQL approach, Key-Value and Document Data Models, Column-Family Stores, Aggregate-Oriented Databases. Replication and sharding, MapReduce on databases. Distribution Models, Single Server, Sharding, Master-Slave Replication, Peer-to-Peer Replication, Combining Sharding and Replication **[8Hrs]**
Unit III	NoSQL Key/Value databases using MongoDB, Document Databases, Document oriented Database Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Web Analytics or Real-Time Analytics, E-Commerce Applications, Complex Transactions Spanning Different Operations, Queries against Varying Aggregate Structure. **[8Hrs]**
Unit IV	NoSQL Key/Value databases using Riak, Key-Value Databases,Key-Value Store, Key-Value Store Features, Consistency, Transactions, Query Features, Structure of Data, Scaling, Suitable Use Cases, Storing Session Information, User Profiles, Preferences, Shopping Cart Data,Relationships among Data, Multi operation Transactions. **[7Hrs]**
Unit V	Column- oriented NoSQL databases using Apache HBASE, Column-oriented NoSQL databases using Apache Cassandra, Architecture of HBASE, Column-Family Data Store Features, Consistency, Transactions, Availability, Query

	Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Counters, Expiring Usage. **[7Hrs]**
Text Books	
1	Sadalage, P. & Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Wiley Publications,1st Edition ,2019."
Reference Books	
1	Dan Sullivan, "NoSQL For Mere Mortals", 1st Edition, Pearson Education India, 2015. (ISBN13: 978-9332557338)
2	Kristina Chodorow, "Mongodb: The Definitive Guide- Powerful and Scalable Data Storage", 2nd Edition, O'Reilly Publications, 2013. (ISBN-13: 978-9351102694)
Useful links	
1	https://www.ibm.com/in-en/topics/nosql-
2	https://www.trustradius.com/nosql-databases

Semester	Course Code	Name of the course	L	T	P	Credits
5th	AI5TE01D	AI in Business Intelligence	3	0	0	3

Prerequisites for the course	
1	Machine learning

Prior Reading Material/useful links	
1	https://www.forbes.com/sites/bernardmarr/2022/11/02/beyond-dashboards-the-future-of-analytics-and-business-intelligence/

Course Outcomes:
Students will be able to:

Sr. No	Course outcome number	CO statement
1	CO1	Student will learn concept, process, and practice of the data science and how methodologies are applied to visualize information from raw data.
2	CO2	To encourage and to motivate students for predictive, statistical and practical understanding of BI concepts and techniques..
3	CO3	To understand and apply BI Techniques to various situations...
4	CO4	Implementation of BI techniques by Weka, Pentaho & Talend Tools
5	CO5	Solve problems using power BI tool.

Syllabus:

Course Contents	
Unit I	Introduction to Business Intelligence: Importance of AI for business intelligence, BI concept, BI architecture, BI in today's perspective, BI Process, Applications of BI like Financial analysis, statistical analysis, sales analysis, CRM, result pattern and ranking analysis, Balanced Scorecard, BI in Decision Modelling: Optimization, Decision making under uncertainty. Ethics and business intelligence. **[7Hrs]**
Unit II	Data Science: The concept, process and typical tools in data science. Example of different algorithms i.e segmentation, classification, validation, regressions, recommendations. Exercises using Excel and R to work on histograms, regression, clustering and text analysis. Co-relation between Algorithm and Code in data science. **[8Hrs]**
Unit III	Data Visualization and Dashboard Design:Responsibilities of BI analysts by focusing on creating data visualizations and dashboards. Importance of data visualization, types of basic and composite charts.Performance Dashboard: Measuring, Monitoring and management of Business, KPIs and dashboard, the types of dashboards , the common characteristics of Enterprise dashboard, design of enterprise dashboards, and the common pitfalls of dashboard design **[8Hrs]**
Unit IV	Modelling and Analysis :Exploring Excel Modelling capabilities to solve business problems, summarize and present selected data, introduction to business metrics and KPIs, creating cubes using Microsoft Excel. **[7Hrs]**

Unit V	Machine learning to scale business intelligence, role of machine learning in BI, Machine learning and BI tools . Introduction to Power BI tool. **[7Hrs]**
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.
Reference Books	
1	Efraim Turban, Ramesh Sharda, Dursun Delen, "Decision Support and Business Intelligence Systems", 9th Edition, Pearson 2011.
2	Business Intelligence – Grundlagen und praktische Anwendungen: Eine Einführung in die IT" by Hans-Georg Kemper and Henning Baars
Useful links	
1	toptal.com/insights/innovation/ai-vs-bi-differences-and-synergies
2	https://www.forbes.com/sites/bernardmarr/2022/11/02/beyond-dashboards-the-future-of-analytics-and-business-intelligence/

Semester	Course Code	Name of the course	L	T	P	Credits
5th	**AI5L004**	Introduction to Deep Learning (LAB)	0	0	2	1

Prerequisites for the course	
1	Machine learning

Prior Reading Material/useful links	
1	https://www.forbes.com/sites/bernardmarr/2022/11/02/beyond-dashboards-the-future-of-analytics-and-business-intelligence/

Course Outcomes:
Students will be able to:

Sr. No	Course outcome number	CO statement
1	CO1	Understand the implementation procedures for the machine learning algorithms.
2	CO2	Design Java/Python programs for various Learning algorithms
3	CO3	Apply appropriate data sets to the Machine Learning algorithms.
4	CO4	Identify and apply Machine Learning algorithms to solve real world problems

Syllabus:

Course Contents
1. Write a program to find mean mode and median of given user input. 2. Study of Python Basic Libraries such as Statistics, Math, Numpy and Scipy. 3. Write a Python program to implement Simple Linear Regression. 4. Write a program to demonstrate the working of the decision tree based ID3 algorithm. 5. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set 6. Implementation of K-Means Clustering 7. Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets. **8.** Performance analysis of Classification Algorithms on a specific dataset (Mini Project)

Semester	Course Code	Name of the course	L	T	P	Credits
5th	AI5L004	Digital Image Techniques & Analysis (Lab)	0	0	2	1

Prerequisites for the course	
1	Mathematics
2	Signals and systems
3	Some basic programming Skills.

Prior Reading Material/useful links	
1	https://www.cis.rit.edu/class/simg718/718_DIP_notes_small_2012-01-25.pdf

Course Outcomes:
Students will be able to:

Sr. No	Course outcome number	CO statement
1	CO1	Students will become familiar with MATLAB Software
2	CO2	Students will know the basic concepts of image processing
3	CO3	Students will become familiar with various methods of edge detection.
4	CO4	Students will come to know how the images are process by applying techniques.
5	CO5	Students will able to develop a project on Image Processing

Syllabus:

Course Contents
1. To study Digital Image Processing and MATLAB Software 2. Write a program to display an image as a grayscale image. 3. Write a program to display any image as a histogram 4. Write a program to enhance an image properties using combination of spatial filters. 5. Write a program to display an image in RED, Grayscale, GREEN and BLUE. 6. Write a program to show salt and pepper noise, Gaussian noise in an image 7. Write a program to implement Negative image transformation and 8. Write a program to apply flip operation in an image. 9. Write a program to detect face from an image. 10. Write a program to show First order edge detection using prewitt operator, canny operator, sobel operator

Semester	Course Code	Name of the course	L	T	P	Credits
5	AI5L004	AI & Cognitive Robotics (Lab)	0	0	2	1

Prerequisites for the course	
1	Mathematics
2	Signals and systems
3	Some basic programming Skills.

Prior Reading Material/useful links	
1	https://www.cis.rit.edu/class/simg718/718_DIP_notes_small_2012-01-25.pdf

Course Outcomes:
Students will be able to:

Sr. No	Course outcome number	CO statement
1	CO1	Use of any robotic simulation software to model the different types of robots and calculate work volume for different robots
2	CO2	Traditional robot programming might come to an end once all the basic behaviours of the robot are realized in code

Syllabus:

Course Contents
1. Define ERGO program. 2. Determine ERGO programming language and its datatypes. 3. Describe sum-up and cube function with their functions in advanced programming. 4. Understand the concept of language primitives of Scheme- Numbers, Strings,Lists,symbols, Boolean values, Hash Table, Vectors and Arrays. 5. Deterministic programming- The: act and: begin primitives. The: act and :begin primitives, The: while and :for-all primitives 6. Write an ERGO program to get to an arbitrary room by first calculating the shortest path 7. Understand programming concept of LEGO Robot. 8. Perform a program for the robotic version of the Towers of Hanoi. 9. Perform the program for JoyRide car to be controlled by ERGO. **10.** Perform the odd bar problem, with 12 bars and 3 weighings allowed**.**

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-

Semester	Course Code	Name of the course	L	T	P	Credits
6th sem	AI6T001	Advanced Computer Vision	2	1	0	3 Credits

Prerequisites for the course	
1	A basic understanding of Data structures.
2	A basic concept of Probability and Statistics.
3	A basic Programming in any high-level language
4	A basic understanding Artificial Intelligence.

Prior Reading Material/useful links	
1	Read more at: https://viso.ai/computer-vision/computer-vision-books
2	https://www.freecodecamp.org/news/advanced-computer-vision-with-python/
3	Concise Computer Vision: An Introduction into Theory and Algorithms

Course Outcomes:

Sr. No	Course outcome number	CO statement
1	CO1	Appreciate the detailed models of image formation.
2	CO2	Analyze the techniques for image feature detection and matching.
3	CO3	Apply various algorithms for pattern recognition.
4	CO4	Examine various Object recognition techniques.
5	CO5	Analyze structural pattern recognition and feature extraction techniques

Syllabus:

Course Contents	
Unit I	Image Formation Models: Monocular imaging system, Orthographic & Perspective Projection, Cameras – lenses, projections, sensors, Radiometry –Measuring Light, light and surfaces Representation – color spaces, Camera model and Camera calibration, Binocular imaging systems, Sources, Shadows and Shading. **[6Hours]**
Unit II	2D/3D Vision: Filters, Binary Images, Features, Edge Detection, Texture, Shape, Segmentation, Clustering, Model Fitting, Probabilistic, 3D Vision: Multiview geometry, Stereo, Shape from X,3D data. **[8Hours]**
Unit III	Image Processing and Feature Extraction: Image representations (continuous and discrete), Linear Filters, Texture, Edge detection. **[6 Hours]**
Unit IV	Motion Estimation: Regularization theory, Optical computation, Stereo Vision, Motion estimation, Structure from motion. Shape Representation and Segmentation: Deformable curves and surfaces, Snakes and active contours, Level

	set representations, Fourier and wavelet descriptors, Medial representations, Multiresolution analysis. **[6Hours]**
Unit V	Object recognition: Hough transforms and other simple object recognition methods, Shape correspondence and shape matching, Principal component analysis, Shape priors for recognition. [**6 Hours]**
Text Books	
1	Computer Vision: A Modern Approach by D. A. Forsyth and J. Ponce, Prentice Hall, 2003/2011
2	Computer Vision by Linda Shapiro and George Stockman, Prentice-Hall, 2001
3	Practical Deep Learning for Cloud, Mobile & Edge
Reference Books	
1	Robot Vision, by B. K. P. Horn, McGraw-Hill. 1986
2	Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, March 2004.
3	Computer Vision: Algorithms and Applications by Richard Szeliski
Useful links	
1	Read more at: https://viso.ai/computer-vision/computer-vision-books
2	https://in.coursera.org/learn/advanced-computer-vision-with-tensorflow
3	https://www.udemy.com/course/advanced-computer-vision/
4	https://www.freecodecamp.org/news/advanced-computer-vision-with-python/

Semester	Course Code	Name of the course	L	T	P	Credits
6th	AI6T002	Data Science	2	1	0	3 Credit

Prerequisites for the course	
1	A basic of AI and Machine learning.
2	A Basic of Python programming.
3	A basics of data mining.
4.	A basics of probability and statistics.

Prior Reading Material/useful links	
1	https://builtin.com/data-science
2	https://in.coursera.org/browse/data-science
3	https://ischoolonline.berkeley.edu/data-science/what-is-data-science/

Course Outcomes:

Sr. No	Course outcome number	CO statement
1	CO1	To build the fundamentals of data science.
2	CO2	To Apply Data Collection and Data Preprocessing Strategies.
3	CO3	To Compare and choose data visualization method for effective visualization of data
4	CO4	To Implement regression models, model evaluation and validation
5	CO5	To Test Multiple Parameters by using Grid Search

Syllabus:

Course Contents	
Unit I	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. **[8Hours]**
Unit II	Data Collection and Data Pre-Processing : Data Collection Strategies, Data Pre-Processing Overview, Data Cleaning, Data Integration and Transformation, Data Reduction, Data Discretization. **[7Hours]**
Unit III	Exploratory Data Analytics: Descriptive Statistics, Mean, Standard Deviation, Skewness and Kurtosis, Box Plots, Pivot Table, Heat Map, Correlation Statistics. **[7Hours]**
Unit IV	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 **[8Hours]**
Unit V	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 **[7Hours]**
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. Cambridge University Press.
3	Laura Igual and Santi Segui, Introduction to Data Science: A Python Approach to Concepts, Techniques
Useful links	
1	https://www.ibm.com/in-en/topics/data-science
2	https://in.coursera.org/browse/data-science
3	https://ischoolonline.berkeley.edu/data-science/what-is-data-science/
4	https://www.simplilearn.com/tutorials/data-science-tutorial/what-is-data-science

Semester	Course Code	Name of the course	L	T	P	Credits
6th	AI6TE02A	Brain Machine Interface & Interaction	3	0	0	3 Credits

Prerequisites for the course	
1	A basic Concept of soft computing.
2	A basic concept of Artificial intelligence & machine Learning.
3	A basic Programming in any high-level language.

Prior Reading Material/useful links	
1	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3497935/
2	https://en.wikipedia.org/wiki/Brain%E2%80%93computer_interface
3	https://www.frontiersin.org/articles/10.3389/fnsys.2021.578875/full
4	https://link.springer.com/chapter/10.1007/978-1-84996-272-8_1

Course Outcomes:

Sr. No	Course outcome number	CO statement
1	CO1	Study the utilization of drives system related to the electroencephalogram (EEG) signals for neuro rehabilitation.
2	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.
3	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.
4	CO4	Solve the interoperability and standardization issues of Brain Computer Interface software platforms.
5	CO5	To identify and design new applications of Brain Computer Interface.

Syllabus:

Course Contents	
Unit I	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. **[7Hours]**
Unit II	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. **[7Hours]**

Unit III	Non-invasive Electromagnetic Methods for Brain Monitoring: A Technical Rev Introduction, Human Brain Anatomy, Brain Diseases, Non-invasive Br Monitoring, Electromagnetic Brain Monitoring Methods. **[5Hours]**
Unit IV	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. **[7Hours**]
Unit V	Applications for Brain-Computer Interfaces: Introduction, BCIs for Assistive Technology, BCIs for Recreation, BCIs for Cognitive Diagnostics and Augmented Cognition, Rehabilitation and Prosthetics. A brief introduction to brain –computer interaction. Interactive systems, interface and interaction. Elementary tasks and interaction techniques. Theory of action feedback, Usability, Properties of BCIs from the perspective of Brain Computer Interaction, BCI interaction loop, BCI interaction loop **[7Hours]**
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
Reference Books	
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
Useful links	
1	https://www.sciencedirect.com/topics/neuroscience/brain-computer-interface
2	https://en.wikipedia.org/wiki/Brain%E2%80%93computer_interface
3	https://www.gao.gov/products/gao-22-106118
4	https://link.springer.com/chapter/10.1007/978-1-84996-272-8_1

Semester	Course Code	Name of the course	L	T	P	Credits
6th	AI6TE02B	Semantic Web	3	0	0	3 Credits

Prerequisites for the course	
1	A basic Programming in any high-level language.
2	A basic concept HTML,CSS,Javascript.

Prior Reading Material/useful links	
1	https://www.w3.org/standards/semanticweb/
2	https://cambridgesemantics.com/blog/semantic-university/intro-semantic-web/
3	https://semantic-web.com/
4	https://www.analyticssteps.com/blogs/what-semantic-web-working-importance-and-applications

Course Outcomes:

Sr. No	Course outcome number	CO statement
1	CO1	Understand the fundamentals of Semantic web
2	CO2	Creating structured web documents in XML
3	CO3	Apply ontology engineering to various problems.
4	CO4	Understand Semantic Web query languages (SPARQL)
5	CO5	Program semantic applications with Java and Jena API.

Syllabus:

Course Contents	
Unit I	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. **[6Hours]**
Unit II	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 **[6Hours]**
Unit III	Introduction, Manual construction of Ontology, Reusing existing ontology, using Semi-automatic methods, Knowledge semantic web architecture **[6Hours]**
Unit IV	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. **[6Hours]**
Unit V	Schema Web Ontology Language: Introduction, OWL language, Examples, OWL in OWL, Future extensions. **[6Hours]**
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.
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.
Useful links	
1	https://www.w3.org/standards/semanticweb/
2	https://cambridgesemantics.com/blog/semantic-university/intro-semantic-web/
3	https://semantic-web.com/
4	https://www.analyticssteps.com/blogs/what-semantic-web-working-importance-and-applications

Semester	Course Code	Name of the course	L	T	P	Credits
6th	AI6TE02C	Machine Intelligence with Big Data Tools & Technologies	3	0	0	3 Credits

Prerequisites for the course	
1	A basic Programming in any high-level language.
2	A basic concept HTML,CSS,Javascript.

Prior Reading Material/useful links	
1	https://machinelearningmastery.com/types-of-learning-in-machine-learning/
2	https://www.tutorialspoint.com/machine_learning_with_python/machine_learning_with_python_types_of_learning.htm

Course Outcomes:

Sr. No	Course outcome number	CO statement
1	CO1	To recognize the characteristics of machine learning strategies.
2	CO2	To understand and work on Hadoop Framework and eco system.
3	CO3	To analyze and implement different NoSQL database Big data tools
4	CO4	To implement and evaluate the data manipulation procedures using Apache pig
5	CO5	To understand the working environment Hive for processing the structured and unstructured data.

Syllabus:

Course Contents	
Unit I	Concept of Learning, Learning Automation, Knowledge base classification Inductive Learning, Type of Machine Learning, Issues in machine learning, Decision trees, Random forest, Overview of supervised learning algorithms, Regression, Linear and Non-Linear, Kernel Functions, K-Nearest Neighbours, Overview of unsupervised learning algorithms, Bayesian learning, Partitional: K-means clustering, K-Mode clustering. **[9 Hrs]**
Unit II	Big data: Concepts, Needs and Challenges of big data. Types and source of big data. Components of Hadoop Eco System, Hadoop: Requirement of Hadoop Framework, Design principle of Hadoop, Comparison with other system, benefits of Hadoop, challenges with Hadoop architectures, HDFS: goals & examples, Map-Reduce in Hadoop, Map-Reduce architecture. **[9Hrs]**
Unit III	NoSQL Data models: Document Data Model, Key-Value Data Model, Columnar Data Model, Graph Data Model, NoSQL system ways to handle big data problems, Key Value Databases: Riak, Redis, Dynamo, Document-oriented Database: Amazon SimpleDB, CouchDB, MongoDB, Column based NoSQL database: HBase, Cassandra, Graph base database:

	Neo4J, Infinite Graph, OrientDB, Comparative study of various NoSQL databases. **[8 Hrs]**
Unit IV	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. **[8 Hrs]**
Unit V	Introduction: Hive modules, Data types and file formats, Hive QL-Data Definition and Data Manipulation, Hive QL queries, Hive QL views-reduce query complexity. Hive scripts. Hive QL Indexes- create, show, drop. Aggregate functions. Bucketing vs Partitioning, **[8 Hrs]**
Text Books	
1	Alan Gates, Programming Pig Data Flow Scripting with Hadoop, O'Reilly Media, Inc,2011.
2	Jason Rutherglen, Dean Wampler, Edward Caprialo, Programming Hive, O'Reilly Media Inc,2012
3	Guy Harrison, Next Generation Database: NoSQL and big data, Apress.
Reference Books	
1	Daniel Abadi, Peter Boncz and Stavros Harizopoulas, The Design and Implementation of Modern Column-Oriented Database Systems, Now Publishers.
2	Ben Sharma, "Architecting Data Lakes", 2nd Edition, O'Reilly Media Inc, 2018
Useful links	
1	https://machinelearningmastery.com/types-of-learning-in-machine-learning/
2	https://www.tutorialspoint.com/machine_learning_with_python/machine_learning_with_python_types_of_learning.htm

Semester	Course Code	Name of the course	L	T	P	Credits
6th	AI6TE02D	Intelligent Information Retrieval	3	0	0	3 Credits

Prerequisites for the course	
1	A basic Programming in any high-level language.
2	A basic concept of Artificial Intelligence.
3	A basic concept Data Structure.

Prior Reading Material/useful links	
1	https://zaguan.unizar.es/record/82806/files/guia-30233-en.pdf
2	https://vit.ac.in/sites/default/files/scope/M.Tech(CSE)-AIandML_2019_2020.pdf
3	http://facweb.cs.depaul.edu/mobasher/classes/csc575/syllabus.html
4	https://condor.depaul.edu/ntomuro/courses/575/

Course Outcomes:

Sr. No	Course outcome number	CO statement
1	CO1	Apply IR principles to locate relevant information large collections of data
2	CO2	Devise different document clustering algorithms
3	CO3	Implement retrieval systems for web search tasks.
4	CO4	Design an Information Retrieval System for web search tasks.
5	CO5	Apply the various Search algorithm to various technique.

Syllabus:

Course Contents	
Unit I	Introduction to Information Retrieval Systems: Definition of Information Retrieval System, Objectives of Information Retrieval Systems, Functional Overview, Relationship to Database Management Systems, Digital Libraries and Data Warehouses. Information Retrieval System Capabilities: Search Capabilities, Browse Capabilities, Miscellaneous Capabilities **[7 Hrs]**
Unit II	Cataloging and Indexing: History and Objectives of Indexing, Indexing Process, Automatic Indexing, Information Extraction Data Structure: Introduction to Data Structure, Stemming Algorithms, Inverted File Structure, N-Gram Data Structures, PAT Data Structure, Signature File Structure, Hypertext and XML Data Structures, Hidden Markov Models**.** **[7 Hrs]**
Unit III	Automatic Indexing: Classes of Automatic Indexing, Statistical Indexing, Natural Language, Concept Indexing, Hypertext Linkages Document and Term Clustering: Introduction to Clustering, Thesaurus Generation, Item Clustering, Hierarchy of Clusters. **[7 Hrs]**
Unit IV	User Search Techniques: Search Statements and Binding, Similarity Measures and Ranking, Relevance Feedback, Selective Dissemination of Information Search, Weighted Searches of Boolean Systems, Searching the INTERNET and Hypertext Information Visualization: Introduction

	to Information Visualization, Cognition and Perception, Information Visualization Technologies. **[7 Hrs]**
Unit V	Text Search Algorithms: Introduction to Text Search Techniques, Software Text Search Algorithms, Hardware Text Search Systems. Multimedia Information Retrieval: Spoken Language Audio Retrieval, Non-Speech Audio Retrieval, Graph Retrieval, Imagery Retrieval, Video Retrieval. **[8 Hrs]**
Text Books	
1	Gerald J. Kowalski, Mark T. Maybury, ―Information Storage and Retrieval Systems – Theory and Implementation‖, Second Edition, Springer 2013.
2	Frakes, W.B., Ricardo Baeza-Yates, ―Information Retrieval Data Structures and Algorithms‖, Prentice Hall, 2007.
Reference Books	
1	Robert Korfhage,―Information Storage & Retrieval‖, John Wiley & Sons, 2006.
2	RichardoBaeza-Yates, BethierRibeiro-Neto,―Modern Information Retrieval‖, Addison Wesley, 2009.
Useful links	
1	https://zaguan.unizar.es/record/82806/files/guia-30233-en.pdf
2	https://vit.ac.in/sites/default/files/scope/M.Tech(CSE)-AIandML_2019_2020.pdf
3	http://facweb.cs.depaul.edu/mobasher/classes/csc575/syllabus.html
4	https://condor.depaul.edu/ntomuro/courses/575/

Semester	Course Code	Name of the course	L	T	P	Credits
6th	AI6TE03A	AI in Satellite and Radar Communication	3	0	0	3 Credits

Prerequisites for the course	
1	A basic Programming in any high-level language.
2	A basic concept machine learning& AI.
3	A basic concept of neural network and fuzzy logic.
4	A basic concept of mathematics.

Prior Reading Material/useful links	
1	https://apps.dtic.mil/sti/citations/AD1177414
2	https://arxiv.org/abs/2101.10899
3	https://www.mdpi.com/2226-4310/10/2/101
4	https://byjus.com/physics/satellite-communication/

Course Outcomes:

Sr. No	Course outcome number	CO statement
1	CO1	Understand the orbital and functional principles of satellite communication systems
2	CO2	Architect, interpret, and select appropriate technologies for implementation of specified satellite communication systems
3	CO3	Analyze and evaluate a satellite link and suggest enhancements to improve the link performance.
4	CO4	Select an appropriate modulation, multiplexing, coding and multiple access schemes for a given satellite communication link.
5	CO5	Specify, design, prototype and test analog and digital satellite communication systems as per given specifications.

Syllabus:

Course Contents	
Unit I	Introduction to Satellite Systems: Types, Satellite Orbit GEO, MEO, LEO, Launch and Control, Basic Satellite Services, Applications of Satellite, Services Space Debris, Navigation Systems, Components of Satellite, Application and Algorithm of AI used in Satellite System Introduction to Radar System: Basic, Types and Applications, Pulse-Doppler Radar, Moving Target indicator, Continuous wave of Radar systems. **[8Hrs]**
Unit II	Basics of Machine Learning: Supervised, Unsupervised and semi supervised learning, SVM Decision Trees, Neural Network, Basics of Deep Learning: Probabilistic modelling, CNN, RNN, AE, Deep Generative Models, Reinforcement Learning. **[8 Hrs]**

Unit III	Model Selection, Model Regularization, Hype and Hope, satellite navigation and the global positioning systems, GPS position location principle, GPS receivers and codes, Satellite Signal Acquisition, GPS navigation Message, Radar Resource management model for Network Radar, Cognitive Radar. **[7 Hrs]**
Unit IV	AI for Satellite Communication, Application and AI based Solutions: Beam Hopping, Anti Jamming, Network traffic for casting, Channel modelling, Telemetry mining, Ionospheric scintillation detecting, Interference managing, Remote Sensing, Behavior Modelling, Space-air-ground integrating, Energy Managing, handoff optimization. **[7 Hrs]**
Unit V	**AI based Radar Resource Management (RRM)**: Fuzzy Logic algorithm, adaptive update rate algorithm, waveform aided algorithm, Dynamic Programming, **Machine Learning for Radar Resource Management**: Target indication and tracking, Spectrum allocation, waveform synthesis and selection, QoS-based Resource Allocation Model, Task Scheduling and parameter selection, Challenges in ML application in Radar, Promising research avenues. **[8 Hrs]**
Text Books	
1	Merrill I. Skolnik 'Introduction to Radar Systems', Mc Graw-Hill.
2	Artificial Intelligence: A modern Approach, Stuart J. Russell and Peter Norwig
3	Machine Learning: The art and Science of Algorithms that make sense of Data, Peter Flach
Reference Books	
1	J.C.Toomay, Paul J. Hannen Principles of Radar, PHI Learning.
2	B.Pratt, A.Bostian, Satellite Communications, Wiley India.
Useful links	
1	https://apps.dtic.mil/sti/citations/AD1177414
2	https://arxiv.org/abs/2101.10899
3	https://www.mdpi.com/2226-4310/10/2/101
4	https://byjus.com/physics/satellite-communication/

Semester	Course Code	Name of the course	L	T	P	Credits
6th	AI6TE03B	Graph Analytics for Big Data	3	0	0	3 Credits

Prerequisites for the course	
1	A basic Programming in any high-level language.
2	A basic concept data science.
3	A basic concept graph theory

Prior Reading Material/useful links	
1	https://www.ee.columbia.edu/~cylin/course/bigdata/EECS6893-BigDataAnalytics-Lecture6.pdf
2	https://charusat.ac.in/documents/pdfs/data/1/1-1-3/Syllabus/CE/113_CE_74.pdf
3	https://web-app.usc.edu/ws/soc_archive/soc/syllabus/20123/30380.pdf

Course Outcomes:

Sr. No	Course outcome number	CO statement
1	CO1	To understand the fundamental concepts of big data and analytics.
2	CO2	To understand the fundamental concepts of Graph.
3	CO3	To understand the fundamental concepts of Graph analytics and big graph System.
4	CO4	The students will be able to Work with big data tools and its analysis techniques
5	CO5	To apply Computing platforms for Graph analytics and graph processing, OLAP style analysis. .

Syllabus:

Course Contents	
Unit I	INTRODUCTION TO BIG DATA Evolution of Big data - Best Practices for Big data Analytics - Big data characteristics - Validating -The Promotion of the Value of Big Data - Big Data Use Cases- Characteristics of Big Data Applications - Perception and Quantification of Value -Understanding Big Data Storage - A General Overview of High-Performance Architecture - HDFS - MapReduce and YARN – Map Reduce Programming Model. **[7 Hrs]**
Unit II	Introduction to Graph: Graph theory: Introduction to graphs, graph terminology, representing graphs and graph isomorphism, connectivity, Euler and Hamilton paths, planar graphs, graph coloring, introduction to trees, application of trees. **[7 Hrs]**
Unit III	Graph analytics: A changing World, Challenges, Data Networks and Graphs, System requirements, Graph analysis, Fundamental Primitives, Filtering applications, History of Big Graph Systems, Features of Big Graph Systems Triads. **[7 Hrs]**
Unit IV	Graph analytics Technique Node degree measure, Path analysis, Clusters, partitions, cliques, motifs, Graph structure and metrics.
Unit V	Computing platforms for Graph analytics: Property graph Processing, Graph analytics approaches, OLAP style analysis. **[8 Hrs]**

Text Books	
1	Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012.
2	David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", Morgan Kaufmann/El sevier Publishers, 2013.
3	EMC Education Services, "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", Wiley publishers, 2015.
Reference Books	
1	Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications", Wiley Publishers, 2015.
2	Dietmar Jannach and Markus Zanker, "Recommender Systems: An Introduction", Cambridge University Press, 2010.
Useful links	
1	https://www.ee.columbia.edu/~cylin/course/bigdata/EECS6893-BigDataAnalytics-Lecture6.pdf
2	https://charusat.ac.in/documents/pdfs/data/1/1-1-3/Syllabus/CE/113_CE_74.pdf
3	https://web-app.usc.edu/ws/soc_archive/soc/syllabus/20123/30380.pdf

Semester	Course Code	Name of the course	L	T	P	Credits
6th	AI6TE03C	Digital Forensic	3	0	0	3 Credits

Prerequisites for the course	
1	A basic Concept of Security and Cryptography..
2	A basic concept of Artificial intelligence & machine Learning.
3	A basic Programming in any high-level language.

Prior Reading Material/useful links	
1	https://www.geeksforgeeks.org/introduction-of-computer-forensics/
2	https://www.coursera.org/articles/computer-forensics
3	https://www.simplilearn.com/what-is-computer-forensics-article
4	https://archives.fbi.gov/archives/about-us/lab/forensic-science-communications/fsc/oct2000/computer.htm

Course Outcomes:

Sr. No	Course outcome number	CO statement
1	CO1	Know how to apply forensic analysis tools to recover important evidence for identifying computer crime.
2	CO2	To be well-trained as next-generation computer crime investigators.
3	CO3	Students will explain and properly document the process of digital forensics
4	CO4	Students will understand the inner workings of file systems.
5	CO5	Students will be introduced to the current research in computer forensics. This will encourage them to define research problems and develop effective solutions.

Syllabus:

Course Contents	
Unit I	Introduction to Digital Forensics, Definition and types of cybercrimes, electronic evidence and handling, electronic media, collection, searching and storage of electronic media, introduction to internet crimes, hacking and cracking, credit card and ATM frauds, web technology, cryptography, emerging digital crimes and modules. **[7Hours]**
Unit II	Computer organisation, components of computer- input and output devices, CPU, Memory hierarchy, types of memory, storage devices, system softwares, application softwares, basics of computer languages. **[6Hours]**
Unit III	Data Acquisition and Authentication Process, Windows Systems-FAT12, FAT16, FAT32 and NTFS, UNIX file Systems, mac file systems, computer artifacts, Internet Artifacts, OS Artifacts and their forensic applications. **[7Hours]**

Unit IV	Evidence Introduction to Forensic Tools, Usage of Slack space, tools for Disk Imaging, Data Recovery, Vulnerability Assessment Tools, Encase and FTK tools, Anti Forensics and probable counters, retrieving information, process of computer forensics and digital investigations, processing of digital evidence, digital images, damaged SIM and data recovery, multimedia evidence, retrieving deleted data: desktops, laptops and mobiles, retrieving data from slack space, renamed file, ghosting, compressed files. **[7Hours]**
Unit V	Developing Forensic Capabilities – Searching and Seizing Computer Related Evidence –Processing Evidence and Report Preparation – Future Issues. **[7Hours]**
Text Books	
1	John R. Vacca, "Computer Forensics: Computer Crime Scene Investigation", Cengage Learning, 2nd Edition, 2005. (CHAPTERS 1 – 18). (UNIT I – IV)
2	Marjie T Britz, "Computer Forensics and Cyber Crime: An Introduction", Pearson Education, 2nd Edition, 2008. (CHAPTERS 3 – 13). (UNIT IV – V)
3	C. Altheide & H. Carvey Digital Forensics with Open-Source Tools, Syngress, 2011. ISBN: 9781597495868.
Reference Books	
1	Online Course management System https://esu.desire2learn.com/ Syllabus - Semester First COMPUTER FORENSIC
2	Vacca, J, Computer Forensics, Computer Crime Scene Investigation, 2nd Ed, Charles River Media, 2005, ISBN: 1-58450-389.
Useful links	
1	https://www.coursera.org/articles/computer-forensics
2	https://www.simplilearn.com/what-is-computer-forensics-article
3	https://archives.fbi.gov/archives/about-us/lab/forensic-science-communications/fsc/oct2000/computer.htm
4	https://www.geeksforgeeks.org/introduction-of-computer-forensics/

Semester	Course Code	Name of the course	L	T	P	Credits
6th	AI6TE03D	Machine Learning with Large Data Sets	3	0	0	3 Credits

Prerequisites for the course	
1	A basic Programming in any high-level language.
2	A basic concept Machine Learning.
3	A basic concept deep Learning.

Prior Reading Material/useful links	
1	https://www.youtube.com/watch?v=lrAe6457ri4
2	https://www.youtube.com/watch?v=rTOi82_HGf4
3	https://towardsdatascience.com/machine-learning-with-big-data-86bcb39f2f0b

Course Outcomes:

Sr. No	Course outcome number	CO statement
1	CO1	Demonstrate a thorough understanding of the principles and algorithms of machine learning, including supervised and unsupervised learning, deep learning, and online learning.
2	CO2	Develop proficiency in using big data tools and platforms such as Hadoop and Spark for machine learning.
3	CO3	Apply data preprocessing and feature engineering techniques to prepare data for machine learning.
4	CO4	Develop and evaluate machine learning models using large data sets, including techniques such as cross-validation and hyper parameter tuning.
5	CO5	Apply machine learning techniques to real-world problems, and develop skills in data exploration, feature engineering, model selection, and performance evaluation.

Syllabus:

Course Contents	
Unit I	Concept of Learning, Learning Automation, Knowledge base classification Inductive Learning, Type of Machine Learning, Issues in machine learning, Overview of machine learning and its applications to large data sets. **[7 Hr]**
Unit II	Overview of supervised learning algorithms, Regression, Type of Regression: Linear regression, Logistic regression, Polynomial regression, Support vector machines, Decision trees, Random Forest, Ridge regression, Lasso Regression. Techniques for model training and evaluation on large data sets. **[8 Hr]**
Unit III	Overview of unsupervised learning algorithms, clustering and dimensionality reduction, PCA, Bayesian learning, Naïve Bayes techniques for model training and evaluation on large data sets. **[7 Hr]**

Unit IV	Introduction to Large Data Analysis, Neural Networks and Deep Learning architectures, Classification of Digital data, Structure and Unstructured data, Big data Characteristics, Techniques for training deep learning models on large data sets using frameworks TensorFlow and Py Torch, **[7 Hr]**
Unit V	Techniques for distributed machine learning and model parallelism, Introduction to online and streaming machine learning, Introduction to MONGODB, MONGODB Query Language, Map-reducer Programming, Introduction to popular tools for big data processing: Hadoop, Spark, NoSQL databases. Apache Flink and Apache Beam. **[7 Hr]**
Text Books	
1	"Mining of Massive Datasets" by Jure Leskovec, Anand Rajaraman, and Jeffrey Ullman
2	"Distributed Computing with Python" by Francesco Pierfederici
Reference Books	
1	"Machine Learning with Large Datasets" by Frank Kane:
2	"Large Scale Machine Learning with Python" by Bastiaan Sjardin, Luca Massaron, and Alberto Boschetti:
Useful links	
1	https://www.youtube.com/watch?v=lrAe6457ri4
2	https://www.youtube.com/watch?v=rTOi82_HGf4
3	https://towardsdatascience.com/machine-learning-with-big-data-86bcb39f2f0b

Semester	Course Code	Name of the course	L	T	P	Credits
6th		Object Oriented Methodology	3	0	0	3 Credits

Prerequisites for the course	
1	A basic Programming in any high-level language.

Prior Reading Material/useful links	
1	https://www.careerride.com/page/object-oriented-methodologies-642.aspx
2	https://beingintelligent.com/object-oriented-methodology.html
3	https://www.rcet.org.in/uploads/academics/rohini_25955485104.pdf
4	https://www.tutorialspoint.com/object_oriented_analysis_design/ooad_object_oriented_system.htm

Course Outcomes:

Sr. No	Course outcome number	CO statement
1	CO1	To understand properties behavior and concept of object-oriented methodology
2	CO2	To implement different methodologies
3	CO3	To implement the activity diagram
4	CO4	To implement the factional and structural models.
5	CO5	To implement behavioural models & class modelling

Syllabus:

Course Contents	
Unit I	**An overview** - Object basics - Object state and properties, Behavior, Methods, Messages. Object Oriented system development life cycle. Benefits of OO Methodology. **Prominent OOMethodology:** The Rumbaugh OMT, The Booch methodology. Jacobson's OOSE methodologies. Unified Process. Introduction to UML. Important views & diagram to be modelled for system by UML. **[5Hours]**
Unit II	**Factional view(models):** Use case diagram. Requirement Capture with Use case.Building blocks of Use Case diagram - actors, use case, guidelines for use case models. Relationships between use cases - extend, include, and generalize. **Activity diagram:** Elements of Activity Diagram - Action state, Activity state, Object.node, Control and Object flow, Transition (Fork, Merge, Join).Guidelines for Creating Activity Diagrams. Activity Diagram - Action Decomposition (Rake). Partition - Swim Lane. **[5Hours]**
Unit III	**Static structural view (Models):** Classes, values and attributes, operations and methods, responsibilities for classes, abstract classes, access specification(visibility of attributes and operations). Relationships among classes: Associations, Dependencies.,Inheritance - Generalizations, Aggregation. Adornments on Association: association

	names, association classes, qualified association, n-ary associations, ternary and reflexive association. Dependency relationships among classes, notations. **[7Hours]**
Unit IV	**Class Modeling and Design Approaches:** a. Three approaches for identifying classes - using Noun phrases, Abstraction, Use Case Diagram. Comparison of approaches. Using combination of approaches. Flexibility guidelines for class diagram: Cohesion, Coupling, Forms of coupling (identity, representational, subclass, inheritance), class Generalization, class specialization versus aggregation. **[6Hours]**
Unit V	**Behavioral (Dynamic structural view):** State diagram, State Diagram Notations, events (signal events, change events, Time events).State Diagram states (composite states, parallel states, History states), transition and condition, state diagram behavior(activity effect, do-activity, entry and exit activity), completion transition, sending signals.Sequence diagram, collaboration diagram**.** **Approaches for developing dynamic systems:** Top - down approach for dynamic systems. Bottom - up approach for dynamic systems. Flexibility Guidelines for Behavioral Design - guidelines for allocating and designing behaviors that lead to more flexible design. **[7Hours**]
Text Books	
1	Designing Flexible Object Oriented systems with UML – Charles Ritcher
2	Object Oriented Analysis & Design, Sat/.inger. Jackson, Burd Thomson
3	Object oriented Modeling and Design with UML – James Rumbaugh. Micheal Blaha (second edition)
Reference Books	
1	The Unified Modeling Language User Guide – Grady Booch, James Rumbaugh, Ivar Jacobson.
2	Object Oriented Modeling and Design - James Rumbaugh
3.	Teach Yourself UML in 24 Hours - Joseph Schmuilers
Useful links	
1	https://www.careerride.com/page/object-oriented-methodologies-642.aspx
2	https://beingintelligent.com/object-oriented-methodology.html
3	https://www.rcet.org.in/uploads/academics/rohini_25955485104.pdf
4	https://www.tutorialspoint.com/object_oriented_analysis_design/ooad_object_oriented_system.htm

Semester	Course Code	Name of the course	L	T	P	Credits
6th	AI6L003	Data Science using R Lab	0	0	2	1 Credit

Prerequisites for the course	
1	A basic Programming in any high-level language.

Prior Reading Material/useful links	
1	https://builtin.com/data-science
2	https://in.coursera.org/browse/data-science
3	https://ischoolonline.berkeley.edu/data-science/what-is-data-science/

Course Outcomes:

Sr. No	Course outcome number	CO statement
1	CO1	To Apply Data Collection and Data Preprocessing Strategies.
2	CO2	To Compare and choose data visualization method for effective visualization of data
3	CO3	To implement regression models, model evaluation and validation

Syllabus:

List of Experiments:	
0	TO STUDY THE DATA SCIENCE LABORATORY.
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

6	MULTIPLE REGRESSION MODEL Apply multiple regressions, if data have a continuous independent variable. Apply on above dataset.
7	MULTIPLE REGRESSION MODEL Apply multiple regressions, if data have a continuous independent variable. Apply on above dataset.
8	REGRESSION MODEL FOR PREDICTION Apply regression Model techniques to predict the data on above dataset
9	Content Beyond Syllabus practical (CLASSIFICATION MODEL) a. Install relevant package for classification. b. Choose classifier for classification problem. c. Evaluate the performance of classifier.
10	Content Beyond Syllabus practical (CLUSTERING MODEL) a. Clustering algorithms for unsupervised classification. b. Plot the cluster data using R visualizations.

Semester	Course Code	Name of the course	L	T	P	Credits
6th	AI6L004	Advanced Computer Vision Lab	0	0	2	1 Credit

Prerequisites for the course	
1	A basic Programming in any high-level language.

Prior Reading Material/useful links	
1	https://builtin.com/data-science
2	https://in.coursera.org/browse/data-science
3	https://ischoolonline.berkeley.edu/data-science/what-is-data-science/

Course Outcomes:

Sr. No	Course outcome number	CO statement
1	CO1	To decompose visual tasks into sequences of image analysis operations, representations, specific algorithms, and inference principles
2	CO2	Understand the roles of image transformations and their invariances in pattern recognition and classification
3	CO3	To describe key aspects of how biological visual systems encode, analyse, and represent visual information to understand a typical graphics pipeline.
4	CO4	To think of ways in which biological visual strategies might be implemented in machine vision, despite the enormous differences in hardware
5	CO5	To understand in depth at least one important application domain, such as face recognition, detection, or interpretation

Syllabus:

List of Experiments:	
0	To study Advanced Computer Vision Lab.
1	Basic Statistical Analysis of Images
2	Image Enhancement for Performance
3	Feature Extraction from Images.
4	Texture, colour, stereo, and motion descriptors. Disambiguation
5	2D → 3D inference
6	Shape description. Codons; super quadrics and surface geometry
7	Bayesian inference in vision. Classifiers; probabilistic methods

Semester	Course Code	Name of the course	L	T	P	Credits
6th	AI6L005	Big Data Tools & Techniques(LAB)	0	0	2	1 Credit

Prerequisites for the course	
1	A basic Programming in any high-level language.

Prior Reading Material/useful links	
1	https://www.guru99.com/big-data-tools.html
2	https://www.geeksforgeeks.org/10-most-popular-big-data-analytics-tools/
3	https://www.softwaretestinghelp.com/big-data-tools/

Course Outcomes:

Sr. No	Course outcome number	CO statement
1	CO1	Understand the key issues in big data management and its associated applications in intelligent business and scientific computing.
2	CO2	Acquire fundamental enabling techniques and scalable algorithms like Hadoop, Map Reduce and NO SQL in big data analytics
3	CO3	Interpret business models and scientific computing paradigms, and apply software tools for big data analytics.
4	CO4	Achieve adequate perspectives of big data analytics in various applications like recommender systems, social media applications etc.

Syllabus:

List of Experiments:	
0	To study Big Data Tools & Techniques (LAB).
1	Study of Hadoop ecosystem.
2	2 programming exercises on Hadoop
3	2 programming exercises in No SQL
4	Implementing simple algorithms in Map- Reduce (3) - Matrix multiplication, Aggregates, joins, sorting, searching etc
5	Implementing any one Frequent Itemset algorithm using Map-Reduce
6	Implementing any one Clustering algorithm using Map-Reduce
7	Implementing any one data streaming algorithm using Map-Reduce.8
8	Mini Project: One real life large data application to be implemented (Use standard Datasets available on the web) a) Twitter data analysis b) Fraud Detection c) Text Mining etc.

Semester	Course Code	Name of the course	L	T	P	Credits
6th	AI6T007	Intellectual Property Rights	0	2	0	Audit

Prerequisites for the course	
1	A basic concept of Ethics in IT.
2	A basic concept of IEED.

Prior Reading Material/useful links	
1	Subramanian, N., & Sundararaman, M. (2018). Intellectual Property Rights – An Overview. Retrieved from http://www.bdu.ac.in/cells/ipr/docs/ipr-eng-ebook.pdf
2	World Intellectual Property Organisation. (2004). WIPO Intellectual property Handbook. Retrieved from https://www.wipo.int/edocs/pubdocs/en/intproperty/489/wipo_pub_489.pdf

Course Outcomes:

Sr. No	Course outcome number	CO statement
1	CO1	To Distinguish and Explain various forms of IPRs.
2	CO2	To Identify criteria to fit one's own intellectual work in particular form of IPRs
3	CO3	To Apply statutory provisions to protect particular form of IPRs.
4	CO4	To Analyze rights and responsibilities of holder of Patent, Copyright, Trademark, Industrial Design etc.
5	CO5	To Identify procedure to protect different forms of IPRs national and international level

Syllabus:

Course Contents	
Unit I	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. **[7Hours]**
Unit II	Nature of Copyright - Subject matter of copyright: original literary, dramatic, musical, artistic works; cinematograph films and sound recordings - Registration Procedure, Term of protection, Ownership of copyright, Assignment and licence of copyright - Infringement, Remedies & Penalties – Related Rights - Distinction between related rights and copyrights. **[7 Hours]**
Unit III	Patents - Elements of Patentability: Novelty , Non Obviousness (Inventive Steps), Industrial Application - Non - Patentable Subject Matter - Registration Procedure, Rights and Duties of Patentee,

	Assignment and licence , Restoration of lapsed Patents, Surrender and Revocation of Patents, Infringement, Remedies & Penalties – Patent office and Appellate Board. **[7Hours]**
Unit IV	Trademarks - Different kinds of marks (brand names, logos, signatures, symbols, well known marks, certification marks and service marks) - Non-Registrable Trademarks - Registration of Trademarks Design: meaning and concept of novel and original - Procedure for registration, effect of registration and term of protection**.** **[7Hours]**
Unit V	International Treaties and Conventions on IPRs, TRIPS Agreement, PCT Agreement, Patent Act of India, Patent Amendment Act, Design Act, Trademark Act, Geographical Indication Act. Introduction to competition Law, Anti-competitive agreements, Abuse of dominance, Regulation of combinations. **[8Hour]**
Text Books	
1	V. Scople Vinod, Managing Intellectual Property, Prentice Hall of India pvt Ltd, 2012
2	S. V. Satakar, "Intellectual Property Rights and Copy Rights, Ess Publications, New Delhi, 2002
Reference Books	
1	Deborah E. Bouchoux, "Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets", Cengage Learning, Third Edition, 2012.
2	Prabuddha Ganguli,"Intellectual Property Rights: Unleashing the Knowledge Economy", McGraw Hill Education, 2011.
3.	Edited by Derek Bosworth and Elizabeth Webster, The Management of Intellectual Property, Edward Elgar Publishing Ltd., 2013.
Useful links	
1	Subramanian, N., & Sundararaman, M. (2018). Intellectual Property Rights – An Overview. Retrieved from http://www.bdu.ac.in/cells/ipr/docs/ipr-eng-ebook.pdf
2	World Intellectual Property Organisation. (2004). WIPO Intellectual property Handbook. Retrieved from https://www.wipo.int/edocs/pubdocs/en/intproperty/489/wipo_pub_489.pdf

Semester	Course Code	Name of the course	L	T	P	Credits
7th	AI7T001	Cyber Security & Privacy	3	0	0	3

Prerequisites for the course	
1	Computer Network,cryptography
2	Mathematics
3	Computer architecture.

Prior Reading Material/useful links	
1	https://www.w3schools.com/cybersecurity/cybersecurity_networking.php
2	https://cybersecurityguide.org/resources/math-in-cybersecurity/
3	https://www.knowledgehut.com/blog/security/cyber-security-architecture

Course Outcomes:
Students will be able to:

Sr. No	Course outcome number	CO statement
1	CO1	Analyze and resolve security issues in networks and computer systems to secure an IT infrastructure.
2	CO2	Develop policies and procedures to manage enterprise security risks.
3	CO3	Evaluate and communicate the human role in security systems with an emphasis on ethics, social engineering vulnerabilities and training
4	CO4	Interpret and forensically investigate security incidents.
5	CO5	To discover unauthorized access to a computer network by analyzing traffic on the network for signs of malicious activity

Syllabus:

Course Contents	
Unit I	**Introduction to Cyber Security and Privacy :** Overview of Cyber Security, Internet Governance – Challenges and Constraints, Cyber Threats: - Cyber Warfare-Cyber Crime-Cyber Terrorism-Cyber Espionage, need for a Comprehensive CyberSecurity Policy.Overview of Cryptography: Public versus private key cryptography, Stream Ciphers, DigitalSignatures, Applications of Cryptography. **[6 Hours]**
Unit II	**Cryptography and Network Security** Traditional Secret Key Ciphers: - Substitution Ciphers (mono alphabetic ciphers, poly alphabetic ciphers)-Transposition Ciphers-Stream and Block Ciphers. Modern Secret Key Ciphers:- Substitution Box-Permutation Box-Product Ciphers **,** Data Encryption Standard (DES) (Fiestel and Non-Fiestel Ciphers, Structure of DES, DES Attacks, 2-DES, 3-DES) - Advanced Encryption Standard (AES) (Structure, Analysis)- Cryptographic Hash Functions– Properties - Secure Hash Algorithm-Message Authentication Code (MAC). **[8 Hours]**
Unit III	**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 SecuritySafeguards- Overview, Access control, Audit, Authentication, Biometrics, Cryptography, Deception, Ethical Hacking, Threats in network, Security policy, Threat Management. **[6 Hours]**
Unit IV	**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. **[6 Hours]**
Unit V	**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. Honeypots, password management. **[8 Hours]**
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	Katz and Y. Lindell, Introduction to Modern Cryptography, CRC press, 2008.
4	Rafeeq Rehman : " Intrusion Detection with SNORT, Apache, MySQL, PHP and ACID," 1st Edition, Prentice Hall , 2003
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.
Useful links	
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. SamuelMadden MIT.

Semester	Course Code	Name of the course	L	T	P	Credits
7th	AI7TE04A	Scalable Systems for Data Science	3	0	0	3

Prerequisites for the course	
1	Data base Management System
2	Machine Learning
3	Programming.

Prior Reading Material/useful links	
1	https://www.coursera.org/learn/ds
2	https://lamastex.gitbooks.io/sds-2-2/content/sds-2-2/000_scalableDataScience.html
3	https://onlinecourses.nptel.ac.in/noc20_cs61/preview

Course Outcomes:
Students will be able to:

Sr. No	Course outcome number	CO statement
1	CO1	Understand the principles and practices of scalable systems for data science
2	CO2	Develop skills for designing and implementing distributed computing systems
3	CO3	Learn how to use cloud computing technologies for data science
4	CO4	Design and develop applications on Big Data platforms and their optimizations on commodity clusters and Clouds
5	CO5	Scale data science algorithms and analytics using Big Data platforms.

Syllabus:

Course Contents	
Unit I	**Introduction to Scalable Systems for Data Science:** Overview of distributed computing, cloud computing, and big data technologies, Importance of scalable systems in data science, Design principles for scalable systems. **[6 Hours]**
Unit II	**Distributed Computing Systems** Introduction to Distributed Systems, evolution, characteristics, design issues, user requirements, Protocols for distributed systems -VMTP and FLIP, Components of DFS, design issues, interfaces, implementation, File Caching and Replication, Google File System. **[8 Hours]**
Unit III	**Cloud Computing for Data Science** Introduction to cloud computing, Cloud computing platforms (AWS, Azure, Google Cloud), Cloud storage and data management**.** **[8 Hours]**
Unit IV	**Big Data Technologies and Tools** Introduction to big data technologies, Big data storage and processing frameworks (Hadoop, Hive, Pig), Hadoop Architecture - Clusters, HDFS, YARN, Basic file system operations in HDFS, File permissions in HDFS, Functional Programming Model of Map Reduce, Job Chaining, Submitting Map Reduce job to YARN. **[8 Hours]**
Unit V	**Parallel Data Mining Agents** Parallel Data Mining Agents, Parallel Data Access, Parallel Data Analysis, Parallel GA in Big

	Data Analysis, Evolutionary Algorithm Based Techniques to Handle Big Data, Statistical and Evolutionary Feature Selection Techniques Parallelized Using Map Reduce Programming Model. **[8 Hours]**
Text Books	
1	Sunita Mahajan, Seema shah, Distributed Computing, Oxford University Press, first edition, 2010
2	George Coulouris, Jean Dellimore and Tim Kindberg, Distributed Systems – Concepts and designing, Pearson Education Asia, Fifth Edition 2006, New Delhi.
3	Pradeep. K, Sinha, Distributed Operating Systems, PHI Edition, first Edition,1997.
4	Andrew S Tenenbaum, Distributed Operating Systems, Pearson Education Asia
Reference Books	
1	Distributed Systems an Algorithmic Approach, Sukumar Ghosh, CRC Press, 2007
2	Techniques and Environments for Big Data Analysis: Parallel, Cloud, and Grid Computing, Studies in Big Data Vol 17, 2016
3	Web based Parallel / Distributed Medical Data Mining Using Software Agents - Hillol Kargupta, Brian Stafford, Ilker Hamzaoglu, Los Alamos National Labs, 1997.
Useful links	
1	https://www.oreilly.com/library/view/foundations-of-scalable/9781098106058/ch01.html
2	http://dsg.csail.mit.edu/6.S080/

Semester	Course Code	Name of the course	L	T	P	Credits
7th	AI7TE04B	Human Computing and Interaction	3	0	0	3

Prerequisites for the course	
1	IOT
2	Mathematics
3	Some practical programming language such as Java, C#, HTML, or Processing.

Prior Reading Material/useful links	
1	https://www.tutorialspoint.com/human_computer_interface/human_computer_interface_introduction.htm
2	https://www.studocu.com/row/document/abdul-wali-khan-university-mardan/human-computer-interaction/hci-notes-lecture-notes-1-45/11751427
3	https://nptel.ac.in/courses/106106177

Course Outcomes:
Students will be able to:

Sr. No	Course outcome number	CO statement
1	CO1	. Design effective dialog for HCI.
2	CO2	Design effective HCI for individuals and persons with disabilities.
3	CO3	Assess the importance of user feedback.
4	CO4	Explain the HCI implications for designing multimedia/ ecommerce/ e-learning Websites.
5	CO5	Develop meaningful user interface.

Syllabus:

Course Contents	
Unit I	**FOUNDATIONS OF HCI** The Human: I/O channels – Memory – Reasoning and problem solving; The computer: Devices – Memory – processing and networks. **[6 Hrs]**
Unit II	**INTERACTIVE SYSTEM DESIGN** 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. **[8 Hrs]**
Unit III	**MODELS AND THEORIES** Cognitive models –Socio-Organizational issues and stake holder requirements – Communication and collaboration models-Hypertext, Multimedia and WWW. **[8 Hrs]**
Unit IV	**MODEL BASED DESIGN AND EVALUATION** Basic idea, introduction to different types of models, GOMS family of models (KLM and CMN- GOMS), Fitts' law and HickHyman's law. **[6 Hrs]**
Unit V	**GUIDELINES IN HCI** Schneiderman'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. **[6 Hrs]**
Text Books	
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 Books	
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).
Useful links	
1	https://www.interaction-design.org/literature/topics/human-computer-interaction#:~:text=Human%2Dcomputer%20interaction%20(HCI)%20is%20a%20multidisciplinary%20field%20of,forms%20of%20information%20technology%20design.
2	https://nptel.ac.in/courses/106106177

Semester	Course Code	Name of the course	L	T	P	Credits
7th	AI7TE04C	Pervasive Computing	3	0	0	3

Prerequisites for the course	
1	IOT
2	Computer organization
3	Computer Networks

Prior Reading Material/useful links	
1	https://www.tutorialspoint.com/human_computer_interface/human_computer_interface_introduction.htm
2	https://www.studocu.com/row/document/abdul-wali-khan-university-mardan/human-computer-interaction/hci-notes-lecture-notes-1-45/11751427
3	https://nptel.ac.in/courses/106106177

Course Outcomes:
Students will be able to:

Sr. No	Course outcome number	CO statement
1	CO1	To discover the characteristics of pervasive computing applications including the major system components and architectures of the systems
2	CO2	To analyse the strengths and limitations of the tools and devices for development of pervasive computing systems
3	CO3	To explore the characteristics of different types of mobile networks on the performance of a pervasive computing system
4	CO4	To analyse and compare the performance of different data dissemination techniques and algorithms for mobile real-time applications
5	CO5	To develop an attitude to propose solutions with comparisons for problems related to pervasive computing system through investigation.

Syllabus:

Course Contents	
Unit I	**I -INTRODUCTION** Pervasive Computing- Principles, Characteristics- interaction transparency, context aware, automated experience capture. Architecture for pervasive computing- Pervasive devices-embedded controls. - smart sensors and actuators -Context communication and access services. **[8 Hours]**
Unit II	**PROTOCOLS** Open protocols- Service discovery technologies- SDP, Jini, SLP, UpnP protocols–data synchronization- SyncML framework - Context aware mobile services - Context aware sensor networks, addressing and communications- Context aware security. **[6 Hours]**
Unit III	**III TECHNOLOGIES** Past, Present and Future-Device Technology-Device Connectivity-Web application Concepts-WAP and Beyond-Voice Technologies-Personal Digital Assistants. **[6 Hours]**

Unit IV	**IV ARCHITECTURE** Server side programming in Java-Pervasive Web application Architecture-Example Application- Access via PCs-Access via WAP-Access via PDA and Voice. **[8 Hours]**
Unit V	**V- EXAMPLES** Smart Tokens, Heating Ventilation and Air Conditioning, Set Top Boxes, Appliances and Home Networking, Residential Gateway, Automotive Computing, On Board Computing Systems, In Vehicle networks, Entertainment Systems. **[8 Hours]**
Text Books	
1	Jochen Burkhardt, , Stefan Hepper, Klaus Rindtorff, Thomas Schaeck "Pervasive Computing-Technology and Architecture of Mobile Internet application",Pearson Education,sixth Edition 2009.
2	Uwe Hansmann etl , Pervasive Computing, Springer, New York,2001.
Reference Books	
1	Seng Loke, Context-Aware Computing Pervasive Systems, Auerbach Pub., New York,2007.
Useful links	
1	https://www.techtarget.com/iotagenda/definition/pervasive-computing-ubiquitous-computing
2	https://www.techopedia.com/definition/667/pervasive-computing

Semester	Course Code	Name of the course	L	T	P	Credits
7th	AI7TE04D	Bio-Inspired Computing	3	0	0	3

Prerequisites for the course	
1	Mathematics
2	Neural Network

Prior Reading Material/useful links	
1	https://www.investopedia.com/terms/n/neuralnetwork.
2	https://www.mdpi.com/2227-7390/10/1/102

Course Outcomes:
Students will be able to:

Sr. No	Course outcome number	CO statement
1	CO1	Implement and apply bio-inspired algorithms
2	CO2	Explain random walk and simulated annealing
3	CO3	Implement and apply genetic algorithms
4	CO4	Explain swarm intelligence and ant colony for feature selection
5	CO5	Apply bio-inspired techniques in image processing.

Syllabus:

Course Contents	
Unit I	**I INTRODUCTION** **[6 Hrs]** Introduction to algorithm - Newton ' s method - optimization algorithm - No-Free-Lunch Theorems - Nature-Inspired Metaheuristics -Analysis of Algorithms -Nature Inspires Algorithms -Parameter tuning and parameter
Unit II	**RANDOM WALK AND ANEALING** **[8 Hrs]** Random variables - Isotropic random walks - Levy distribution and flights - Markov chains - step sizes and search efficiency - Modality and intermittent search strategy - importance of randomization- Eagle strategy-Annealing and Boltzmann Distribution - parameters -SA algorithm - Stochastic Tunnelling
Unit III	**GENETIC ALOGORITHMS AND DIFFERENTIAL EVOLUTION** **[8 Hrs]** Introduction to genetic algorithms and - role of genetic operators - choice of parameters - GA varients - schema theorem - convergence analysis - introduction to differential evolution - varients - choice of parameters - convergence analysis - implementation
Unit IV	SWARM OPTIMIZATION AND FIREFLY ALGORITHM **[6 Hrs]** Swarm intelligence - PSO algorithm - accelerated PSO - implementation - convergence analysis - binary PSO - The Firefly algorithm - algorithm analysis - implementation - varients- Ant colony optimization toward feature selection.
Unit V	**APPLICATION IN IMAGE PROCESSING** **[8 Hrs]** Bio-Inspired Computation and its Applications in Image Processing: An Overview - Fine- Tuning Enhanced Probabilistic Neural Networks Using Meta-heuristic-driven Optimization - Fine-Tuning Deep Belief Networks using Cuckoo Search - Improved Weighted Thresholded Histogram Equalization Algorithm for Digital Image Contrast Enhancement Using Bat Algorithm - Ground Glass Opacity Nodules Detection and Segmentation using Snake Model - Mobile Object Tracking

	Using Cuckoo Search
Text Books	
1	Eiben,A.E.,Smith,James E, "Introduction to Evolutionary Computing", Springer 2015.
2	Helio J.C. Barbosa, "Ant Colony Optimization - Techniques and Applications", Intech 2013
Reference Books	
1	Xin-She Yang , Jaao Paulo papa, "Bio-Inspired Computing and Applications in Image Processing",Elsevier 2016
2	Yang ,Cui,XIao,Gandomi,Karamanoglu ,"Swarm Intelligence and Bio-Inspired Computing", Elsevier First Edition 2013
Useful links	
1	https://www.easytechjunkie.com/what-is-bio-inspired-computing.htm
2	http://www.dcs.shef.ac.uk/intranet/teaching/public/modules/level3/com3524.html

Semester	Course Code	Name of the course	L	T	P	Credits
7th	AI7TE05A	Randomized Algorithms	3	0	0	3

Prerequisites for the course	
1	Basic knowledge of programming
2	Mathematics.
3	Design and analysis of Algorithmn

Prior Reading Material/useful links	
1	http://www.wisdom.weizmann.ac.il/~robi/teaching/2021a-RandomizedAlgorithms/

Course Outcomes:
Students will be able to:

Sr. No	Course outcome number	CO statement
1	CO1	To understand the basics of randomized algorithms.
2	CO2	. To Illustrations of randomized incremental algorithms.
3	CO3	To apply fundamental algorithmic ideas to design randomized algorithms.
4	CO4	To analyze distributed algorithms and Property testing algorithms to design randomized algorithms.
5	CO5	To describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it. Recite algorithms that employ this paradigm. Synthesize dynamic-programming algorithms, and analyze them.

Syllabus:

Course Contents	
Unit I	**Randomized Data Structures:** Random numbers: Properties of a random sequence. Generating uniform random numbers: the linear congruential method and others. Statistical tests for random numbers: Chi-square test, Kolmogorov-Smirnov test, empirical / theoretical / spectral tests. Non-uniform random sequences. **[8 Hrs]**
Unit II	**Randomized Computational Geometry:**Illustrations of randomized incremental algorithms like randomized convex hull construction, geometric duality, half space intersections, Delaunay Triangulation, trapezoidal decomposition; illustrations of random sampling like point location in arrangements, and linear programming. **[8 Hrs]**
Unit III	**Online algorithms:** Adversary models, online paging against oblivious and adaptive adversaries, Yao's minimax principle, lower bound for online paging against an oblivious adversary, the k-server problem, Tools and techniques of randomized algorithmics: game theoretic techniques, moments and deviations, Random Treaps, Skip Lists, Hash Tables, Universal Family of Hash Functions, Perfect Hashing. **[8 Hrs]**
Unit IV	**Distributed algorithms:** Symmetry breaking problems like leader election, Byzantine agreement, maximal independent set, and colouring; algorithms for dynamic networks; the k-machine model for

	processing large graphs. **[8 Hrs]**
Unit V	**Property testing algorithms:** The property testing model, testing whether a graph is connected, bipartite (enforce and test paradigm), and triangle free (using Szemeredi's regularity lemma). **[6 Hrs]**
Text Book	
1	Randomized Algorithms, by Motwani and Raghavan, Cambridge University Press, 1995
2	Probability and Computing: Randomized Algorithms and Probabilistic Analysis, by Mitzenmacher and Upfal, Cambridge University Press, 2nd edition, 2017.
Reference Books	
1	Computational Geometry: Algorithms and Applications, by Mark de Berg, Otfried Cheong, Marc van Kreveld, and Mark Overmars, 3rd edition, Springer-Verlag, 2008.
2	Algorithmic and Analysis Techniques in Property Testing, by Dana Ron. Found. Trends Theor. Comput. Sci. 5, 2 (February 2010), 73-205.
Useful links	
1	https://www.tutorialspoint.com/design_and_analysis_of_algorithms/index.htm#:~:text=Prerequisites,Formal%20Language%20and%20Automata%20Theory.
2	https://www.cs.utexas.edu/~ecprice/courses/randomized/fa17/

Semester	Course Code	Name of the course	L	T	P	Credits
7th	AI7TE05C	Quantum Computing	3	0	0	3

Prerequisites for the course	
1	Mathematics
2	Programming
3	Physics

Prior Reading Material/useful links	
1	https://www.quora.com/What-are-the-prerequisites-for-learning-quantum-computing
2	https://www.quora.com/What-are-the-prerequisites-for-learning-quantum-computing

Course Outcomes:
Students will be able to:

Sr. No	Course outcome number	CO statement
1	CO1	Understand the basic principles of quantum computing
2	CO2	To describe the fundamental differences between conventional computing and quantum computing.
3	CO3	To differentiate Several basic quantum computing algorithms.
4	CO4	To classify the classes of problems that can be expected to be solved well by quantum computers.
5	CO5	To understand the Quantum mechanics as applied in Quantum computing.

Syllabus:

Course Contents	
Unit I	Introduction to Quantum Computation: Quantum bits, B loch sphere representation of a qubit, History of Quantum Computing, Advantages & Disadvantages of Quantum Computing, Application of Quantum Computing. [**6 Hrs]**
Unit II	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. [**8 Hrs]**
Unit III	Quantum mechanics, Measurements in bases other than computational basis. 083 Quantum Circuits: single qubit gates, design of quantum circuits. [**6 Hrs]**
Unit IV	Quantum Information and Cryptography: Comparison between classical and quantum information theory. Bell states, Quantum teleportation. Quantum Cryptography, no cloning theorem. **[8 Hrs]**
Unit V	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 **[8 Hrs]**
Text book	
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
Useful links	
1	https://www.adelaide.edu.au/course-outlines/109883/1/sem-2/2019/
2	https://www.youtube.com/watch?v=X8MZWCGgIb8

Semester	Course Code	Name of the course	L	T	P	Credits
7th	AI7TE05D	Genetic Algorithms	3	0	0	3

Prerequisites for the course	
1	Mathematics
2	Neural Network.

Prior Reading Material/useful links	
1	https://brainly.in/question/10121325

Course Outcomes:
Students will be able to:

Sr. No	Course outcome number	CO statement
1	CO1	To Understand basic concept of Genetic Algorithms
2	CO2	To Understand the Representational & Operator issues in GAs:
3	CO3	To Learn the Experimental Issues in GAS
4	CO4	To Analyze the Rival Method in GAs.
5	CO5	To acquire the knowledge of various optimization techniques in GAS.

Syllabus:

Course Contents	
Unit I	**Introduction** Basic Concepts- History of Genetic Algorithms (GA), Working Principle, Various Encoding methods, Fitness function, GA Operators- Reproduction, Crossover, Mutation, Convergence of GA, Bit wise operation in GA, Multi-level Optimization. GA based Weight Determination, K - factor determination in Columns. **[6Hrs]**
Unit II	**Representational & Operator issues:** Representational issues: binary, integer and real-valued encodings; permutation-based encodings. Operator issues: different types of crossovers and mutation, of selection and replacement. Inversion and other operators. Constraint satisfaction: penalty-function and other methods; repair and write-back; feasibility issues. **[8Hrs]**
Unit III	**Experimental issues:** Experimental issues: design and analysis of sets of experiments by t-tests, F-tests, bootstrap tests etc Some theory: the schema theorem and its flaws; selection takeover times; optimal mutation rates; other approaches to providing a theoretical basis for studying GA issues. **[8Hrs]**
Unit IV	**Rival methods:** Rival methods: hill-climbing, simulated annealing, population-based incremental learning, tabu search, etc. Hybrid/memetic algorithms. Multiple-solutions methods: crowding, niching; island and cellular models. **[6 Hrs]**
Text Books	
1	N.P.Padhy, S.P.Simon, "Soft Computing with MATLAB Programming", Oxford

	University Press, 2015.
2	S.N.Sivanandam , S.N.Deepa, "Principles of Soft Computing", Wiley India Pvt.Ltd., 2nd Edition, 2011.
3	S.Rajasekaran, G.A.Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm, Synthesis and Applications ", PHI Learning Pvt.Ltd., 2017.
Reference Books	
1	Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, ―Neuro-Fuzzy and Soft Computing‖, Prentice-Hall of India, 2002.
2	James A. Freeman and David M. Skapura, ―Neural Networks Algorithms, Applications, and Programming Techniques‖, Addison Wesley, 2000
Useful links	
1	https://towardsdatascience.com/introduction-to-genetic-algorithms-including-example-code-e396e98d8bf3
2	https://www.youtube.com/watch?v=Z_8MpZeMdD4

Semester	Course Code	Name of the course	L	T	P	Credits
7th	AI7T002	Natural Language Processing	3	0	0	3 Credits

Prerequisites for the course	
1	A basic understanding of mathematics.
2	A basic Probability and Statistics.
3	A basic Programming in any high-level language

Prior Reading Material/useful links	
1	https://www.javatpoint.com/classification-of-programming-languages
2	https://www.khanacademy.org/math/statistics-probability
3	https://coderdojo.com/2015/03/20/top-5-programming-languages-for-beginners/

Course Outcomes:

Sr. No	Course outcome number	CO statement
1	CO1	Understand approaches to syntax and semantics in NLP.
2	CO2	To build the Natural language processing Models.
3	CO3	Apply current methods for statistical approaches to machine translation.
4	CO4	Analyze technique of summarization and classification on text.
5	CO5	Recognize the significance of pragmatics for natural language understanding.

Syllabus:

Course Contents	
Unit I	**Introduction to Natural Language Processing (NLP):** What is NLP and its motivations, Stages of language processing, Challenges of NLP, Applications of NLP. **[6Hours]**
Unit II	**NLP Models**-Models for Sequential tagging, Simple N-gram models, Trigram model, Evaluation of language models. Syntax – Constituency Parsing, Dependency Parsing, POS tagging, Grammars for natural language, Tokenization and Sentence splitting, Computational Phonetics and Speech Processing. **[8Hours]**
Unit III	**Semantics:** Lexical Semantics, WordNet and Frame Net, Distributional Semantics & Word-Space models, Logical approaches to sentence semantics. [**6 Hours]**
Unit IV	**Text Summarization & Classification:** Information Extraction, Text Summarization, Text Classification. **[6Hours]**
Unit V	**Sentiment Analysis:** Sentiment Analysis and Opinion Mining, Named Entity Recognition, Semantic Textual Similarity. [**6Hours]**
Text Books	
1	Dan Jurafsky and James Martin. Speech and Language Processing: An Introduction to Natural Language Processing.
2	Computational Linguistics and Speech Recognition. Prentice Hall, Second Edition, 2009.
3	Chris Manning and HinrichSchütze. Foundations of Statistical Natural Language Processing. MIT Press, Cambridge, MA: May 1999.
4	Handbook-Computational-Linguistics-Language-Processing/dp/1118347188/ref=d_pd_vtp_sccl_1_1/135-0048941-
Reference Books	
1	1.Siddiqui T., Tiwary U. S. Natural language processing and Information retrieval, OUP, 2008
2	2. Bharati A., Sangal R., Chaitanya V. Natural language processing: a Paninian perspective, PHI, 2000.
3	The Oxford Handbook of Computational Linguistics (Oxford Handbooks) 1st Edition
Useful links	
1	https://www.javatpoint.com/classification-of-programming-languages
2	https://www.khanacademy.org/math/statistics-probability
3	https://coderdojo.com/2015/03/20/top-5-programming-languages-for-beginners/
4	https://nlp.stanford.edu/fsnlp/

Semester	Course Code	Name of the course	L	T	P	Credits
7th	AI7TE05B	Kernel Methods for Machine Learning	3	0	0	3 Credits

Prerequisites for the course	
1	A basic of machine learning and artificial intelligence.
2	A Basic of Python programming.
3	A basics of Neural Network and Fuzzy logic.
4.	A basics of Mathematics.

Prior Reading Material/useful links	
1	https://www.ibm.com/in-en/topics/machine-learning
2	https://www.geeksforgeeks.org/machine-learning/
3	https://www.engati.com/glossary/kernel-method

Course Outcomes:

Sr. No	Course outcome number	CO statement
1	CO1	Student shall be able to learn and understand fundamentals of Kernel.
2	CO2	Students will know the basic concepts of Kernel Method in Machine Learning.
3	CO3	Students will use different Kernel Methods Techniques.
4	CO4	Students will able to analysis learning Models of SVM.
5	CO5	Students will become familiar with Kernelization of ML.

Course Contents	
Unit I	Introduction of Kernel, Basic Kernel, Kernel Design, Kernel Model, Kernel in Operating System, Kernel in Linux, Difference Between Operating System and Kernel, Types of Kernels, Components of Kernel, Functions of The Kernel, User-Mode and Kernel Mode, Kernel Panics, Advantages and Disadvantages of Kernel, Use of Kernel in Machine Learning. **[7Hours]**
Unit II	Introduction to Kernel Methods, Kernel Method in Machine Learning, Types of Kernels Method, Need for Kernel Method and Its Working, Kernel-Based Approaches in Machine Learning, Constructing Kernels in Machine Learning, Applications of Kernel Methods, Support Vector Machine in Machine Learning, Advantages & Disadvantages of Support Vector Machine, Applications of Support Vector Machine. **[7Hours]**
Unit III	Kernel Methods Techniques, Support Vector Machine, Adaptive Filter, Kernel Perception, Principal Component Analysis, Spectral Clustering. Introduction to SVM Kernel, SVM Kernel Functions, Kernel Rules, Examples of SVM Kernels. **[7 Hours]**
Unit IV	Classification and Regression using SVM, Properties of Kernels, Non-Mercer Kernels, Kernel Selection, Multiple Kernel Learning, Kernel PCA; Probabilistic Graphical Models: Bayesian networks, Undirected Models, Bayesian Learning, Structure Learning, Inference on Graphical Models, Exponential Families. **[7Hours]**

Unit V	Kernelization of ML Algorithms, Representer Theorem, Machine Learning and Kernel Vector Spaces, Kernel Methods for Green Machine Learning Technologies, Efficient Kernel Methods for Learning and Classification, Multiple Kernel Learning, Kernel Methods and Statistical Estimation Theory. **[8Hours]**
Text Books	
1	1. S. Y. Kung, "Kernel Methods and Machine Learning", Cambridge University Press, Princeton University, New Jersey
2	N. Cristianini and J. Shawe-Taylor. *Kernel Methods for Pattern Analysis*. Cambridge University Press, 2004.
3	2. D. Koller and N. Friedman, Probabilistic Graphical Models – Principles and Techniques, MIT Press, 2009.
4	3. I. Goodfellow, Y. Bengio , A. Courville, Deep Learning, MIT Press, 2017.
Reference Books	
1	1. Daniel P. Bovet, Marco Cesati, "Understanding the Linux Kernel" 2nd Edition, THM Publications
2	2. D. Koller and N. Friedman, Probabilistic Graphical Models – Principles and Techniques, MIT Press, 2009.
3	3. I. Goodfellow, Y. Bengio , A. Courville, Deep Learning, MIT Press, 2017.
4.	N. Aronszajn. *Theory of reproducing kernels*. Transactions of the American Mathematical Society, 68:337-404, 1950.
Useful links	
1	https://www.geeksforgeeks.org/machine-learning/
2	https://www.section.io/engineering-education/introduction-to-kernel-methods-in-machine-learning/
3	https://www.tutorialspoint.com/machine_learning/index.htm
4	https://towardsdatascience.com/kernel-methods-a-simple-introduction-4a26dcbe4ebd

Semester	Code	Name of the course	L	T	P	Credits
8th	AI8TE06C	Game Theory	3	0	0	3 Credits

Prerequisites for the course	
1	A basic understanding of mathematics.
2	A basic concept of Probability and Statistics.
3	A basic Programming in any high-level language

Prior Reading Material/useful links	
1	https://math.stackexchange.com/questions/406375/prerequisites-for-understanding-game-theory
2	https://onlinecourses.nptel.ac.in/noc21_ge24/preview
3	https://www.math.ucla.edu/~tom/GameTheory.html

Course Outcomes:

Sr. No	Course outcome number	CO statement
1	CO1	To Deal with the practicalities of writing a computer game.
2	CO2	To analyses mathematics involved in computer games.
3	CO3	To implement AI algorithms and Physical Laws involved in generating computer games.
4	CO4	To Implement computer games for various platforms.
5	CO5	To apply how Computer Graphics, AI, Physics and Networks are combined in developing computer games.

Syllabus:

Course Contents	
Unit I	Core Design: What Is a Game? Games Aren't Everything. Games Mean Gameplay. Creating the Game Spec. Example Game Spec, Initial Design: The Beginning. Hardware Abstraction. The Problem Domain. Thinking in Tokens. **[6Hours]**
Unit II	Use of Technology: The State of the Art. Blue-Sky Research. Reinventing the Wheel. Use of Object Technology, Building Bricks: Reusability in Software, Initial Architecture Design: The Birth of Architecture. The Tier System. Architecture Design. **[8Hours]**
Unit III	Development: The Development Process. Code Quality. Coding Priorities. Debugging and Module Completion. The Seven Golden Gambits. The Three Lead Balloons. GAMEPROGRAMMING: Technologies: Display, Mixing 2D and 3D, DirectX, User Interface code, Resource caching, the main loop **[6 Hours]**
Unit IV	Design Practices: Smart & naked pointers, using memory correctly, Game scripting languages, building your game: Creating a project, source code repositories and version control, Building the game and scripts, User interface programming and

	input devices: Getting the Device State, working with the Mouse (and Joystick), Working with the Keyboard, User Interface Components. **[6Hours]**
Unit V	2D Drawing and DirectX, Basic 2D Drawing Concepts, Drawing Text, working with Sprites, Graphics File Formats, Initialization and the Main Loop: Initialization, Some C++ Initialization Pitfalls, initializing your Game, the Main Loop, Stick the Landing: A Nice Clean Exit, Loading and Caching Game Resources, 3D Graphics and 3D Engines. **[6 Hours]**
Text Books	
1	Game Architecture and Programming, Shankarmani, Jain, Sinha, Wiley Publication, India
2	Fundamentals of Game Design, 3rd Edition, Ernest Adams, Pearson Publication
3	"Professional Game Programming" Mike McShaffry, Dreamtech Press.
Reference Books	
1	Game Theory: An Introduction, E. N. Barron, Wiley Student Edition.
2	ActionScript 3.0 Game Programming University, 2nd Edition, Gary Rosenzweig, Pearson Education.
3	"Game Architecture and Design", Andrew Rollings and Dave Morris
Useful links	
1	https://oyc.yale.edu/economics/econ-159
2	https://www.bsmath.hu/14spring/GameTheory-PBenatos_MathPrerequisites-BSM2014S.pdf
3	https://www.physicsforums.com/threads/prerequisites-for-game-theory.400604/
4	https://onlinecourses.nptel.ac.in/noc21_ge24/preview

Semester	Course Code	Name of the course	L	T	P	Credits
8th	AI8TE06A	Pattern Recognition	3	0	0	3 Credits

Prerequisites for the course	
1	A basic of Neural Network and fuzzy logic.
2	A Basic of Python programming.
3	A basics of Computer Vision.
4.	A basics of Mathematics.

Prior Reading Material/useful links	
1	https://onlinecourses.nptel.ac.in/noc19_ee56/preview
2	https://www.isical.ac.in/~k.ramachandra/PR_Course.htm
3	https://www.geeksforgeeks.org/pattern-recognition-introduction/

Course Outcomes:

Sr. No	Course outcome number	CO statement
1	CO1	To Summarize the various techniques involved in pattern recognition.
2	CO2	To Categorize the various pattern recognition techniques into supervised and unsupervised.
3	CO3	To Illustrate the artificial neural network-based pattern recognition.
4	CO4	To Discuss the applications of pattern recognition in various applications
5	CO5	To analyze Hidden Markov model and Support Vector Machine

Syllabus:

Course Contents	
Unit I	Pattern Classifier: Overview of Pattern recognition, Discriminant functions, supervised learning, parametric estimation, Maximum Likelihood Estimation. **[6Hours]**
Unit II	Bayes Classifier: Bayesian parameter Estimation, Problems with Bayes approach, Pattern classification by distance functions, Minimum distance pattern classifier. **[6Hours]**
Unit III	Clustering: Clustering for unsupervised learning and classification Clustering concept, CMeans algorithm, Hierarchical clustering, Graph theoretic approach to pattern Clustering, Validity of Clusters. **[8Hours]**
Unit IV	Feature Extraction and Structural Pattern Recognition: KL Transforms, Features election through functional approximation, Binary selection, Elements of formal grammars, Syntactic description, stochastic grammars, Structural representation**.** **[8Hours]**
Unit V	Hidden Markov model and Support Vector Machine: State machine, Hidden Markov model, Training, Classification, Support vector machine, Feature Selection. Recent Advances: Fuzzy logic, Fuzzy Pattern Classifier, Pattern classification using genetic algorithms. **[8Hours]**
Text Books	
1	M. Narasimha Murthy and V. Susheela Devi, "Pattern Recognition", Springer 2011
2	S. Theodoridis and K. Koutroumbas, "Pattern Recognition", 4th Ed., Academic Press, 2009.
3	Robert J. Schalkoff, "Pattern Recognition Statistical, Structural and Neural Approaches", John Wiley and Sons Inc., New York, 1992.
4	C. M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2006.
Reference Books	
1	The Black Swan: The Impact of the Highly Improbable (Hardcover)
2	Pattern Recognition and Machine Learning (Information Science and Statistics)
3	Introduction to Statistical Pattern Recognition (Hardcover)
4.	How to Create a Mind: The Secret of Human Thought Revealed (Hardcover)
Useful links	
1	https://onlinecourses.nptel.ac.in/noc19_ee56/preview
2	http://www.cse.msu.edu/~cse802/
3	https://cedar.buffalo.edu/~srihari/CSE555/
4	https://www.geeksforgeeks.org/pattern-recognition-introduction/

Semester	Course Code	Name of the course	L	T	P	Credits
8th	AI8TE06B	Approximation Algorithm	3	0	0	3 Credits

Prerequisites for the course	
1	A basic understanding of mathematics.
2	A basic concept of Probability and Statistics.
3	A basic Programming in any high-level language

Prior Reading Material/useful links	
1	https://in.coursera.org/learn/approximation-algorithms-part-1
2	https://www.csa.iisc.ac.in/~arindamkhan/courses
3	http://web.stanford.edu/class/msande319
4	https://www.geeksforgeeks.org/approximation-algorithms

Course Outcomes:

Sr. No	Course outcome number	CO statement
1	CO1	Understanding the foundations of approximation algorithm
2	CO2	Provide the solutions on Duality Theorem.
3	CO3	Differentiate the problems and apply the Searching Techniques.
4	CO4	Learn Dynamic Programming.
5	CO5	Apply the concept of Hardness of Approximation.

Syllabus:

Course Contents	
Unit I	Introduction to approximation algorithms; greedy algorithms for unweighted set cover and max coverage problems; deterministic LP rounding for weighted set cover**.** **[6Hours]**
Unit II	Dual of an LP, weak duality theorem, strong duality theorem, f-approximation to weighted set cover by rounding a dual solution, complementary slackness, f-approximation to weighted set cover by the primal dual method. Dual fitting & randomized rounding for weighted set cover. **[8Hours]**
Unit III	Greedy algorithms for k-Center problem and metric TSP; Christofides-Serdyukov algorithm for metric TSP. Minimum degree spanning tree algorithm; local search techniques. Edge coloring; greedy + local search. **[6Hours]**
Unit IV	Dynamic Programming for Bin Packing Deterministic rounding of the LP solutions and Incapacitated Facility Location Problem. Bin packing approximation via deterministic LP rounding. Randomized Rounding schemes. Semidefinite Programming and Shannon zero-error capacity. **[6Hours]**
Unit V	Introduction to Hardness of Approximation and Unique Games Conjecture, Primal Dual Technique, Primal Dual algorithm for Incapacitated Facility Location. Multicut. **[6Hours]**

Text Books	
1	The Design of Approximation Algorithms by David Williamson and David Shmoys, Cambridge University Press, 2011.
2	Approximation Algorithms by Vijay Vazirani, Springer-Verlag, 2004.
3	Chandra Chekuri's Lectures.
Reference Books	
1	https://www.designofapproxalgs.com/book.pdf
2	https://books.google.com/books/about/Approximation_Algorithms.html?id=bJmqCAAAQBAJ
3	https://www.cambridge.org/core/books/design-of-approximation-algorithms/88E0AEAEFF2382681A103EEA572B83C6
Useful links	
1	http://www.designofapproxalgs.com/
2	https://www.ics.uci.edu/~vazirani/book.pdf
3	https://courses.engr.illinois.edu/cs583/fa2021/
4	https://courses.engr.illinois.edu/cs583/fa2021/

Semester	Course Code	Name of the course	L	T	P	Credits
8th	AI8TE06D	Data Visualization	3	0	0	3 Credits

Prerequisites for the course	
1	A basic Concept of mathematics, Probability and Statistics.
2	A basic concept of Data Mining.
3	A basic Programming in any high-level language
4	A basic Concept of Data Science & Computer Vision.

Prior Reading Material/useful links	
1	https://www.javatpoint.com/what-is-data-visualization
2	https://powerbi.microsoft.com/en-us/data-visualization/
3	https://www.techtarget.com/searchbusinessanalytics/definition/data-visualization
4	https://www.tableau.com/learn/articles/data-visualization

Course Outcomes:

Sr. No	Course outcome number	CO statement
1	CO1	Identify the different data types, visualization types to bring out the insight. Relate the visualization. towards the problem based on the dataset.
2	CO2	Identify the different attributes and showcasing them in plots.
3	CO3	Ability to visualize categorical, quantitative and text data.
4	CO4	Design visualization dashboard to support the decision-making on large scale data.
5	CO5	Design the dashboard for data visualization.

Syllabus:

Course Contents	
Unit I	Introduction to Data Visualization: A Brief History of Data Visualization, need of Data Visualization, Overview of data visualization - Data Abstraction - Analysis: Four Levels for Validation- Task Abstraction - Analysis: Four Levels for Validation. Good Graphics, Static Graphics, Data Visualization through their Graph Representations, High-dimensional Data Visualization, MultivariateData. **[8Hours]**
Unit II	Visualization Techniques: Scalar and point techniques Color maps Contouring Height Plots – Vector Visualization techniques Vector properties Vector Glyphs, Vector Color Coding Stream Objects. **[6Hours]**

Unit III	Visual Analytics: Visual Variables- Networks and Trees - Map Color and Other Channels- Manipulate View. Arrange Tables Geo Spatial Data Reduce Items and Attributes. **[6Hours]**
Unit IV	Visualization Tools and Techniques: Introduction to data visualization tools- Tableau - Visualization using R. Diverse Types of Visual Analysis: Time- Series data visualization Text data visualization Multivariate data visualization and case studies. **[8Hours]**
Unit V	Visualization Dashboard Creations: Dashboard creation using visualization tools for the use cases: Finance-marketing-insurance healthcare etc**.** **[6Hours]**
Text Books	
1	Tamara Munzer, Visualization Analysis and Design -, CRC Press 2014
2	AlexandruTelea, Data Visualization Principles and Practice CRC Press 2014.
3	Paul J. Deitel, Harvey Deitel, Java SE8 for Programmers (Deitel Developer Series) 3rd Edition, 2014.
4	Y. Daniel Liang, Introduction to Java programming-comprehensive version-Tenth Edition, Pearson ltd 2015.
Reference Books	
1	Paul Deitel Harvey Deitel ,Java, How to Program, Prentice Hall; 9th edition , 2011
2	Cay Horstmann BIG JAVA, 4th edition,John Wiley Sons,2009
3	Nicholas S. Williams, Professional Java for Web Applications, Wrox Press, 2014
Useful links	
1	https://www.techtarget.com/searchbusinessanalytics/definition/data-visualization
2	https://www.sas.com/en_in/insights/big-data/data-visualization.html
3	https://www.javatpoint.com/what-is-data-visualization
4	https://www.tableau.com/learn/articles/data-visualization

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JDCOEM, Nagpur

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., 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

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				
				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 *f*

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	Teachin			Evaluation				
				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

.

[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
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
"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
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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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J D COLLEGE OF ENGINEERING & MANAGEMENT, NAGPUR

Department of Electronics / Electronics & Telecommunication Engineering

"Rectifying Ideas, Amplifying Knowledge"

SESSION 2022-23

ANNEXURE-I

SCHEME FOR POSTGRADUATE COURSE IN M.TECH (ELECTRONICS ENGINEERING)

I SEMESTER

Sr. No	Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme					Credits
				L	T	P	CA	MSE	ESE	PR/OR	TOTAL	
1	PCC	EN1T001	Computational Methods	3	1	0	20	20	60	0	100	3
2	PCC	EN1T002	Embedded System Design	3	1	0	20	20	60	0	100	4
3	PCC	EN1T003	VLSI System Design	3	1	0	20	20	60	0	100	4
4	HSMC	EN1T004	Research Methodology	3	0	0	20	20	60	0	100	3
5	PEC	EN1E101	ELECTIVE-I	3	0	0	20	20	60	0	100	3
6	PEC	EN1E201	ELECTIVE-II	3	0	0	20	20	60	0	100	3
7	LC	EN1L001	Embedded System Design Lab	0	0	2	25	0	0	25	50	1
8	LC	EN1L002	VLSI System Design Lab	0	0	2	25	0	0	25	50	1
			TOTAL	**18**	**3**	**4**	**170**	**120**	**360**	**50**	**700**	**22**

II SEMESTER

Sr. No	Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme					Credits
				L	T	P	CA	MSE	ESE	PR/OR	TOTAL	
1	PCC	EN2T001	Advanced DSP	3	1	0	20	20	60	0	100	3
2	PCC	EN2T002	Advanced Embedded System Design	3	1	0	20	20	60	0	100	4
3	PEC	EN2E301	Elective-III	3	0	0	20	20	60	0	100	3
4	PEC	EN2E401	Elective- IV	3	0	0	20	20	60	0	100	3
5	PEC	EN2E501	Elective-V	3	0	0	20	20	60	0	100	3
6	LC	EN2L001	Advanced Embedded System Design Lab	0	0	2	25	0	0	25	50	1
7	LC	EN2S001	Seminar-I	0	0	4	25	0	0	25	50	2
8	Project	EN2P001	Mini-Project/ Field training	0	0	4	50	0	0	50	100	2
			TOTAL	**15**	**2**	**10**	**200**	**100**	**300**	**100**	**700**	**21**

III SEMESTER

Sr. No	Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme					Credits
				L	T	P	CA	MSE	PR/OR	ESE	TOTAL	
2	HSMC	EN3T001	Intellectual Property Rights	0	0	0	50	0	50	0	100	2
3	Project	EN3P001	Major Project Stage -I	0	0	0	50	0	50	0	100	10
			TOTAL	**0**	**0**	**0**	**100**	**0**	**100**	**0**	**200**	**12**

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ANNEXURE-I

SCHEME FOR POSTGRADUATE COURSE IN M.TECH (ELECTRONICS ENGINEERING)

IV SEMESTER

Sr.No	Catego	Course Code	Course Title	Teaching Scheme			Evaluation Scheme					Credits
				L	T	P	CA	MSE	PR/OR	ESE	TOTAL	
1	Project	EN4P001	Major Project- Stage II	0	0	0	100	0	100	0	200	18
TOTAL				**0**	**0**	**0**	**100**	**0**	**100**	**0**	**200**	**18**
GRAND TOTAL										**1800**		

Sr.No	Elective-I
1	Advanced Digital System Design & Architecture
2	Wearable Medical Devices
3	Artificial Neural Networks and Applications
4	Fault Tolerant Systems
5	Analog and Mixed Signal Processing
6	MIMO Systems

Sr. No	Elective-II
1	MEMS
2	Speech Processing
3	ASIC & SOC
4	RF and Millimeter Wave circuit Design
5	Electromagnetic Interference and Compatibility
6	Cognitive Radio

Sr.No	Elective-III
1	Multirate Digital Signal Processing
2	Wireless Sensor Network Design
3	Statistical Signal Processing
4	Artificial Intelligence
5	Optical Fiber Communication
6	Smart Antennas

Sr. No	Elective-IV
1	Advanced Biomedical Signal Processing
2	Reconfigurable Computing
3	Radar Signal Processing
4	Electromagnetics, Antenna and Propagation
5	Numerical Methods in Electromagnetics
6	Hardware Implementation of AI

Sr.No	Elective-V
1	Internet of Things
2	Quantum computing
3	Neural Networks in Embedded Applications
4	Nanoscale Devices and Circuit Design
5	Wavelet Transforms and its Applications
6	Broadband Communication

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An Autonomous Institute, with NAAC "A" Grade

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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.

Scheme for B. Tech in Electronics and Telecommunication Engineering (w.e.f. 2022-23)

B. Tech Third Semester

Sr. No.	Category of Course	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				Credits
				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 and Circuits	2	1	0	20	20	60	100	3
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 Circuits and Applications	2	1	0	20	20	60	100	3
6	PCC	ET3T006	Network Synthesis and Analog Filters	2	1	0	20	20	60	100	3
7	ESC	ET3L002	Electronic Devices and Circuits 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	HSMC	ET3T007	Universal Human Values	3	0	0	20	20	60	100	3
			Total	**15**	**6**	**6**	**320**	**140**	**540**	**1000**	**24**

B. Tech Fourth Semester

Sr. No.	Category of Course	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				Credits
				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	Microcontroller and Application	3	0	0	20	20	60	100	3
5	PCC	ET4T005	Signals and Systems	3	0	0	20	20	60	100	3
6	PCC	ET4T006	Electromagnetic Fields	2	1	0	20	20	60	100	3
7	ESC	ET4L003	Electrical Machines and Instruments Lab	0	0	2	60	0	40	100	1
8	ESC	ET4L004	Microcontroller and Application Lab	0	0	2	60	0	40	100	1

9	PCC	ET4L005	Basics of Python Programming Lab	0	0	2	60	0	40	100	1
10	Project	ET4P001	Field Training-1/ Industrial Visit	0	0	0	50	0	0	50	1
11	MC	ET4T007	Innovation and Entrepreneurship Development	2	0	0	10	15	25	50	Audit
12			NPTEL Course	2	0	0	25	0	25	50	2
			Total	**19**	**3**	**6**	**385**	**135**	**530**	**1050**	**24**

B. Tech Fifth Semester

Sr. No.	Category of Course	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				Credits
				L	T	P	CA	MSE	ESE	Total	
1	PCC	ET5T001	Digital Signal Processing	2	1	0	20	20	60	100	3
2	PCC	ET5T002	Introduction to IOT	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	Project	ET5P001	Field Training-2/ Industrial Visit	0	0	0	50	0	0	50	1
9	Project	ET5P002	Mini Project	0	0	2	30	0	20	50	1
10	MC	ET5T006	Consumer Affairs	2	0	0	10	15	25	50	Audit
			Total	**17**	**1**	**6**	**310**	**115**	**425**	**850**	**20**

B. Tech Sixth Semester

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
10	Project	ET6P003	Mini Project	0	0	2	30	0	20	50	1
11	MC	ET6T007	Research Methodology	2	0	0	10	15	25	50	Audit
			Total	**17**	**0**	**10**	**325**	**115**	**460**	**900**	**20**

B. Tech Seventh Semester

Sr. No.	Category of Course	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				Credit
				L	T	P	CA	MSE	ESE	Total	
1	PCC	ET7T001	Digital Communication	3	0	0	20	20	60	100	3
2	PEC	ET7E002	Professional Elective Course-III	3	0	0	20	20	60	100	3
3	PEC	ET7E003	Professional Elective Course-IV	3	0	0	20	20	60	100	3
4	PEC	ET7E004	Professional Elective Course-V	3	0	0	20	20	60	100	3
5	OEC	ET7O003	OPEN Elective Course-III	4	0	0	20	20	60	100	4
6	ESC	ET7L005	Basic Electronic Simulation Lab	0	0	2	60	0	40	100	1
7	PCC	ET7L001	Digital Communication Lab	0	0	2	60	0	40	100	1
8	Project	ET7P002	Major Project Part-1	0	0	6	50	0	50	100	3
9	MC	ET7T006	Intellectual Property Rights	2	0	0	10	15	25	50	Audit
			Total	**18**	**0**	**10**	**280**	**115**	**455**	**850**	**21**

B. Tech Eighth Semester

Sr. No.	Category of Course	Course Code	Course Name	Teaching Scheme			Evaluation Scheme				Credit
				L	T	P	CA	MSE	ESE	Total	
1	PEC	ET8E001	Professional Elective Course-VI	3	0	0	20	20	60	100	3
2	OEC	ET8O004	OPEN Elective Course-IV	4	0	0	20	20	60	100	4
3	Project	ET8P001	Major Project Part-2	0	0	12	75	0	75	150	5
4			NPTEL Course	2	0	0	25	0	25	50	2
Total				**7**	**0**	**12**	**140**	**40**	**220**	**400**	**14**

Prof. Mohammad Hassan
Secretary
BoS ETC Board

Prof. Gayatri A. Bhoyar
Chairman
BoS ETC Board

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ET3T002	Electronics Devices and Circuits	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/MOSFET
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: JFET AND MOSFET [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.

MOSFET: 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-4: 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-5: 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-6: 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

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/

ET4T005	Signal and System	3 Credit

Prerequisites:

1. Basic Idea of Transform and its mathematical descriptions (Laplace, Fourier and Z Transform)
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: Students should be able to

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 using various mathematical tools.

Course Contents:

Module-1: Basics of signals and system [8 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 etc., 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.

Module-2: Time Response Analysis [6 Hrs]

Discrete-Time LTI (Linear Time Invariant System) Systems, the impulse response and Convolution Sum, Convolution of two sequences, Continuous-Time LTI Systems, the Convolution Integral, Properties of convolutions, Causal LTI Systems Described by Differential and Difference Equations.

Module-3: Fourier Series Analysis [6 Hrs]

The 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

Module-4: Fourier Transform Analysis [6 Hrs]

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, 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 of Frequency Response, Frequency response of discrete time systems, 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 [4 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, 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.

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. Shaila Dinkar Apte “Signals and Systems” Principles and Applications”, Cambridge University Press.

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

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J D COLLEGE OF ENGINEERING AND MANAGEMENT
KATOL ROAD, NAGPUR
SESSION 2019-20

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							

JAIDEV EDUCATION SOCIETY'S
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Session 2020-21

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	Teaching			Evaluation Scheme				
				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

JAIDEV EDUCATION SOCIETY'S
J D COLLEGE OF ENGINEERING AND MANAGEMENT
Session 2021-22

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

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

Dr. Babasaheb Ambedkar Technological University
(Established as a University of Technology in the State of Maharashtra)
(under Maharashtra Act No. XXIX of 2014)
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Detailed Syllabus
for
First Year B. Tech program(All Branches)

Dr. Babasaheb Ambedkar Technological Engineering

Teaching and Evaluation Scheme for First Year B. Tech. (All Branches)

Group A

Semester I									
Course Code	**Course Title**	**Teaching Scheme**			**Evaluation Scheme**				
		L	T	P	CA	MSE	ESE	Total	Credit
Mandetory	**Induction Program**	**3-weeks duration in the beginning of semester.**							
BTBS101	Engineering Mathematics- I	3	1	-	20	20	60	100	4
BTBS102	Engineering Physics	3	1	-	20	20	60	100	4
BTES103	Engineering Graphics	2	-	-	20	20	60	100	2
BTHM104	Communication Skills	2	-	-	20	20	60	100	2
BTES105	Energy and Environment Engineering	2	-	-	20	20	60	100	2
BTES106	Basic Civil and Mechanical Engineering	2	-	-	50	-	-	50	Audit
BTBS107L	Engineering Physics Lab	-	-	2	60	-	40	100	1
BTES108L	Engineering Graphics Lab	-	-	4	60	-	40	100	2
BTHM109L	Communication Skills Lab.	-	-	2	60	-	40	100	1
		14	**2**	**8**	**330**	**100**	**420**	**850**	**18**
Semester II									
BTBS201	Engineering Mathematics-II	3	1	-	20	20	60	100	4
BTBS202	Engineering Chemistry	3	1	-	20	20	60	100	4
BTES203	Engineering Mechanics	2	1	-	20	20	60	100	3
BTES204	Computer Programming in C	2	-	-	20	20	60	100	2
BTES205	Workshop Practices	-	-	4	60	-	40	100	2
BTES206	Basic Electrical and Electronics Engineering	2	-	-	50	-	-	50	Audit
BTES207L	Computer Programming Lab	-	-	2	60	-	40	100	1
BTBS208L	Engineering Chemistry Lab	-	-	2	60	-	40	100	1
BTES209L	Engineering Mechanics Lab	-	-	2	60	-	40	100	1
BTES210P	Mini Project	-	-	2	60	-	40	100	1
BTES211P	Field Training / Internship/Industrial Training (minimum of 4 weeks which can be completed partially in first semester and second Semester or in at one time).	**-**	**-**	**-**	-	-	-	-	Credits To be evaluated in III Sem.
		12	**3**	**12**	**430**	**80**	**440**	**950**	**19**
		27							

Dr. Babasaheb Ambedkar Technological Engineering

Teaching and Evaluation Scheme for First Year B. Tech. (All Branches)

Group B

Semester I									
Course Code	**Course Title**	**Teaching Scheme**			**Evaluation Scheme**				
		L	T	P	CA	MSE	ESE	Total	Credit
Mandetory	**Induction Program**	**3-weeks duration in the beginning of semester.**							
BTBS101	Engineering Mathematics- I	3	1	-	20	20	60	100	4
BTBS102	Engineering Chemistry	3	1	-	20	20	60	100	4
BTES103	Engineering Mechanics	2	1	-	20	20	60	100	3
BTES104	Computer Programming in C	2	-	-	20	20	60	100	2
BTES105L	Workshop Practices	-	-	4	60	-	40	100	2
BTES106	Basic Electrical and Electronics Engineering	2	-	-	50	-	-	50	Audit
BTES107L	Computer Programming Lab	-	-	2	60	-	40	100	1
BTBS108L	Engineering Chemistry Lab	-	-	2	60	-	40	100	1
BTES109L	Engineering Mechanics Lab	-	-	2	60	-	40	100	1
		12	**3**	**10**	**370**	**80**	**400**	**850**	**18**
		25							
Semester II									
BTBS201	Engineering Mathematics-II	3	1	-	20	20	60	100	4
BTBS202	Engineering Physics	3	1	-	20	20	60	100	4
BTES203	Engineering Graphics	2	-	-	20	20	60	100	2
BTHM204	Communication Skills	2	-	-	20	20	60	100	2
BTES205	Energy and Environment Engineering	2	-	-	20	20	60	100	2
BTES206	Basic Civil and Mechanical Engineering	2	-	-	50	-	-	50	Audit
BTBS207L	Engineering Physics Lab	-	-	2	60	-	40	100	1
BTES208L	Engineering Graphics Lab	-	-	4	60	-	40	100	2
BTHM209L	Communication Skills Lab.	-	-	2	60	-	40	100	1
BTES210P	Mini Project	-	-	2	60	-	40	100	1
BTES211P	Field Training / Internship/Industrial Training (minimum of 4 weeks which can be completed partially in first semester and second Semester or in at one time)	-	-	-	-	-	-	-	Credits To be evaluated in III Sem.
		14	**2**	**10**	**390**	**100**	**460**	**950**	**19**
		26							

Guide to Induction Program

When new students enter an institution, they come with diverse thoughts, backgrounds and preparations. It is important to help them adjust to the new environment and inculcate in them the ethos of the institution with a sense of larger purpose. Precious little is done by most of the institutions, except for an orientation program lasting a couple of days.

We propose a 3-week long induction program for the UG students entering the institution, right at the start. Normal classes start only after the induction program is over. Its purpose is to make the students feel comfortable in their new environment, open them up, set a healthy daily routine, create bonding in the batch as well as between faculty and students, develop awarness, sensitivity and understanding of the self, people around them, society at large, and nature.

The time during the Induction Program is also used to rectify some critical lacunas, for example, English background, for those students who have deficiency in it.

The following are the activities under the induction program in which the student would be fully engaged throughout the day for the entire duration of the program.

- **Physical Activity** This would involve a daily routine of physical activity with games and sports. It would start with all students coming to the field at 6 am for light physical exercise or yoga. There would also be games in the evening or at other suitable times according to the local climate. These would help develop team work. Each student should pick one game and learn it for three weeks. There could also be gardening or other suitably designed activity where labour yields fruits from nature.
- **Creative Arts** Every student would chose one skill related to the arts whether visual arts or performing arts. Examples are painting, sculpture, pottery, music, dance etc. The student would pursue it everyday for the duration of the program. These would allow for creative expression. It would develop a sense of aesthetics and also enhance creativity which would, hopefully, flow into engineering design later.
- **Universal Human Values:** It gets the student to explore oneself and allows one to experience the joy of learning, stand up to peer pressure, take decisions with courage, be aware of relationships with colleagues and supporting staff in the hostel and department, be sensitive to others, etc. Need for character building has been underlined earlier. A module in Universal Human Values provides the base. Methodology of teaching this content is extremely important. It must not be through do's and dont's, but get students to explore and think by engaging them in a dialogue. It is best taught through group discussions and real life activities rather than lecturing. The role of group discussions, however, with clarity of thought of the teachers cannot be over emphasized. It is essential for giving exposure, guiding thoughts, and realizing values. The teachers must come from all the departments rather than only one department like HSS or from outside of the Institute. Discussions would be conducted in small groups of about 20 students with a faculty mentor each. It is to open thinking towards the self. Universal Human Values discussions could even continue for rest of the semester as a normal course, and not stop with the induction program. Besides drawing the attention of the student to larger issues of life, it would build relationships between teachers and students which last for their entire 4-year stay and possibly beyond.
- **Literary** Literary activity would encompass reading, writing and possibly, debating, enacting a play etc.
- **Proficiency Modules:** This period can be used to overcome some critical lacunas that students might have, for example, English, computer familiarity etc. These should run like crash courses, so that when normal courses start after the induction program, the student has overcome the lacunas substantially. We hope that problems arising due to lack of English skills, wherein students start lagging behind or failing in several subjects, for no fault of theirs, would, hopefully, become a thing of the past.
- **Lectures by Eminent People** This period can be utilized for lectures by eminent people, say, once a week. It would give the students exposure to people who are socially active or in public life.

- **Visits to Local Area** A couple of visits to the landmarks of the city, or a hospital or orphanage could be organized. This would familiarize them with the area as well as expose them to the under privileged.
- **Familiarization to Dept./Branch & Innovations :** The students should be told about different method of study compared to coaching that is needed at IITs. They should be told about what getting into a branch or department means what role it plays in society, through its technology. They should also be shown the laboratories, workshops & other facilties.

Schedule

The activities during the Induction Program would have an ***Initial Phas***e, a ***Regular Phase*** and a ***Closing Phase***. The Initial and Closing Phases would be two days each.

Initial Phase

Time	Activity
Day 0	
Whole day	Students arrive - Hostel allotment. (Preferably do preallotment)
Day 1	
9.00 AM to 3.00 PM	Academic Registration
4.30 PM to 6.00 PM	Ori Orientation
Day 2	
9.00 AM to 10.00 AM	Diagnostic test (for English etc.) Visi
10.15 AM to 12.25 PM	Visits to Respective Departments
12.30 to 2.00	Lunch time
2.00 PM to 3.00 PM	Director's Speech
3.00 PM to 4.00 PM	Interaction with Parents
4.00 PM to 5.30 PM	Mentor-Mentee groups- Introduction within group

Regular Phase

After two days is the start of the Regular Phase of induction. With this phase there would be regular program to be followed every day.

Daily Schedule

Some of the activities are on a daily basis, while some others are at specified periods within the Induction Program. We first show a typical daily timetable.

Session	Time	Activity	Remark
Day 3 Onwards			
I	9.00 AM to 11.00 AM	Creative Arts / Universal Human Values	Half the groups will do creative arts
II	11.00 AM to 1.00 PM	Universal Human Values/ Creative Arts	Complementary Alternate
Lunch Time			
IV	2.00 PM to 4.00 PM	Afternoon Session	See below
V	4.00 PM to 5.00 PM	Afternoon Session	See below

Sundays are off. Saturdays have the same schedule as above or have outings.

Afternoon Activities (Non-Daily) : The following five activities are scheduled at different times of the Induction Program, and are not held daily for everyone:

1. Familiarization to Dept./Branch & Innovations
2. Visits to Local Area
3. Lectures by Eminent People
4. Literary
5. Proficiency Modules

Closing Phase

Time	Activity
Last But one day	
9.00 AM to 12.00 PM	Discussions and finalizations of presentations within each group
2.00 PM to 5.00 PM	Presentation by each group in front of 4 other groups besides their own (about 100 students)
Last Day	
Whole day	Examinations if any

Follow Up after Closure

A question comes up as to what would be the follow up program after the formal 3-week Induction Program is over? The groups which are formed should function as mentor- mentee network. A student should feel free to approach his faculty mentor or the student guide, when facing any kind of problem, whether academic or financial or psychological 6etc. (For every 10 undergraduate first year students, there would be a senior student as a student guide, and for every 20 students, there would be a faculty mentor.) Such a group should remain for the entire 4-5 year duration of the stay of the student. Therefore, it would be good to have groups with the students as well as teachers from the same department/discipline Here we list some important suggestions which have come up and which have been experimented with.

- **Follow Up after Closure – Same Semester:** It is suggested that the groups meet with their faculty mentors once a month, within the semester after the 3-week Induction Program is over. This should be a scheduled meeting shown in the timetable. (The groups are of course free to meet together on their own more often, for the student groups to be invited to their faculty mentor's home for dinner or tea, nature walk, etc.)
- **Follow Up – Subsequent Semesters:** It is extremely important that continuity be maintained in subsequent semesters. It is suggested that at the start of the subsequent semesters (upto fourth semester), three days be set aside for three full days of activities related to follow up to Induction Program. The students be shown inspiring films, do collective art work, and group discussions be conducted. Subsequently, the groups should meet at least once a month.

Summary

Engineering institutions were set up to generate well trained manpower in engineering with a feeling of responsibility towards oneself, one's family, and society. The incoming undergraduate students are driven by their parents and society to join engineering without understanding their own interests and talents. As a result, most students fail to link up with the goals of their own institution.
The graduating student must have values as a human being, and knowledge and meta-skills related to his/her profession as an engineer and as a citizen. Most students who get demotivated to study engineering or their branch, also lose interest in learning.
The Induction Program is designed to make the newly joined students feel comfortable, sensitize them towards exploring their academic interests and activities, reducing competition and making them work for excellence, promote bonding within them, build relations between teachers and students, give a broader view of life, and building of character.

The Universal Human Values component, which acts as an anchor, develops awareness and sensitivity, feeling of equality, compassion and oneness, draw attention to society and 4
We are aware that there are advantages in mixing the students from different depts. However, in mixing, it is our experience that the continuity of the group together with the faculty mentor breaks down soon after. Therefore, the groups be from the same dept. but hostel wings have the mixed students from different depts. For example, the hostel room allotment should be in alphabetical order irrespective of dept. 7nature, and character to follow through. It also makes them reflect on their relationship with their families and extended family in the college (with hostel staff and others). It also connects students with each other and with teachers so that they can share any difficulty they might be facing and seek help.

References:

Motivating UG Students Towards Studies, Rajeev Sangal, IITBHU Varanasi, Gautam Biswas, IIT Guwahati, Timothy Gonsalves, IIT Mandi, Pushpak Bhattacharya, IIT Patna, (Committee of IIT Directors),
31 March 2016, IIT Directors' Secretariat, IIT Delhi.

Engineering Mathematics – I

Unit 1:Linear Algebra- Matrices
Inverse of a matrix by Gauss-Jordan method; Rank of a matrix; Normal form of a matrix ; Consistency of non- homogeneous and homogeneous system of linear equations ; Eigen values and eigen vectors ; Properties of eigen values and eigen vectors (without proofs); Cayley-Hamilton's theorem (without proof) and its applications. **[6 Hours]**

Unit 2:Partial Differentiation
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.
[06 Hours]

Unit 3:Applications of Partial differentiation
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. **[06 Hours]**

Unit 4: Reduction Formulae and Curve Tracing
Reduction formulae for $\int_0^{\frac{\pi}{2}} \sin^n x\,dx$, $\int_0^{\frac{\pi}{2}} \cos^n x\,dx$, $\int_0^{\frac{\pi}{2}} \sin^m x \cos^n x\,dx$; Tracing of the curves given in Cartesian, parametric & polar forms. **[06 Hours]**

Unit 5: Multiple Integrals
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; Applications of multiple integrals to find area as double integral , volume as triple integral and surface area.
[08 Hours]

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 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. 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.

General Instructions:
The tutorial classes in Engineering Mathematics-I are to be conducted batchwise. Each class should be divided into three batches for the purpose.
The internal assessment of the students for 20 marks will be done based on assignments, surprise tests, quizzes, innovative approach to problem solving and percentage attendance.
The minimum number of assignments should be eight covering all topics.

BTBS102/ BTBS202 Engineering Physics

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.

Unit I

Oscillatio, Ultrasonics and Dielectric Materials: (06 Hrs)

Free oscillation, damped oscillation, Forced oscillation and Resonance, differential wave equation, Ultrasonic waves, production of ultrasonics (Piezoelectric effect, Magnetostriction effect) and its applications.

Dielectric parameters (Dielectric constant, Electric displacement, Polarization & Polarizability), Types of polarization, temperature and frequency dependences of dielectric materials.

Unit II

Optics, Fibre Optics and Laser: (06 Hrs)

Interference of light in thin film, wedge shaped film , Newton's rings, polarization of light, methods for production of polarized light(Reflection, Refraction& Double refraction), Huygen's theory of double refraction, Laurent's half shade Polarimeter, Principle and structure of optical fibre, acceptance angle, acceptance cone, numerical aperture.

Principle of laser, Einstein's coefficients, Types of laser – Ruby and He-Ne laser and their applications.

Unit III

Electron Optics, Nuclear Physics and Quantum Mechanics: (06 Hrs)

Measurement of 'e/m' by Thomson's method, Determination of electronic charge by Millikan's oil drop method, Bainbridge mass spectrograph,

G.M. counter, Heisenberg's uncertainty principle, Schrödinger's time dependent and time independent wave equations, physical significance of wave function.

Unit IV

Crystal Structure, X-rays and Electrodynamics: (06 Hrs)

Unit cell, Bravais lattice, cubic system, number of atoms per unit cell, coordination number, atomic radius, packing density, relation between lattice constant and density, lattice planes and Miller indices, Interplaner spacing for cubic system, Bragg's law, X-ray diffraction, Line and Continuous Spectrum of X-ray, Mosley's law. Introduction of Maxwell equations(no derivation), Electromagnetic wave in free space.

Unit V

Magnetic, Superconducting and Semiconducting materials: (06 Hrs)

Types of magnetic materials(Ferrimagnetic & Antiferromagnetic, Ferrites & Garnets), B-H curve, Classical free electron theory-electrical conductivity, resistivity and its temperature dependence, microscopic Ohm's law, Superconductivity, types of superconductors, Meissner effect and Applications. Band theory of solids, conductivity of semiconductors, Hall effect.

Expected Outcome:-

1. The student will be able to understand Engineering problems based on the principle of Oscillation, Ultrasonics, Optics, Laser, Fibre optics, Nuclear physics, Quantum mechanics.
2. The student will be able to understand Fundamental of Electrodynamics, Semiconductor, Dielectric, Magnetic and Superconducting materials which forms the base of many modern devices and technologies.

Text books:

1. Engineering Physics M.N. Avadhanulu and P.G. Kshirsagar. S.Chand and Company LTD.
2. Engineering Physics – Dr. L. N. Singh. Synergy Knowledgeware-Mumbai.

3. Engineering Physics - R.K. Gaur and S. L. Gupta. Dhanpat Rai Publications Pvt. Ltd.-New Delhi.
4. Fundamental of Physics - Halliday and Resnik. Willey Eastern Limited.

Reference books:

1. Introduction to Electrodynamics –David R. Griffiths.
2. Concept of Modern Physics – Arthur Beizer. Tata McGraw-Hill Publishing Company Limited.
3. Optics – Ajoy Ghatak.MacGraw Hill Education (India) Pvt. Ltd.
4. Science of Engineering Materials- C.M. Srivastava and C. Srinivasan. New Age International Pvt.Ltd.
5. Solid State Physics – A.J. Dekker. McMillan India –Limited.
6. The Feynman Lectures on Physics Vol I,II,III.
7. Introduction to solid state physics – Charles Kittel. John Willey and Sons

Engineering Physics Lab.

At least 10 experiments should be performed from the following list.

1. Newton's rings - Determination of radius of curvature of Plano convex lens / wavelength of light
2. Wedge Shaped film - Determination of thickness of thin wire
3. Half shade Polarimeter - Determination of specific rotation of optically active material
4. Laser - Determination of wavelength of He-Ne laser light
5. Magnetron Tube - Determination of 'e/m' of electron
6. G.M. Counter - Determination of operating voltage of G.M. tube
7. Crystal Plane – Study of planes with the help of models related Miller Indices
8. Hall Effect - Determination of Hall Coefficient
9. Four Probe Method - Determination of resistivity of semiconductor
10. Measurement of Band gap energy of Semiconductors
11. Study of I-V characteristics of P-N junction diode
12. Experiment on fibre optics
13. Ultrasonics Interferometer
14. B-H Curve Experiment
15. Susceptiblity measurement experiment

BTES103/203 Engineering Graphics

Teaching Scheme:	Examination Scheme:
Lecture: 2 hrs/week	Internal Assessment: 20 Marks Mid Term Test: 20 Marks End Semester Exam: 60 Marks (Duration 04 hrs)

Unit 1: Drawing standards and geometrical construction: 4hrs

Drawing standard SP: 46, Type of lines, lettering, dimensioning, scaling conventions. Geometrical construction: Dividing a given straight line into any number of equal parts, bisecting a given angle, drawing a regular polygon given one side, special methods of constructing a pentagon and a hexagon.

Unit 2: Orthographic Projections and Projections of Points: 4hrs

Introduction to orthographic projection, drawing of orthographic views of objects from their isometric views. Projection of points lying in four quadrants.

Unit 3: Projections of Straight Lines and Planes and their Traces : 4hrs

Projections of lines parallel and perpendicular to one or both planes, projections of lines inclined to one or both planes. Traces of lines.

Projections of planes parallel and perpendicular to one or both planes, projection of planes inclined to one or both planes.

Unit 4: Projections of Solids 4hrs

Types of solids, projections of solids with axis perpendicular and parallel to HP and VP, solids with axis inclined to one or both the planes. Projections of spheres touching each other.

Unit 5: Sectioning of Solids, Isometric Projections 4hrs

Sectioning of solids: Section planes perpendicular to one plane and parallel or inclined to other plane. Isometric projections: Isometric scale, drawing of isometric projections from given orthographic views.

Reference/Text Books:

1. N. D. Bhatt, *Engineering Drawing*, Charotar Publishing House, 46th Edition, 2003.
2. K. V. Nataraajan, *A text book of Engineering Graphic*, Dhanalakshmi Publishers, Chennai, 2006.
3. K. Venugopal and V. Prabhu Raja, *Engineering Graphics*, New Age International (P) Ltd, 2008.
4. Dhananjay A. Jolhe, *Engineering Drawing with an Introduction to Autocad*, McGraw Hill Education, 2017

Engineering Graphics Lab

Practical Scheme:	**Examination Scheme:**
Practical: 4 hrs/batch	Internal Assessment: 60 Marks External Exam: 40 Marks

List of Practical:

1. Lines, lettering and dimensioning.
2. Geometrical Constructions.
3. Orthographic projections.
4. Projections of points.
5. Projections of straight lines.
6. Projections of planes.
7. Projections of solids.
8. Section of solids.
9. Isometric Projections.

Communication Skills

Unit 1: Communication and Communication Processes (04 hrs)

Introduction to Communication, Forms and functions of Communication, Barriers to Communication and overcoming them, Verbal and Non-verbal Communication

Reading: Introduction to Reading, Barriers to Reading, Types of Reading: Skimming, Scanning, Fast Reading, Strategies for Reading, Comprehension.

Listening : Importance of Listening, Types of Listening, Barriers to Listening.

Unit 2: Verbal & Non-verbal Communication (04 hrs)

Use of Language in Spoken Communication, Principles and Practice of Group Discussion, Public Speaking (Addressing Small Groups and Making Presentation), Interview Techniques, Appropriate Use of Non-verbal Communication, Presentation Skills, Extempore, Elocution.

Unit 3: Study of Sounds in English (02 hrs)

Introduction to phonetics, Study of Speech Organs, Study of Phonemic Script, Articulation of Different Sounds in English.

Unit 4: English Grammar (05 hrs)

Grammar: Forms of Tenses, Articles, Prepositions, Use of Auxiliaries and Modal Auxiliaries, Synonyms and Antonyms, Common Errors.

Unit 5: Writing Skills, Reading Skills & Listening Skills (04 hrs)

Features of Good Language, Difference between Technical Style and Literary Style, Writing Emails, Formal and Informal English, Technical Reports: Report Writing: Format, Structure and Types

Letter Writing: Types, Parts, Layouts, Letters and Applications, Use of Different Expressions and Style, Writing Job Application Letter and Resume.

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, 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) Bovee Courtland,L and Thrill, John V. *Business Communication*, Today McGraw Hill, New York, Taxman Publication (1989).

Communication Skills Lab

List of Practicals (Any 10 PR sessions can be conducted)

1) How to introduce oneself ? (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) Introduction to stress and intonation (02 hrs)
8) Rapid reading sessions (02 hrs)
9) Know your friend (02 hrs)
10) How to introduce yourself (02 hrs)
11) Extempore (02 hrs)
12) Group discussion (02 hrs)
13) Participating in a debate (02 hrs)
14) Presentation techniques (02 hrs)
15) Interview techniques (02 hrs)

Energy and Environment Engineering

Unit 1

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. **[4 hrs]**

Unit 2

Renewable Power Generation: Solar, Wind, Biogas and Biomass, Ocean Thermal energy conversion (OTEC), Tidal, Fuel cell, Magneto Hydro Dynamics (MHD): Schematic arrangement, advantages and disadvantages. **[4 hrs]**

Unit 3

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, compressors, pumps, fans and blowers, Energy conservation in electric furnaces, ovens and boilers., lighting techniques. **[4 hrs]**

Unit 4

Air Pollution: Environment and Human health - Air pollution: sources- effects- control measures - Particulate emission, air quality standards, and measurement of air pollution. **[4 hrs]**

Unit 5

Water Pollution: Water pollution- effects- control measures- Noise pollution –effects and control measures, Disposal of solid wastes, Bio-medical wastes-Thermal pollution – Soil pollution -Nuclear hazard. **[4 hrs]**

Reference/Text Books:

1. A Chakrabarti, M. L Soni, P. V. Gupta, U. S. Bhatnagar, A Text book of Power System Engineering, Dhanpat Rai 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.

Basic Civil and Mechanical Engineering

Module 1: Introduction to civil engineering **4hrs**

Various Branches, role of civil engineer in various construction activities, basic engineering properties and uses of materials: earth, bricks, timber, stones, sand, aggregates, cement, mortar, concrete, steel, bitumen, glass, FRP, composite materials.

Module 2: Building Components & Building Planning **4hrs**

Foundation and superstructure, functions of foundation, types of shallow and deep foundations, suitability in different situation, plinth, walls, lintels, beams, columns, slabs, roofs, staircases, floors, doors, windows, sills, Study of Building plans, ventilation, basics of plumbing and sanitation

Module 3: Surveying **4hrs**

Principles of survey, elements of distance and angular measurements, plotting of area, base line and offsets, introduction to Plane table surveying, introduction to levelling, concept of bench marks, reduced level, contours

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 **[4 hrs]**

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 **[4 hrs]**

Text Books

- Anurag Kandya, “Elements of Civil Engineering”, Charotar Publishing, Anand
- M. G. Shah, C. M. Kale, and S. Y. Patki, “Building Drawing”, Tata McGraw Hill
- Sushil Kumar, “Building Construction”, Standard Publishers Distributors
- M. S. Palani Gamy, “Basic Civil Engineering”, Tata Mc-Graw Hill Publication
- Kanetkar T. P. and Kulkarni S. V., “Surveying and Levelling”, Vols. I, II and III, Vidyarthi Gruh Prakashan, Pune
- B. C. Punmia, “Surveying”, Vol.- I, Vol.-II, Vol.-III, Laxmi Publications
- G. K. Hiraskar, “Basic Civil Engineering”, Dhanpat Rai Publications
- Gopi Satheesh, “Basic Civil Engineering”, Pearson Education
- P. K. Nag “Engineering Thermodynamics”, Tata McGraw Hill, New Delhi 3rd ed. 2005
- A. Ghosh, A K Malik, “Theory of Mechanisms and Machines”, Affiliated East West Press Pvt. Ltd. New Delhi.

- Serope Kalpakaji and Steven R Schimd “ Amanufacturing Engineering and Techology” Addision Wsley Laongman India 6th Edition 2009
- V. B. Bhandari, “ Deisgn of Machine Elements”, Tata McGraw Hill Publications, New Delhi.

Engineering Mathematics – II

Unit 1: Complex Numbers

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.

[07 Hours]

Unit 2:Ordinary Differential Equations of First Order and First Degree and Their Applications

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. **[07 Hours]**

Unit 3: Linear Differential Equations with Constant Coefficients

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. **[07 Hours]**

Unit 4: Fourier Series

Introductory remarks- Euler's formulae ; Conditions for Fourier series expansion - Dirichlet's conditions ; Functions having points of discontinuity ; Change of interval ; Odd and even functions - expansions of odd and even periodic functions ; Half -range series. **[07 Hours]**

Unit 5: Vector Differential Calculus

General rules of vector Differentiation; Scalar and vector fields: Gradient , divergence and curl ; Solenoidal and irrotational vector fields; Vector identities . **[07 Hours]**

Unit 6: Vector Integral Calculus

Vector Integration : line integral , surface integral and volume integral ; Green's lemma , Gauss' divergence theorem and Stokes' theorem (without proofs) . **[07 Hours]**

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 II) 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.

General Instructions:

1. The tutorial classes in Engineering Mathematics-II are to be conducted batchwise. Each class should be divided into three batches for the purpose.
2. The internal assessment of the students for 20 marks will be done based on assignments, surprise tests, quizzes, innovative approach to problem solving and percentage attendance.
3. The minimum number of assignments should be eight covering all topics.

ENGINEERING CHEMISTRY

Unit 1: Water Treatment (6L)

Introduction , hard and soft water, softening of water – Zeolite process, Ion exchange process, Hot Lime –Soda process, water characteristics- Hardness and its determination by EDTA method, Dissolve oxygen (DO) and its determination by Winkler's method.

Unit 2: Phase Rule (7L)

Phase Rule, statement, Explaination of the terms – Phase, Components, Degrees of freedom. One component system – Water and Sulphur. Reduced phase rule equation, Two components alloy system- Phase diagram of Silver- Lead alloy system.

Unit 3: Metallurgy (6L)

Introduction, Occurrence of metals, types of ores, concentration of ores by physical methods- Crushing and Sizing, Froth- Flotation, Magnetic Separation, Gravity separation method. Chemical methods- Calcination, Roasting, Reduction of Ore- by Pyrolysis, Chemical reductions, Electrolytic Refining of Metals.

Unit 4: Fuels and Lubricants (7L)

Fuels: Introduction, classification of fuel, Calorific value of a fuel, characteristics of a good fuel, solid fuel- Coal , Various types of Coal, Analysis of coal- Proximate and Ultimate analysis, liquid fuel- Refining of Petroleum

Lubricants: Introduction, classification of lubricants - Solid, Semi –solid and Liquid Lubricants , properties of lubricants ,Physical properties – Viscosity, Viscosity index, surface tension, Flash point and Fire point. Chemical properties – Acidity, Saponification.

Unit 5: Electrochemistry (6L)

Introduction - **Basic concepts**: Definition and units of Ohm's law, Specific resistance, Specific Conductance, Equivalent conductance, Molecular conductance, Method of conductance measurement by Wheatstone bridge method, Cell constant.

Debye- Huckel theory of strong electrolyte, Conductometric titrations, Ostwald's theory of acid-base indicator, Quinonoid theory, Glass electrode.

Text books:

1. Jain P.C & Jain Monica, Engineering Chemistry, Dhanpat Rai & Sons, Delhi, 1992.
2. Bhal & Tuli, Text book of Physical Chemistry (1995), S. Chand & Company, New Delhi.
3. O. G. Palanna , Engineering Chemistry, Tata McGraw-Hill Publication, New Delhi.
4. S. S. Dara, A textbook of Engineering Chemistry, McGraw-Hill Publication, New Delhi.

Reference books:

1. Barrow G.M., Physical Chemistry, McGraw-Hill Publication, New Delhi.
2. Shikha Agarwal, Engineering Chemistry- Fundamentals and applications, Cambridge Publishers - 2015.
3. WILEY, Engineering Chemistry, Wiley India, New Delhi 2014.
4. Atkins, Physical chemistry.

ENGINEERING CHEMISTRY Lab

List of Experiments: (Perform any 10 Experiments)

1. Determination of Hardness of water sample by EDTA method.
2. Determination of Chloride content in water sample by precipitation titration method.
3. Determination of Dissolve Oxygen in water by Iodometric method.
4. Determination of percent purity of Bleaching Powder.
5. pH – metric Titration (Acid Base titration)
6. Conducto-metric Titration (Acid Base titration)
7. Surface tension
8. Viscosity
9. To determine acidity water sample.
10. To determine calorific value of a fuel.
11. Determination of Acid value of an oil sample.
12. Determination of Saponification value of an oil sample.
13. Experiment on water treatment by using Ion exchange resins.
14. To find out P-T curve diagram of steam.
15. To determine alkalinity water 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.

Engineering Mechanics

Course Contents

Module1:Basic Concepts (7 Lectures)

Objectives of Engineering Analysis and Design, Idealization of Engineering Problems, Simplification of real 3D problems to 2-D and 1-D domain,Basis of Assumptions, types of supports, types of load, free body diagram, Laws of Motion, Fundamental principles, Resolution and composition of a forces, Resultant, couple, moment, Varignon's theorem, force systems, Centroid of composite shapes, moment of inertia of planer sectionsand radius of gyration

Module 2:Equilibrium (7 Lectures)

Static equilibrium, analytical and graphical conditions of equilibrium, Lami's theorem, equilibrium of coplanar concurrent forces, coplanar non concurrent forces, parallel forces,beams reactionsSimple trusses (plane and space), method of joints for plane trusses, method of sections for plane trusses

Friction: Coulomb law, friction angles, wedge friction, sliding friction and rolling resistance

Module3:Kinematics (7 Lectures)

Types of motions, kinematics of particles, rectilinear motion, constant and variable acceleration, relative motion, motion under gravity, study of motion diagrams, angular motion, tangential and radial acceleration, projectile motion, kinematics of rigid bodies, concept of instantaneous center of rotation, concept of relative velocity,

Module4:Kinetics (6 Lectures)

Mass moment of inertia, kinetics of particle, D'Alembert's principle:applications in linear motion, kinetics of rigid bodies, applications in translation, applications in fixed axis rotation

Module5: Work, Power, Energy (6 Lectures)

Principle of virtual work, virtual displacements for particle and rigid bodies, work done by a force, spring, potential energy, kinetic energy of linear motion and rotation, work energy equation, conservation of energy, power, impulse momentum principle, collision of elastic bodies.

Text Books

- S. Timoshenko, D. H. Young, "Engineering Mechanics", McGraw Hill, 1995.
- Tayal A. K., "Engineering Mechanics", Umesh Publications, 2010.
- Bhavikatti S. S., Rajashekarappa K. G., "Engineering Mechanics", New Age International Publications, 2nd Edition.
- Beer, Johnston, "Vector Mechanics for Engineers", Vol. 1: Statics and Vol. 2: Dynamics, McGraw Hill Company Publication, 7th edition, 1995.
- Irving H. Shames, "Engineering Mechanics - Statics and Dynamics", Pearson Educations, Fourth edition, 2003.
- McLean, Nelson, "Engineering Mechanics", Schaum's outline series, McGraw Hill Book Company, N. Delhi, Publication.
- Singer F. L., "Engineering Mechanics - Statics & Dynamics", Harper and Row Pub. York.
- Khurmi R. S., "Engineering Mechanics", S. Chand Publications, N. Delhi

Engineering Mechanics Laboratory

Students are expected to satisfactorily complete any ten experiments listed below.

List of Practical's/Experiments/Assignments

1. Polygon law of coplanar forces.
2. Centroid of irregular shaped bodies.
3. Bell crank lever.
4. Support reaction for beam.
5. Problems on beam reaction by graphics statics method.
6. Simple / compound pendulum.
7. Inclined plane (to determine coefficient of friction).
8. Collision of elastic bodies (Law of conservation of momentum).
9. Moment of Inertia of fly wheel.
10. Verification of law of Machine using Screw jack
11. Verification of law of Machine using Worm and Worm Wheel
12. Verification of law of Machine using Single and Double Gear Crab.
13. Assignment based on graphics statics solutions
14. Application of Spreadsheet Program for conceptslike law of moments, beam reactions, problems in kinematics, etc.
15. Any other innovative experiment relevant to Engineering Mechanics.

Computer Programming in C

Unit 1

Process of programming: Editing, Compiling, Error Checking, executing, testing and debugging of programs. IDE commands. Eclipse for C Program development, Flowcharts, Algorithms. **(4 Lectures)**

Unit 2

Types, Operators and Expressions: 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. **(4 Lectures)**

Unit 3

Control Flow: Statements and Blocks. If-else, else-if switch Loops while and for, do-while break and continue goto and Labels. Functions and Program Structure: Basic of functions, functions returning non-integers external variables scope rules. **4 Lectures)**

Unit 4

Arrays in C: Initializing arrays, Initializing character arrays ,multidimensional arrays. **(4 Lectures)**

Unit 5

Structures C: Basics of structures, structures and functions arrays of structures, **(4 Lectures)**

Pointer in C. Pointers to integers, characters, floats, arrays, structures.

Special Note: Topic of Pointers in C is only for lab exercises and not for end semester examinations.

Reference/Text Books:

1. Brain W. Kernighan & Dennis Ritchie, The C Programming Language, Prentice Hall, 2 nd Edition, 1988.
2. R. S. Bichkar, Programming with C, Orient Blackswan, 1 st Edition, 2012.
3. Herbert Schildit, C the Complete Reference, McGraw-Hill Publication, 2000.
4. Balguruswamy, Programming in C, PHI.
5. Yashwant Kanitkar, Let Us C, PHI

Computer Programming in C: Laboratory

List of Practical:

1. Assignment on Flow Chart.
2. A Simple program to display a message “Hello world” on screen.
3. A Program to take input from user and display value entered by user on screen.
4. Basic example for performing different C Operations using operator. (With and without using scanf()).
5. Basic Program on Operator. (Using scanf()).

a) Program to find and print area, perimeter and volume of geometric objects.

b) Program to check a number entered by user is Perfect number or not.

6. Program to find maximum and minimum between two numbers given by user using if-else and conditional Operators.
7. Program to swap two numbers.
8. Program to print square and factorial of an entered number using while loop.
9. Program to check a number is Palindrome number or not.
10. Program to check Armstrong number.
11. Program to check and generate prime numbers up to n.
12. Program to find GCD of two entered numbers.
13. Program to find maximum and minimum from n entered numbers.
14. Program to print alternate numbers from n entered numbers.
15. Program to search an element in an Array using linear and binary search.
16. Program to print entered numbers in ascending order using sorting.
17. Program to print addition, subtraction and multiplication of Matrices.
18. Program to find length of string. (With and without using library function).
19. Programs demonstrating use of Structures, Arrays of Structures and Structure containing arrays.
20. Programs demosntrating use of pointers to integers, floats, char, strings, structures and arrays.

ESC-105 Basic Electrical and Electronics Engineering

Unit 1 **(4 Lectures)**

Elementary Electrical Concepts:
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. Energy Resources and Utilization: Conventional and nonconventional energy resources; Introduction to electrical energy generation from different resources, transmission, distribution and utilization, Advantages & Disadvantages of AC & DC transmission. Concept of Supply Demand, Power Factor, Need of unity factor.

Unit 2 **(4 Lectures)**

Measurement of Electrical Quantities:
Measurement of Voltage, Current, and Power; Measurement of 3 phase power; Study of Energy meters. Study of Electrical Storage devices: Batteries such as Nickel-cadmium (NiCd), Lithium-ion (Li-ion), Lithium Polymer (Li-pol.) batteries. Study of circuit breakers & Actuators (MCB & MPCB, Power Contactors & Aux contactors, Electro-Mechanical & Solid state Relays)

Unit 3 **(4 Lectures)**

Diodes and Circuits:
The P-N Junction Diode, V-I characteristics, Diode as Rectifier, specifications of Rectifier Diodes, Half Wave, Full wave, Bridge rectifiers, Equations for I_{DC} V_{DC} V_{RMS}, I_{RMS}, Efficiency and Ripple Factor for each configuration. Filters: Capacitor Filter, Choke Input Filter, Capacitor Input Filter(Π Filter), Zener Diode, Characteristics, Specifications, Zener Voltage Regulator, Types of Diodes: LED, Photodiode

Unit 4 **(4 Lectures)**

Semiconductor Devices and Applications:
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. Boylstad, Electronics Devices and Circuits Theory, Pearson Education.
5. Edward Hughes, Electrical Technology, Pearson Education.
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

Workshop Practices

Instructions to the student:

Each student is required to maintain a „workshop diary" consisting of drawing / sketches of the jobs and a brief description of tools, equipment, and procedure used for doing the job.

List of Practical:

1. Wood sizing exercises in planning, marking, sawing, chiseling 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.A job on use of plumbing tools and preparation of plumbing line involving fixing of water tap and use of elbow, tee, union and coupling, etc.

4. Making a small parts using GI sheet involving development, marking, cutting, bending, brazing and soldering operations- i)Tray ii) Funnel and similar articles.

5. Exercise in Arc welding (MMAW) to make a square butt joint.

6. Exercise in Resistance (Spot) welding to make a lap joint.

7. A job using power operated tools related to sheet metal work, Welding, Fitting, Plumbing, Carpentry and pattern making.

8.A job on turning of a Mild Steel cylindrical job using center lathe.

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 and Plumbing: Fitting operation like chipping, filing, right angle, marking, drilling, tapping etc., Fitting hand tools like vices, cold chisel, etc. Drilling machine and its operation, Different types of pipes, joints, taps, fixtures and accessories used in plumbing, safety precautions.

d) Sheet Metal Work: Simple development and cutting, bending, Beading, Flanging, Lancing and shearing of sheet metal, Sheet metal machines - Bending Machine, Guillotine shear, Sheet metal joints, Fluxes and their use.

e) Machine shop: Lathe machine, types of lathes, major parts, cutting tool, turning operations, safety precautions

R**eference/Text Books:**

1. K. C. John, Mechanical Workshop Practice, Prentice Hall Publication, New Delhi, 2010.

2. Hazra and Chaudhary, Workshop Technology-I, Media promoters & Publisher private limited.

JAIDEV EDUCATION SOCIETY'S
J D COLLEGE OF ENGINEERING AND MANAGEMENT
KATOL ROAD, NAGPUR
SESSION 2019-20

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							

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	Teaching			Evaluation 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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Session 2021-22

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

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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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Department of Electrical Engineering

AY-2022-23

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.

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- I	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- II	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	2	1	0	20	20	60	100	3
4	PCC-EE	EE3T004	Network Analysis	3	0	0	20	20	60	100	3
5	PCC-EE	EE3T005	Electrical Machine I	3	1	0	20	20	60	100	4
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 training/ Industrial visit	0	0	0	0	0	50	50	1
11	HSMC	EE3T007	Universal Human Values -II	3	0	0	10	15	25	50	3
				18	**4**	**6**	**310**	**135**	**555**	**1000**	
								Total Credits			**26**

IV Semester

Sr. No.	Subject Category	Subject Code	Course Title	Teaching Scheme			Evaluation Scheme				Credits
				L	T	P	CA	MSE	ESE	**TOTAL**	
1	BSC	EE4T001	Numerical method and probability	2	1	0	20	20	60	100	3
2	ESC	EE4T002	Power Station Practice	4	0	0	20	20	60	100	4
3	PCC-EE	EE4T003	Electronic Devices and circuits	3	0	0	20	20	60	100	3
4	PCC-EE	EE4T004	Power System I	2	1	0	20	20	60	100	3
5	PCC-EE	EE4T005	Electrical Machine II	3	0	0	20	20	60	100	3
6	BSC	EE4L001	Numerical method and probability Lab	0	0	2	60	0	40	100	1
7	PCC-EE	EE4L004	Power System I Lab	0	0	2	60	0	40	100	1
8	PCC-EE	EE4L005	Electrical Machine II Lab	0	0	2	60	0	40	100	1
9	PROJ-EE	EE4P002	Field trainning/ Internship/ industrial visit	0	0	0	0	0	50	50	1
10	MC	EE4T007	Innovation and entrepreneurship Development	2	0	0	10	15	25	50	Audit
				16	**2**	**6**	**290**	**115**	**495**	**900**	
								Total Credits			**20**

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	3	1	0	20	20	60	100	4
3	PCC-EE	EE5T003	Power System II	3	0	0	20	20	60	100	3
4	PEC-EE	EE5E001	**Elective I**	3	0	0	20	20	60	100	3
5	PEC-EE	EE5E002	**Elective II**	3	0	0	20	20	60	100	3
6	OEC-EE	EE5O001	**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/Seminar (Phase I)	0	0	2	30	0	20	50	1
11	MC	EE5T004	Consumer Affairs	2	0	0	10	15	25	50	Audit
				21	**1**	**8**	**340**	**135**	**525**	**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	EE6E003	**Elective III**	3	0	0	20	20	60	100	3
4	PEC-EE	EE6E004	**Elective IV**	3	0	0	20	20	60	100	3
5	OEC-EE	EE6O002	**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	Computer Aided Design Lab	0	0	2	60	0	40	100	1
8	PROJ-EE	EE6P004	Mini Project/Seminar(phase II)	0	0	2	30	0	20	50	1
9	PROJ-EE	EE6P005	Campus Recruitment Training(CRT)	0	0	2	50	0	0	50	1
10	PROJ-EE	EE6P006	Skill Development Courses	0	0	2	15	0	35	50	1
11	MC	EE6T003	Research Methodology	2	0	0	10	15	25	50	Audit
				15	**0**	**10**	**305**	**95**	**400**	**800**	
								Total Credits			**21**

VII Semester

Sr. No.	Subject Category	Subject Code	Course Title	Teaching Scheme			Evaluation Scheme				Credits
				L	T	P	CA	MSE	ESE	TOTAL	
1	PCC-EE	EE7T001	Switch gear and protection	3	0	0	20	20	60	100	3
2	PCC-EE	EE7T002	High Voltage Engineering	3	0	0	20	20	60	100	3
3	PEC-EE	EE7E005	**Elective V**	3	0	0	20	20	60	100	3
4	OEC-EE	EE7O003	**Open Elective III**	4	0	0	20	20	60	100	4
5	PCC-EE	EE7L001	Switch gear and protection Lab	0	0	2	60	0	40	100	1
6	PCC-EE	EE7L002	High Voltage Engineering Lab	0	0	2	60	0	40	100	1
7	PROJ-EE	EE7P006	Project-I	0	0	10	0	0	50	50	5
8	MC	EE7T003	Intellectual Property Rights	2	0	0	10	15	25	50	Audit
				15	**0**	**14**	**210**	**95**	**395**	**700**	
								Total Credits			**20**

VIII Semester

Sr. No.	Subject Category	Subject Code	Course Title	Teaching Scheme			Evaluation Scheme				Credits
				L	T	P	CA	MSE	ESE	TOTAL	
	PEC-EE	EE8E006	Elective VI	3	0	0	20	20	60	100	3
	OEC-EE	EE8O004	Open Elective IV	4	0	0	20	20	60	100	4
1	PROJ-EE	EE8P007	Project-II	0	0	6	0	0	100	100	3
OR											
2	PROJ-EE	EE8P008	Internship(3 months)	0	0	0	0	0	0	20	10
				7	**0**	**6**	**40**	**40**	**220**	**320**	
								Total Credits			**10**

EE Credits		121
First Year		35
Total Credits		**156**

Member Secretary
Board of Studies, EE Dept

Chairperson
Board of Studies, EE Dept

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

JAIDEV EDUCATION SOCIETY'S
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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 Electrical Engineering
"Igniting minds to illuminate the world"

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.

Program: B.Tech in Electrical Engineering

Semester	Course Code	Name of the course	L	T	P	Credits
III	EE3T001	Engineering Economics	3	0	0	3

Prerequisites for the course	
1	Basic Mathematical concepts studied up to Higher secondary schools like Simple and compound Interest & basic financial calculations.

Prior Reading Material/useful links	
1	https://archive.nptel.ac.in/courses/112/107/112107209/
2	Chopra P. N., Principle of Economics, Kalyani Publishers

Course Outcomes:

Sr. No	Course outcome number	CO statement
1	CO1	Remember and define theoretical framework of the Economics
2	CO2	Understand the concepts of demand,supply and elasticity.
3	CO3	Identify best project with application of time value of money& capital budgeting techniques.
4	CO4	Analyze and classify basic Factors of Production
5	CO5	Plan to become self employed.
6	CO6	Evaluate the Indian economy & impact of Inflation on Indian economy

Syllabus:

Course Contents	
Unit I	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 (7 Hours)

Unit II	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 (6Hours)
Unit III	Time value of Money ,Capital Budgeting ,Traditional and modern methods of Payback, IRR, ANR, Case studies (7Hours)
Unit IV	Factors of Production, Concepts of cost, Break even Analysis, Law of variable Proportions ,Internal and External Economies of scale, Depreciation. (7Hours)
Unit V	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 Opportunity. (6Hours)
Unit VI	Features of Indian Economy, Fiscal and Monetary policy, LPG, Inflation, Banking, World Economic bodies (7Hours)

Text Books	
1	R.Paneerselvam, Modern economic theory, Pentice Hall India
2	H. L. Ahuja., Modern economic theory, Mc Graw Hill India
Reference Books	
1	Entrepreneurial Development By S.S.Khanka.
2	Financial Management: Theory and Practice: Author: Prasanna Chandra, Mc Graw Hill India .
Useful links	
1	https://archive.nptel.ac.in/courses/112/107/112107209/

Contributions for syllabus designing:

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1	Dr.Asha Dave	Asst.Prof.	MBA Dept,JDCOEM,Nagpur
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3.	Dr. S. G. Tarnekar	Ex-Prof.	VNIT,Nagpur
4.	Ms.Shreya Ramteke	Technical Recruiter	Collabera Pvt.Ltd. (Alumni batch JDCOEM,Nagpur)
5.	Ms.Snehal Tembhurne	Business Development Executive	Byjus Pvt.Ltd. (Alumni JDCOEM,Nagpur)

Program: B.Tech in Electrical Engineering

Semester	Course Code	Name of the course	L	T	P	Credits
III	EE3T002	Engineering Mathematics –III	2	1	0	3

Prerequisites for the course	
1	Basic Mathematical concepts studied up to Second Semester such as Integration ,Fourier Transform etc.

Prior Reading Material/useful links	
1	https://nptel.ac.in/courses/111105121
2	Higher Engineering Mathematics by B. S. Grewal, Khanna Publishers, New Delhi.

Course Outcomes:

Sr. No	Course outcome number	CO statement
1	CO1	Remember properties of Laplace transform, Convolution Theorem, Fourier integral theorem, Parseval‟s identity , Cauchy's integral theorem , Cauchy's residue theorem
2	CO2	Describe properties of Laplace transform, Convolution Theorem, Fourier integral theorem , Parseval‟s identity , Cauchy's integral theorem , Cauchy's residue theorem .
3	CO3	Illustrate the examples using Laplace transform, Fourier Transform, Partial differential equation, Function of Complex Variables, Matrices.
4	CO4	Apply the knowledge of Laplace transform, Z-transform, function of complex variable, Advance partial differential equation.
5	CO5	Analyze the question on Laplace transform, Fourier Transform, Partial differential equation , Function of Complex Variables
6	CO6	Create a modal using Laplace transform, Fourier Transform, Partial differential equation, Function of Complex Variables, Matrices.

Syllabus:

Course Contents	
Unit I	Matrices: 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.] (7Hours)

Unit II	Laplace transform: Definition , conditions for existence; Properties of Laplace transforms; Transforms of some special functions- periodic function, Heaviside-unit step function. (7Hours)
Unit III	Inverse Laplace transform :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 (7Hours)
Unit IV	Z transform: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.. (7Hours)
Unit V	Advance Partial Differential equations :Introduction Partial differential equation, method of separation of variables, Application of partial differential equations .(Heat equation ,wave equation , Laplace Equation) (7Hours)
Unit VI	Functions of Complex Variable: 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) (7Hours)
Text Books	
1	Advanced Engineering Mathematics by Erwin Kreyszig, John Wiley & Sons, New York.
2	A Course in Engineering Mathematics (Vol III) by Dr. B. B. Singh, Synergy Knowledge ware, Mumbai.
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.
Useful links	
1	https://nptel.ac.in/courses/111105121

Contributions for syllabus designing:

Sr. No	Name of the person	Designation	Organization
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2	Ms.Leena Bhoyar	Asst.Prof.	JDCOEM,Nagpur
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4	Mr.Vaibhav Suryawanshi	Business Development trainee	Scholar Verzo Pvt.Ltd(Alumni JDCOEM,Nagpur)

Program: B.Tech in Electrical Engineering

Semester	Course Code	Name of the course	L	T	P	Credits
III	EE3T003	Fundamentals of Electrical Engineering	2	1	0	3

Prerequisites for the course	
1	Basic Electrical concepts studied up to Second Semester in the subject BEEE such as current,voltage,power,etc.

Prior Reading Material/useful links	
1	https://onlinecourses.nptel.ac.in/noc19_ee35/preview
2	Elements of Electrical sciences: P. Mukhopadhyay, N. Chand & Bros Roorkee (1989).

Course Outcomes:

Sr. No	Course outcome number	CO statement
1	CO1	Remember the basic laws of electric and magnetic circuits also Define various A.C. and D.C Quantities
2	CO2	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	CO3	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	CO4	Analyze various electric, magnetic circuit and distinguish between properties
5	CO5	Evaluate lighting system, recommend various lighting as per requirement also able to Explain A.C. fundamentals.
6	CO6	Design lighting system and also able to give solutions on single phase, poly phase and magnetic circuit unknown quantities.

Syllabus:

Course Contents	
Unit I	D. C. Circuits (Only Independent sources) 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. (8Hours)

Unit II	Electromagnetism 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. (10Hours)
Unit III	A.C. Fundamentals 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. (12Hours)
Unit IV	Single phase and poly phase A. C. circuits 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. (12Hours)
Unit V	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. (7Hours)
Unit VI	Illumination and Electrical Energy Tariff 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.) (7Hours)
Text Books	
1	Electrical Technology: B. L. Thareja, S. Chand Publications.
2	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	Edward Hughes, " Electrical Technology,", Pearson Education

Useful links	
1	https://onlinecourses.nptel.ac.in/noc19_ee35/preview

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3	Ms.S.V.Jethani	Asst.Prof.	JDCOEM,Nagpur
4	Mr. P. V. Ambade	Asst.Prof.	JDCOEM,Nagpur
5	Mr. J. S. Joshi	Professor (EE)	RKNEC,Nagpur
6	Dr. S. G. Tarnekar	Ex-Prof.	VNIT,Nagpur
7	Ms.Shreya Ramteke	Technical Recruiter	Collabera Pvt.Ltd. (Alumni batch JDCOEM,Nagpur)
8	Ms.Snehal Tembhurne	Business Development Executive	Byjus Pvt.Ltd. (Alumni JDCOEM,Nagpur)

Program: B.Tech in Electrical Engineering

Semester	Course Code	Name of the course	L	T	P	Credits
III	EE3T004	Network Analysis	3	0	0	3

Prerequisites for the course	
1	Basic Electrical concepts studied up to Second Semester in the subject BEEE such as current,voltage,power,etc

Prior Reading Material/useful links	
1	https://onlinecourses.nptel.ac.in/noc22_ee07/preview
2	Sudhakar Shyammohan Tata Mc Graw Hill 2005, "Circuit and Network Analysis"\

Course Outcomes:

Sr. No	Course outcome number	CO statement
1	CO1	Define basic concepts and principles related to Circuit Analysis
2	CO2	Identify the super mesh & super nodal problems.
3	CO3	Apply a variety of circuit analysis methods including theorems and Laplace transform
4	CO4	Solve two port network problems.
5	CO5	To design and develop network equations and their solutions.
6	CO6	Select best possible method of circuit analysis for a given situation

Syllabus:

Course Contents	
Unit I	Terminal Element Relationships: 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. (6Hours)
Unit II	Mesh And Nodal analysis: 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. (8Hours)

Unit III	Network Theorems: Linearity theorem, Thevinin's theorem, Norton's theorem, Maximum power transfer theorem, Reciprocity theorem, Compensation theorem, Tellegen's theorems (Both AC & DC) (7Hours)
Unit IV	Time Domain Analysis of Circuits: 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. (7Hours)
Unit V	Laplace Transform & Properties: 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. (7Hours)
Unit VI	Two Port Networks : 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. (7Hours)
Text Books	
1	Mac.E Van Valkenburg, "Network Analysis"
2	M. L. Soni, J. C. Gupta, "A Course in Electrical Circuits and Analysis"
Reference Books	
1	Franklin Fa-Kun. Kuo, "Network Analysis & Synthesis", John Wiley & Sons.
2	Joseph A. Edminister, Mahmood Maqvi, "Theory and Problems of Electric Circuits", Schaum's Outline Series
Useful links	
1	https://onlinecourses.nptel.ac.in/noc22_ee07/preview

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2	Mr.A.V.Joshi	Asst.Prof.	JDCOEM,Nagpur
3	Ms.S.V.Jethani	Asst.Prof.	JDCOEM,Nagpur
4	Mr. P. V. Ambade	Asst.Prof.	JDCOEM,Nagpur
5	Mr. J. S. Joshi	Professor (EE)	RKNEC,Nagpur
6	Dr. S. G. Tarnekar	Ex-Prof.	VNIT,Nagpur
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Program: B.Tech in Electrical Engineering

Semester	Course Code	Name of the course	L	T	P	Credits
III	EE3T005	Electrical Machine I	3	1	0	4

Prerequisites for the course	
1	Basic Electrical concepts studied up to Second Semester such as electromagnetic induction ,emf,current,voltage,power,etc

Prior Reading Material/useful links	
1	https://onlinecourses.nptel.ac.in/noc20_ee60/preview
2	Electrical Machines: Ashfaq Hussain; Dhanpat Rai Publication

Course Outcomes:

Sr. No	Course outcome number	CO statement
1	CO1	Recall the basic laws and rules of electromagnetic induction, electric and magnetic circuits.
2	CO2	Understand constructional features, working principles of electrical machines and explain different types of starting & speed control methods of electric motors.
3	CO3	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	CO4	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	CO5	Evaluate braking methods of DC, and induction motor.
6	CO6	Design motoring system able to give solutions for single phase, three phase and DC supply with respect to supply available and load requirements.

Syllabus:

Course Contents	
Unit I	Single Phase Transformer 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.

	(5Hours)
Unit II	Three Phase Transformer 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. (5Hours)
Unit III	DC Generator 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. DC Motor 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 (5Hours)
Unit IV	DC Motor 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 (8Hours)
Unit V	Three Phase Induction Motor Types of 3-Ø 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. (7Hours)
Unit VI	Single Phase Induction Motor 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. (7Hours)

Text Books	
1	Electrical Machines: Dr. P.S. Bimbhra
2	A Text Book of Electrical Technology: B. L. Theraja (Vol. II)
Reference Books	
1	Performance & Design of A.C. Machine: M. G. Say
2	Electrical Machines and Transformers: Nasser Syed
Useful links	
1	https://onlinecourses.nptel.ac.in/noc20_ee60/preview

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3	Ms.S.V.Jethani	Asst.Prof.	JDCOEM,Nagpur
4	Mr. P. V. Ambade	Asst.Prof.	JDCOEM,Nagpur
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6	Dr. S. G. Tarnekar	Ex-Prof.	VNIT,Nagpur
7	Ms.Shreya Ramteke	Technical Recruiter	Collabera Pvt.Ltd. (Alumni batch JDCOEM,Nagpur)
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Program: B.Tech in Electrical Engineering

Semester	Course Code	Name of the course	L	T	P	Credits
III	EE3T006	Measurement and Instrumentation	2	1	0	3

	Prerequisites for the course
1	Basic Electrical concepts studied up to Second Semester such as electromagnetic induction ,emf,current,voltage,power,etc

	Prior Reading Material/useful links
1	https://onlinecourses.nptel.ac.in/noc19_ee44/preview
2	Gupta, A course in Electrical & Electronic Measurement & Instrumentation., S K Kataria & Sons

Course Outcomes:

Sr. No	Course outcome number	CO statement
1	CO1	Remember the different types of instruments used in electrical measurements.
2	CO2	Understand the operating principles of various electrical measuring instruments.
3	CO3	Apply knowledge of variety of instruments available for required parameter and identify the appropriate one.
4	CO4	Analyze and classify different electrical measuring instruments on basis of type of electrical/ physical quantity to be measured.
5	CO5	Evaluate different electrical measuring instruments
6	CO6	Test and solve various problems on electrical measuring instruments

Syllabus:

	Course Contents
Unit I	General principles of measurements 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. (5Hours)
Unit II	Measurement of resistance 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. (5Hours)
Unit III	AC bridges 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. (5Hours)
Unit IV	Introduction to high voltage and high current measurements 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 (4Hours)
Unit V	Measurement of Power & Energy 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. (5Hours)
Unit VI	Transducers 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. (4Hours)
Text Books	
1	Sawhney A.K., A course in Electrical and Electronic Measurements & instrumentation, DhanpatRai .
2	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
Reference Books	
1	Golding E.W., Electrical Measurements & Measuring Instruments, Wheeler Pub.
2	Cooper W.D., Modern Electronics Instrumentation, Prentice Hall of India
Useful links	
1	https://onlinecourses.nptel.ac.in/noc19_ee44/preview

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3	Ms.S.V.Jethani	Asst.Prof.	JDCOEM,Nagpur
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Program: B.Tech in Electrical Engineering

Semester	Course Code	Name of the course	L	T	P	Credits
III	EE3T007	Universal Human Values -II	3	0	0	3

Prerequisites for the course	
1	Basic concepts of subject Universal Human Values -I studied in Second Semester.

Prior Reading Material/useful links	
1	https://nptel.ac.in/courses/109104068
2	Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010

Course Outcomes:

Sr. No	Course outcome number	CO statement
1	CO1	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	CO2	They would have better critical ability.
3	CO3	They would also become sensitive to their commitment towards what they believe in (humane values. Humane relationships and humane society).
4	CO4	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.

Syllabus:

Course Contents	
Unit I	Course Introduction - Need, Basic Guidelines, Content and Process for Value Education 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.

	(10Hours)
Unit II	Understanding Harmony in the Human Being - Harmony in Myself! 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 (12Hours)
Unit III	Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship 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 (12Hours)
Unit IV	Understanding Harmony in the Nature and Existence - Whole existence as Coexistence 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. (10 Hours)
Unit V	Implications of the above Holistic Understanding of Harmony on Professional Ethics 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. (12Hours)
Text Books	
1	Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
Reference Books	
1	Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
Useful links	
1	https://nptel.ac.in/courses/109104068

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Program: B.Tech in Electrical Engineering

Semester	Course Code	Name of the course	L	T	P	Credits
III	EE3L004	Network Analysis Lab	0	0	2	1

Prerequisites for the course	
1	Basic Electrical concepts studied up to Second Semester & Network Theory concepts studying in current semester.

Prior Reading Material/useful links	
1	http://vlabs.iitb.ac.in/vlabs-dev/labs/network_lab/labs/explist.php

Course Outcomes:

Sr. No	Course outcome number	CO statement
1	CO1	Define basic concepts and principles related to Circuit Analysis
2	CO2	Identify the super mesh & super nodal problems
3	CO3	Verifies principles of network
4	CO4	Solve two port network problems
5	CO5	To Analyze RLC Circuit

Syllabus:

List of Experiments
• To Study & Verify Superpostion theorem • To Study & Verify Thevinion's theorem • To Study & Verify Norton's theorem • To Study & Verify maximum power transfer theorem • To Study & Verify reciprocating theorem • Determination of transient response of current in RL & RC circuits with step voltage input • Analysis of RL/ RC and RLC circuits • Determination of driving point and transfer functions of a two port ladder network and verify with theoretical values • Determination of z and h parameters (dc only) for a network and computation of Y and ABCD parameters.

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Program: B.Tech in Electrical Engineering

Semester	Course Code	Name of the course	L	T	P	Credits
III	EE3L005	Electrical Machine I Lab	0	0	2	1

Prerequisites for the course	
1	Basic Electrical concepts studied up to Second Semester & Electrical machine theory concepts studying in current semester.

Prior Reading Material/useful links	
1	https://em-coep.vlabs.ac.in/

Course Outcomes:

Sr. No	Course outcome number	CO statement
1	CO1	The basic principle of transfer of electrical power, operation, construction of Single phase and Three phase transformers, their classification, connections and phasor diagrams.
2	CO2	The basic principle, construction, operation, Performance characteristics, steady state analysis and applications of DC generators and motors.
3	CO3	The basic principle, construction, operation, Performance characteristics, steady state analysis, Speed control and applications of Single Phase and Three phase Induction motors.

Syllabus:

List of Experiments
• To verify turns ratio of Transformer. • To perform polarity test on Single Phase Transformer. • To determine equivalent circuit diagram of transformer through O.C & S.C Test. • To determine efficiency by direct loading test on Single Phase Transformer. • To verify V-I relationship & draw Phasor diagram of 1. Star-Star 2.Star-delta 3.delta-star • Delta-Delta connection of single-phase transformer. • To study the construction of field and armature of DC Machine. • To determine external characteristics of DC Generator. • To perform Load test on DC shunt motor. • To perform speed control of DC shunt motor using armature and field control method.

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Program: B. Tech in Electrical Engineering

Semester	Course Code	Name of the course	L	T	P	Credits
III	EE3L006	Measurement and Instrumentation Lab	0	0	2	1

Prerequisites for the course	
1	Basic Electrical concepts studied up to Second Semester & Measurement and Instrumentation Theory concepts studying in current semester.

Prior Reading Material/useful links	
1	http://sl-coep.vlabs.ac.in/

Course Outcomes:

Sr. No	Course outcome number	CO statement
1	CO1	Choose correct instrument for measuring given electrical/ physical quantity.
2	CO2	Compare various methods and instruments available for measurement of single quantity.
3	CO3	Apply understanding about instrumentation concepts which can be applied to electrical measurements.
4	CO4	Analyse the testing and measuring set up for electrical systems
5	CO5	Evaluate efficiency of different instruments
6	CO6	Design circuit for measuring given quantity

Syllabus:

List of Experiments
• To measure low resistance by Kelvin's double bridge • To measure medium resistance by Wheatstone bridge • To measure self inductance by Hay's bridge • To measure capacitance by De Sauty Bridge • To calibrate a given single phase induction type energy meter. • To Study and Calibrate Three Phase Wattmeter. • To measure active and reactive power in three phase balanced load by one wattmeter method • To find the effect of various parameters on output of given LVDT • To Study the change in resistance of RTD probe depending on the process temperature and to Study the dynamic response of RTD probe. • To Study the change in EMF of a thermocouple in response to the process temperature. • To study impulse voltage generator • To study impulse current generator

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3	Ms.S.V.Jethani	Asst.Prof.	JDCOEM,Nagpur
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Program: B. Tech in Electrical Engineering

Semester	Course Code	Name of the course	L	T	P	Credits
IV	EE4T001	Numerical method and probability	2	1	0	3

	Prerequisites for the course
1	Concepts studied in the subject Engineering Mathematics –III in third semester such as fourier transform, numerical methods etc.

	Prior Reading Material/useful links
1	https://onlinecourses.nptel.ac.in/noc21_ma45/preview
2	Erdedition,2003. 3. K. E. Atkinson, "An Introduction to Numerical Analysis", Wiley,1978.

Course Outcomes:

Sr. No	Course outcome number	CO statement
1	CO1	Define approximation and errors in numerical differentiation and Integration.
2	CO2	Evaluate the roots of the equation using Bracketing methods: Bisection methods, Open methods: Newton Raphson method
3	CO3	Apply the Cramer's rule, Gauss- Elimination Method, pivoting, scaling, Heun's method, Runge–Kutta Method, to engineering problem.
4	CO4	Analyze the question Newton's Cotes Integration Formulas: Trapezoidal Rule, Simpson's rule, engineering applications Numerical differentiation using Finite divide Difference method.
5	CO5	Compute the linear and non-linear equation, regression, Interpolation and ordinary differential equation using MATLAB programming
6	CO6	Develop computer program for linear and non-linear equation.

Syllabus:

	Course Contents
Unit I	Error Analysis 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. (8Hours)

Unit II	Roots of Equations Motivation, Bracketing methods: Bisection methods, Open methods: Newton Raphson method, Engineering applications. (6Hours)
Unit III	Numerical Solution of Algebraic Equations: Cramer's rule, Gauss- Elimination Method, pivoting, scaling, engineering applications, Heun's method, Runge–Kutta Method, engineering applications. (7Hours)
Unit IV	Numerical Integration and Differentiation Motivation, Newton's Cotes Integration Formulas: Trapezoidal Rule, Simpson's rule, engineering applications Numerical differentiation using Finite divide Difference method (6Hours)
Unit V	Curve Fitting and Interpolation Motivation, Least Square Regression: Linear Regression, Polynomial regression. Interpolation: Newton's Divide Difference interpolation, engineering applications. Motivation, Euler's and Modified Euler's Method. (8Hours)
Unit VI	Introduction to MATLAB Programming: 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. (7Hours)
Text Books	
1	V. Rajaraman, "Fundamental of Computers", Prentice Hall of India,NewDelhi,2003.
2	S.Sastri,"IntroductoryMethodsofNumericalMethods",PrenticeHallofIndia,NewDelhi
Reference Books	
1	M.J. Maron, "Numerical Analysis: A Practical Approach", Macmillan, New York, 1982
Useful links	
1	https://onlinecourses.nptel.ac.in/noc21_ma45/preview

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Program: B.Tech in Electrical Engineering

Semester	Course Code	Name of the course	L	T	P	Credits
IV	EE4T002	Power Station Practice	4	0	0	4

Prerequisites for the course	
1	Basic Electrical Engineering concepts like emf generation, active and reactive power etc.

Prior Reading Material/useful links	
1	https://onlinecourses.nptel.ac.in/noc21_me86/preview
2	W. D. Stevenson, "Elements of Power System Analysis", McGraw Hill.

Course Outcomes:

Sr. No	Course outcome number	CO statement
1	CO1	Remember the basic operations of various power plants.
2	CO2	Understand and interpret the requirements and basics of power plant installation and site selection.
3	CO3	Apply knowledge to Economic Operation of Power Systems and the knowledge related with its need.
4	CO4	Analyze various electric power plants operations and distinguish between properties.
5	CO5	Evaluate thermal, hydro, nuclear, gas power plant also able to Explain its fundamentals.
6	CO6	Design Economic Operation of Power Systems and also able to give solutions implementation of power plant on its basics.

Syllabus:

Course Contents	
Unit I	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 (8Hours)
Unit II	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 (6Hours)
Unit III	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. (7Hours)
Unit IV	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 (6Hours)
Unit V	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 (8Hours)
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 &
Reference Books	
1	S. L. Uppal, “Electrical Power”, Khanna Publishers
Useful links	
1	https://onlinecourses.nptel.ac.in/noc21_me86/preview

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4	Mr. P. V. Ambade	Asst.Prof.	JDCOEM,Nagpur
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Program: B.Tech in Electrical Engineering

Semester	Course Code	Name of the course	L	T	P	Credits
IV	EE4T003	Electronic Devices and circuits	3	0	0	3

Prerequisites for the course	
1	Basic concepts of Engineering Physics studied in First year like transistor,diodes,semiconductor physics etc.

Prior Reading Material/useful links	
1	https://onlinecourses.nptel.ac.in/noc21_ee80/preview

Course Outcomes:

Sr. No	Course outcome number	CO statement
1	CO1	Understand the characteristics of the p-n junction, the diode and some special function diodes and these diodes' application in electronic circuits
2	CO2	Familiarize the operation and applications of transistor like BJT .
3	CO3	Develop design competence in power amplifiers using BJT.
4	CO4	Apply the knowledge of amplifier in order to Design various differential amplifier
5	CO5	Design Various Oscillator Circuits and Understand the concept of FETs as well as MOSFETs
6	CO6	Apply the knowledge of Digital Electronics in order to develop the truth tables for various logic Gates

Syllabus:

Course Contents	
Unit I	Diode theory and Diode Circuits Theory of PN-junction diodes, operation and characteristics, Zener diodes and voltage regulators, Half and Full Wave Rectifiers, Filters, Ripple factor, Voltage doublers. (7Hours)
Unit II	Bipolar Junction Transistor 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 (7Hours)
Unit III	Power Amplifiers Power amplifiers- classification as A,B, AB, C, Push pull amplifiers, Cross over distortion, Positive and Negative amplifiers- classification, feedback amplifiers,

	advantages and applications (7Hours)
Unit IV	Differential Amplifiers Differential amplifier circuits and their stages, current source, biasing, level Shifting techniques, Common mode and differential mode gain, Impedance of different stages. (7Hours)
Unit V	Oscillators Oscillators- Barkhausen‟s criterion, RC and Crystal oscillators. Field effect transistors and MOSFETs- Principle of operation and characteristics, biasing arrangements. (7Hours)
Unit VI	Digital Electronics 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. (7Hours)
Text Books	
1	Sanjeev Gupta, “Electronic Devices and Circuits” Dhanpat Rai Publication
2	P. Godse, U. A. Bakshi, “Electronic Devices and Circuits” Technical Publication
Reference Books	
1	Millman and Halkias;, “Electronic Devices and Circuits” McGraw Hill
2	H. Taub,“ Digital Integrated Electronics”, McGraw Hill
Useful links	
1	https://onlinecourses.nptel.ac.in/noc21_ee80/preview

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Program: B.Tech in Electrical Engineering

Semester	Course Code	Name of the course	L	T	P	Credits
IV	EE4T004	Power System I	2	1	0	3

Prerequisites for the course	
1	Basic Electrical Engineering concepts like emf generation, active and reactive power etc.

Prior Reading Material/useful links	
1	https://onlinecourses.nptel.ac.in/noc22_ee17/preview
2	John J Grainger, W.D. Stevenson, Power System Analysis, McGraw-Hill (India) Pub. , 2003

Course Outcomes:

Sr. No	Course outcome number	CO statement
1	CO1	To define basic components of power system and remember the structure of power system
2	CO2	To understand the working of transmission and distribution system and relate the different parameters of transmission and distribution system
3	CO3	To do Modeling and representation of the system component used in power system
4	CO4	To Analyze the per unit system of power system
5	CO5	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	CO6	To create the structure of power system with suitable components and improve the efficiency of power system

Syllabus:

Course Contents	
Unit I	General Structure of Electrical Power System 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 (7Hours)
Unit II	Inductance 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. (7Hours)
Unit III	Representation of power system elements 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. (7Hours)
Unit IV	Transmission 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. (7Hours)
Unit V	Insulators and Cables Types 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. (7Hours)
Unit VI	Mechanical Design of Transmission Line 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. (7Hours)
Text Books	
1	Wadhva C. L., "Electric Power System",(Tata McGraw Hill Publications)
2	Kothari Nagrath, "Electric Power System", (Tata McGraw Hill Publications)
Reference Books	
1	W.D. Stevenson Jr., Elements of power system analysis, McGraw-Hill publications
Useful links	
1	onlinecourses.nptel.ac.in/noc22_ee17/preview

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Program: B. Tech in Electrical Engineering

Semester	Course Code	Name of the course	L	T	P	Credits
IV	EE4T005	Electrical Machine II	3	0	0	3

Prerequisites for the course	
1	Basic Electrical Engineering concepts like emf generation, active and reactive power etc.

Prior Reading Material/useful links	
1	https://onlinecourses.nptel.ac.in/noc20_ee60/preview
2	Electrical Machine: Dr.P.K. Mukherjee and S. Chakravarti, DhanpatRai

Course Outcomes:

Sr. No	Course outcome number	CO statement
1	CO1	Define voltage regulation, load torque angle and MMF of windings.
2	CO2	Classify reactances under transient conditions and effects of variable excitation.
3	CO3	Apply the method of synchronous impedance and Potier triangle to find voltage regulation.
4	CO4	Develop phasor diagram of three phase synchronous machine.
5	CO5	Analyze the V curves and effects of excitation and load on motor operation
6	CO6	Compare various methods of cooling in synchronous machine.

Syllabus:

Course Contents	
Unit I	Synchronous Machines 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. (8Hours)
Unit II	Steady State Operation of Three Phase Synchronous Machine Phasor diagram, voltage regulation using synchronous impedance and Potier triangle method, steady state performance of three phase synchronous machines, circle diagrams (6Hours)
Unit III	Synchronization Parallel operation, experimental determination of parameters (positive sequence reactance, negative sequence reactance, Zero sequence reactance), short circuit ratio, losses and efficiency (8Hours)
Unit IV	Synchronous Machines on Infinite Bus Phasor diagram, expression for torque, load torque angle, V curve and inverted V curve, effects of variable excitation and power input on generator operation and effect of variable excitation and load on motor operation, asynchronous generator. (6Hours)
Unit V	Transient Behavior Sudden 3, phase short circuit. Transient and sub- transient reactances and their measurement. Time constant and equivalent circuit diagram, hunting & damper windings. (7Hours)
Unit VI	Methods Of Cooling In Synchronous Machines 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. (7Hours)
Text Books	
1	P. S. Bhimbra, “Electrical Machinery”
2	Electrical Machinery : Nagrath and Kothari, 3rd , Tata Mcgraw Hill
Reference Books	
1	JFitzgerald and Kingsley and Kusco , “Electrical Machinery” McGraw Hill
Useful links	
1	https://onlinecourses.nptel.ac.in/noc22_ee06/preview

Contributions for syllabus designing:

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3	Ms.S.V.Jethani	Asst.Prof.	JDCOEM,Nagpur
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Program: B. Tech in Electrical Engineering

Semester	Course Code	Name of the course	L	T	P	Credits
IV	EE4T007	Innovation and entrepreneurship Development	2	0	0	3

Prerequisites for the course	
1	Basics idea of Entreprenurship derived from live examples of startups and innovation from various news channels, newspapers and social media.

Prior Reading Material/useful links	
1	https://onlinecourses.nptel.ac.in/noc21_mg63/preview

Course Outcomes:

Sr. No	Course outcome number	CO statement
1	CO1	Discover the creative / innovative side within her/him
2	CO2	Hone entrepreneurial and leadership skills within his/her personality.
3	CO3	Develop new ways of thinking and Learn the entire innovation cycle from Ideation to GoToMarket.
4	CO4	Study frameworks, strategies, techniques and business models for conceived ideas.
5	CO5	Develop skills for evaluating, articulating, refining, and pitching a new product or service.

Syllabus:

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	
Text 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.
Reference Books	
1	Paddy Miller, Thomas Wedell-Wedellsborg, "Innovation as Usual: How to Help Your People Bring Great Ideas to Life, Harvard Business Review Press, Kindle Edition.

Useful links	
1	https://onlinecourses.nptel.ac.in/noc21_mg63/preview

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Program: B.Tech in Electrical Engineering

Semester	Course Code	Name of the course	L	T	P	Credits
III	EE4L005	Electrical Machine II Lab	0	0	2	1

Prerequisites for the course	
1	Basic Electrical concepts studied up to Third Semester & Electrical machine-II theory concepts studying in current semester.

Prior Reading Material/useful links	
1	https://ems-iitr.vlabs.ac.in/

Course Outcomes:

Sr. No	Course outcome number	CO statement
1	CO1	Performance characteristics of synchronous machines using direct and indirect methods
2	CO2	Regulation of three phase alternator using the predetermination methods
3	CO3	Saliency nature of synchronous machine
4	CO4	Starting and Speed control of ac machines
5	CO5	Synchronization of two three phase alternators
6	CO6	Measurement of impedances and short circuit ratio of alternator

Syllabus:

List of Experiments
• Predetermination of regulation of three phase alternator using emf, mmf and Potier triangle method • To determine Xd and Xq of the salient pole type synchronous machine • To plot V curves and inverted V curves for three phase synchronous machine. • Study of prime mover and damper windings in synchronous motor • To measure the synchronous reactance of a synchronous generator by measured values of open circuit voltage and short circuit current • To study and measure positive, negative and zero sequence impedance of alternator. • To measure short circuit ratio of synchronous generator • To perform synchronization of two three phase alternators by • Synchroscope method • Three dark lamp method • Two bright one dark lamp method • To perform OC test on synchronous generator and determine full load regulation of a three phase synchronous generator by synchronous impedance method • To study synchronization of the alternator with infinite bus bar

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Program: B.Tech in Electrical Engineering

Semester	Course Code	Name of the course	L	T	P	Credits
V	EE5T001	Power Electronics	3	0	0	3

Prerequisites for the course	
1	Concepts of transistors & semiconductor physics studied in subject Electronic Devices & Circuits.

Prior Reading Material/useful links	
1	https://nptel.ac.in/courses/108105066
2	Bimbhra.P. S- Power Electronics.(Khanna Publication).

Course Outcomes:

Sr. No	Course outcome number	CO statement
1	CO1	To remember the principle of operation of various basic semiconductor devices
2	CO2	To understand the characteristics of various types of semiconductor device and its working as converters.
3	CO3	To make use of various semiconductor device for the converter's operation under various load types.
4	CO4	Examine the performance of various types of converters.
5	CO5	Compare various types of converters based on performance parameter.
6	CO6	To design the converters based on real time industrial applications.

Syllabus:

Course Contents	
Unit I	Power semiconductor devices & their characteristics SCR, triac, diac-construction, characteristics & applications, turning ON-OFF SCR, turn ON mechanism, different methods of turning ON-OFF SCR, series and parallel connections of SCRs, Protection of SCR gate circuit protection (6Hours)
Unit II	Turn on and turn off circuits for power semiconductor devices Introduction to GTO, power MOSFET & IGBT & their construction &characteristics. Triggering circuits and opt couplers and Pulse transformer Introduction to types of power electronic circuits: diode rectifiers, AC-DC converters, AC-AC converters, DC-DC converters, DC-AC converters (6Hours)
Unit III	Diode Rectifiers and AC-DC converters Diode Rectifiers: Single phase half wave, full wave rectifiers with R and RL load, Three phase bridge rectifier with R and RL load. Controlled Rectifiers: Principle of phase controlled rectification, single phase semi

	and full converter with R and RL load, power factor improvement in controlled rectifiers, three phase semi and full converter with R and RL load. (Only descriptive approach) (7Hours)
Unit IV	DC-AC converters Classification , series inverter, improved series inverter output voltage control, principle of operation for three phase bridge inverter in 120 deg. and 180 deg. mode, single phase bridge inverter. (6Hours)
Unit V	DC-DC converters Basic principles of chopper, time ratio control and current limit control techniques, voltage commutated chopper ckt, step-up chopper, step-down chopper (7Hours)
Unit VI	AC voltage controllers (AC-AC converters) 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. (7Hours)
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).
Useful links	
1	https://nptel.ac.in/courses/108105066

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Program: B.Tech in Electrical Engineering

Semester	Course Code	Name of the course	L	T	P	Credits
V	EE5T002	Control System I	3	0	0	3

Prerequisites for the course	
1	Concepts Laplace transform, z-transform etc. studied in subject Engineering Mathematics-III.

Prior Reading Material/useful links	
1	https://onlinecourses.nptel.ac.in/noc19_de04/preview
2	D'AzzoHoupis, Logakusha, Huelsoman, "Linear System Analysis", McGraw Hill.

Course Outcomes:

Sr. No	Course outcome number	CO statement
1	CO1	To remember the basic concept of control system, types & effect of Feedback
2	CO2	To apply Block diagram and Signal flow graph technique
3	CO3	To apply knowledge for Time domain analysis.
4	CO4	To analyze the stability of a system & to construct Root Locus
5	CO5	To apply knowledge for Frequency domain analysis.
6	CO6	To construct state model of a system

Syllabus:

Course Contents	
Unit I	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 (7Hours)
Unit II	Characteristics of Feedback Control Systems: 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 (7Hours)
Unit III	Time domain analysis 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. (7Hours)
Unit IV	Stability 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 (6Hours)
Unit V	Frequency domain analysis of control systems 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. (7Hours)
Unit VI	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. (7Hours)
Text Books	
1	Benjamin C Kuo, “Automatic Control Systems”, Prentice Hall of India.
2	M. Gopal, “Control Systems- Principle of Design”, Fourth Edition, 2012, McGraw Hill.
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
Useful links	
1	https://onlinecourses.nptel.ac.in/noc19_de04/preview

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Program: B. Tech in Electrical Engineering

Semester	Course Code	Name of the course	L	T	P	Credits
V	EE5T003	Power System II	3	0	0	3

Prerequisites for the course	
1	Basic Electrical Engineering concepts like emf generation, active and reactive power etc & Power Systems-I basic concepts.

Prior Reading Material/useful links	
1	https://archive.nptel.ac.in/courses/108/105/108105067/
2	AshfaqHussian - Power System Analysis. (Tata Mcgraw Hill).

Course Outcomes:

Sr. No	Course outcome number	CO statement
1	CO1	Define the different parameters of power system operation.
2	CO2	Illustrate the different parameters of power system operation and control.
3	CO3	To identify the different issues related to power systems
4	CO4	Analyze the different solution methods related to power system ..
5	CO5	Choose amongst the different analytical & numerical methods for power flow solutions.
6	CO6	Solve the different problems related to cost load flow, fault, reactive power and Stability constraints in the power systems

Syllabus:

Course Contents	
Unit I	Economic Operation of Power System 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. (7Hours)
Unit II	Load Flow Studies Per Unit System, Y_{bus} formation Simple example of a load flow solution, Network model formulation, (Applications of iterative techniques like Gauss-Siedal method, and Newton-Raphson method, etc.). (7Hours)
Unit III	Symmetrical fault analysis: 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. (7Hours)
Unit IV	Unsymmetrical fault analysis: Unsymmetrical Fault Analysis: L-G, L-L-G-, L-L-L, LL-L-G, Open Conductors Fault Using Symmetrical Components (6Hours)
Unit V	Stability of Power System: 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. (7Hours)
Unit VI	Load dispatch center functions Contingency analysis, preventive, emergency and restorative Control. power quality def., causes, affects, slandered and mitigation methods (7Hours)
Text Books	
1	Nagrath& Kothari – Modern Power System Analysis.(Tata Mcgraw Hill).
Reference Books	
1	Stevension .W. D– Power System Analysis. (Tata Mcgraw Hill).
2	AshfaqHussian - Power System Analysis.(Tata Mcgraw Hill).
Useful links	
1	https://archive.nptel.ac.in/courses/108/105/108105067/

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Program: B.Tech in Electrical Engineering

Semester	Course Code	Name of the course	L	T	P	Credits
V	EE5E001(A)	Elective I (Renewable Energy System)	3	0	0	3

Prerequisites for the course	
1	Concepts of transistors & semiconductor physics studied in first year & some basics of Renewable Energy.

Prior Reading Material/useful links	
1	https://nptel.ac.in/courses/108102047
2	V. V. N. Kishore: Renewable Energy Engineering and Technology, TERI. 2006

Course Outcomes:

Sr. No	Course outcome number	CO statement
1	CO1	To define basic properties of different renewable sources of energy and technologies for their utilization.
2	CO2	Describe main elements of technical systems designed for utilization of renewable sources of energy
3	CO3	Interpret advantages and disadvantages of different renewable sources of energy
4	CO4	Undertake simple analysis of energy potential of renewable sources of energy
5	CO5	Interpret the knowledge of fuel cells, wave power, tidal power and geothermal principles and applications.
6	CO6	Discuss the economics of harnessing energy from renewable energy sources.

Syllabus:

Course Contents	
Unit I	Overview of conventional &renewable energy sources, need , potential & development of renewable energy sources, types of renewable energy sources ,types of renewable energy system, 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 (7Hours)
Unit II	Solar Radiation & its Measurement: Solar constant, solar radiation on earth's surface, 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.

	(7Hours)
Unit III	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. (7Hours)
Unit IV	Geothermal Energy: Geothermal fields, , 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. (6Hours)
Unit V	Energy from Oceans : Oceans thermal electric conversion (OTEC) , 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, Power in simple single basin Tidal system,Estimation of Energy & Power in double basin Tidal system , Advantages & limitations of Tidal Power Generation. (7Hours)
Unit VI	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. (7Hours)
Text Books	
1	Non Conventional Energy Sources : G.D. Rai , Khanna publishers
Reference Books	
1	A. N. Mathur: Non-Conventional Resources of Energy. 2010 .
Useful links	
1	https://nptel.ac.in/courses/108102047

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Program: B.Tech in Electrical Engineering

Semester	Course Code	Name of the course	L	T	P	Credits
V	EE5E001(B)	Elective I (Electromagnetic Field)	3	0	0	3

	Prerequisites for the course
1	Basics of Electrical Engineering concepts studied in subject Fundamentals of Electrical Engineeering like mmf,flux,field intensity etc.

	Prior Reading Material/useful links
1	https://nptel.ac.in/courses/108102047

Course Outcomes:

Sr. No	Course outcome number	CO statement
1	CO1	Remember, Understand Scalars & vector analysis, vector and scalars conversion for different coordinate system.
2	CO2	Apply Gauss law, Divergence theorem to electric field intensity.
3	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.
4	CO4	Apply effective analysis tool like Poisson's and Laplace equations to current, current density, dielectrics and capacitances.
5	CO5	Analyze& Apply Biot-Savorts law.
6	CO6	Solve & Analyze problems of Capacitance of parallel plate capacitor, Capacitance of two wire line, Poissons.

Syllabus:

	Course Contents
Unit I	Review of Mathematics 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. (7Hours)
Unit II	Electrostatics 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.

	(7Hours)
Unit III	Gauss's law, Energy and Potential of charge system 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. (7Hours)
Unit IV	Conductors, Dielectric and Capacitance and Poisson's and Laplace's Equations (07 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. (6Hours)
Unit V	Magneto Statics 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. (7Hours)
Unit VI	Maxwell Equations 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. (7Hours)
Text Books	
1	Matthew N. O. Sadiku, "Elements of Electromagnetics", Oxford University publication, 6 th Edition, 2014.
Reference Books	
1	G.W.Carter,"The electromagnetic field in its engineering aspects", Longmans, 1st Edition, 1954.
2	VW.J.Duffin,"Electricity and Magnetism", McGraw Hill Publication, 3rd Edition (Rev), 1980.
Useful links	
1	https://nptel.ac.in/courses/108102047

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Program: B.Tech in Electrical Engineering

Semester	Course Code	Name of the course	L	T	P	Credits
V	EE5E001(C)	Elective I (Introduction to Special Machines)	3	0	0	3

	Prerequisites for the course
1	All basic concepts studied in the subjects Electrical Machines-I & II

	Prior Reading Material/useful links
1	https://nptel.ac.in/courses/108102047
2	Krishnan, R., "Permanent Magnet and BLDC Motor Drives", CRC Press, 2009.

Course Outcomes:

Sr. No	Course outcome number	CO statement
1	CO1	Remember basic principles of some special electrical machines.
2	CO2	Understand the basics of construction & principle of operation of special electrical machines.
3	CO3	Identify the different operational characteristics related to the special electrical machines.
4	CO4	Analyze the performance indices of special electrical machines.
5	CO5	Evaluate the operation & characteristics of special electrical machines.
6	CO6	Solve the different problems related to operation, supply conversion & performance indices of special electrical machines.

Syllabus:

	Course Contents
Unit I	SPECIAL AC MACHINES Inverted Induction Machine, Synchronous Induction motor, Linear induction Motors (LIM), High efficiency Induction motors, Repulsion motors, Schrage motors. (Only Elementary Aspects). (7Hours)
Unit II	FRACTIONAL KILOWATT MACHINES Reluctance motors, AC tachometers, AC Series Motor-Universal Motor, Stepper Motor & its types, Hysteresis Motor, (Only Elementary Aspects). (7Hours)

Unit III	SPECIAL D.C. MACHINES PMDC motors: Construction, Working, Characteristics & applications, BLDC Motors: Construction, Working, Characteristics & applications.. (7Hours)
Unit IV	PERMANENT MAGNET SYNCHRONOUS MOTORS Introduction, Construction, Working, Ideal PMSM, EMF and Torque equations, Armature MMF, Phasor diagram, Torque/speed characteristics, Applications.. (6Hours)
Unit V	SERVOMOTORS DC servomotors: Construction, working, torque speed characteristics, applications.AC servomotors: Construction, working, torque speed characteristics, applications, Comparison of servomotors with conventional motors. (7Hours)
Unit VI	SOFTWARE APPLICATIONS NPTEL, (Swayam) courses, Software Applications in Electrical Machines. (7Hours)
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.
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.
Useful links	
1	https://nptel.ac.in/courses/108102047

Contributions for syllabus designing:

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3	Dr.V.S.Dhok	Asst.Prof.	JDCOEM,Nagpur
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5	Mr.M.S.Isasare	Asst.Prof.	JDCOEM,Nagpur
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Program: B.Tech in Electrical Engineering

Semester	Course Code	Name of the course	L	T	P	Credits
V	EE5E001(C)	Elective I (Introduction to Special Machines)	3	0	0	3

	Prerequisites for the course
1	All basic concepts studied in the subjects Electrical Machines-I & II

	Prior Reading Material/useful links
1	https://nptel.ac.in/courses/108102047

Course Outcomes:

Sr. No	Course outcome number	CO statement
1	CO1	Remember basic principles of some special electrical machines.
2	CO2	Understand the basics of construction & principle of operation of special electrical machines.
3	CO3	Identify the different operational characteristics related to the special electrical machines.
4	CO4	Analyze the performance indices of special electrical machines.
5	CO5	Evaluate the operation & characteristics of special electrical machines.
6	CO6	Solve the different problems related to operation, supply conversion & performance indices of special electrical machines.

Syllabus:

	Course Contents
Unit I	SPECIAL AC MACHINES Inverted Induction Machine, Synchronous Induction motor, Linear induction Motors (LIM), High efficiency Induction motors, Repulsion motors, Schrage motors. (Only Elementary Aspects). (7Hours)
Unit II	FRACTIONAL KILOWATT MACHINES Reluctance motors, AC tachometers, AC Series Motor-Universal Motor, Stepper Motor & its types, Hysteresis Motor, (Only Elementary Aspects). (7Hours)
Unit III	SPECIAL D.C. MACHINES PMDC motors: Construction, Working, Characteristics & applications, BLDC Motors: Construction, Working, Characteristics & applications..

	(7Hours)
Unit IV	PERMANENT MAGNET SYNCHRONOUS MOTORS Introduction, Construction, Working, Ideal PMSM, EMF and Torque equations, Armature MMF, Phasor diagram, Torque/speed characteristics, Applications.. (6Hours)
Unit V	SERVOMOTORS DC servomotors: Construction, working, torque speed characteristics, applications. AC servomotors: Construction, working, torque speed characteristics, applications, Comparison of servomotors with conventional motors. (7Hours)
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2	AshfaqHussain, "Electric Machines", SecondEdition,DhanpatRai& Co. Ltd.
Reference Books	
1	Krishnan, R., "Permanent Magnet and BLDC Motor Drives", CRC Press, 2009.
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Useful links	
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Program: B. Tech in Electrical Engineering

Semester	Course Code	Name of the course	L	T	P	Credits
V	EE5E001(D)	Elective I (Electrical Power Utilization & Practice)	3	0	0	3

	Prerequisites for the course
1	All basic concepts studied in the subjects Power Systems-I & II.

	Prior Reading Material/useful links
1	https://onlinecourses.nptel.ac.in/noc22_ch27/preview
2	Uppal S.L, "Electric Power", Khanna Publishers, 1988

Course Outcomes:

Sr. No	Course outcome number	CO statement
1	CO1	The students should be able to understand the process and application of different types of Electric Heating equipments.
2	CO2	The students should be able to understand the process and application of different types of Welding equipments.
3	CO3	Students should be able to understand basics of illumination and working principles of different light sources.
4	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.
5	CO5	The students should be able to understand the working principles and applications for various electrolytic processes for industrial applications.
6	CO6	The students should be able to understand the Refrigeration cycle process and electrical circuit used in different cooling system.

Syllabus:

	Course Contents
Unit I	Electric Heating 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. (7Hours)
Unit II	Electric Welding 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

	(7Hours)
Unit III	Design of Lightning System 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. (7Hours)
Unit IV	Electrolytic Processes 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. (6Hours)
Unit V	Other Applications of Electrical Energy 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 (7Hours)
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
Reference Books	
1	Guide book for National Certification Examination for Energy Managers and Energy Auditors, Bureau of Energy Efficiency.
Useful links	
1	https://onlinecourses.nptel.ac.in/noc22_ch27/preview

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Program: B.Tech in Electrical Engineering

Semester	Course Code	Name of the course	L	T	P	Credits
V	EE5E002(A)	Elective II(Advance Renewable Energy System)	3	0	0	3

Prerequisites for the course	
1	Concepts of transistors & semiconductor physics studied in first year & some basics of Renewable Energy.

Prior Reading Material/useful links	
1	https://onlinecourses.nptel.ac.in/noc22_ch27/preview
2	Solar Energy: Principles of Thermal Collection and Storage by S,P Sukhatme, Tata McGraw Hill

Course Outcomes:

Sr. No	Course outcome number	CO statement
1	CO1	To Define the principle of energy conversion technique from biomass, geothermal and hybrid energy systems.
2	CO2	To Summarize the effects of air pollution and ecosystems Unit Contents Contact
3	CO3	To Identify the essential characteristics and technical requirements of photovoltaic and biomass energy systems.
4	CO4	To Analyze the need of various forms of non conventional energy sources, historical and latest developments
5	CO5	Illustrate design of biogas, geothermal and hybrid power plant.
6	CO6	Discuss about the environmental aspects of renewable energy resources.

Syllabus:

Course Contents	
Unit I	Biomass Energy 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. (8Hours)
Unit II	Geothermal Energy 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. (6Hours)
Unit III	Hybrid energy systems 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. (6Hours)
Unit IV	Air pollution 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. (6Hours)
Unit V	Environment and Social Structure 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. (7Hours)
Text Books	
1	Non-conventional energy sources by G.D. Rai, Khanna Publishers
Reference Books	
1	Solar Energy: Principles of Thermal Collection and Storage by S,P Sukhatme, Tata McGraw Hill
Useful links	
1	https://onlinecourses.nptel.ac.in/noc22_ch27/preview

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Program: B. Tech in Electrical Engineering

Semester	Course Code	Name of the course	L	T	P	Credits
V	EE5E002(B)	Elective II (Analog Digital Electronics)	3	0	0	3

	Prerequisites for the course
1	All basic concepts studied in the subject Electronic Devices and Circuits in fourth semester.

	Prior Reading Material/useful links
1	https://onlinecourses.nptel.ac.in/noc22_ch27/preview
2	Digital Electronic Principles, By Malvino PHI, 3 Edition

Course Outcomes:

Sr. No	Course outcome number	CO statement
1	CO1	Understand the operation and analyze the characteristics of semiconductor diodes, MOSFET, and BJT
2	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
3	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
4	CO4	Design different combinational circuits for various applications
5	CO5	Design various sequential circuits for different applications
6	CO6	Design and verify digital systems using combinational and sequential circuits

Syllabus:

	Course Contents
Unit I	Diode Circuits: P-N junction diode, V-I characteristics of a diode; half-wave and full-wave rectifiers, Zener diodes, clamping and clipping circuit. (7Hours)
Unit II	BJT Circuits 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. (7Hours)

Unit III	MOSFET Circuits: 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 (7Hours)
Unit IV	Number Systems 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. (7Hours)
Unit V	Combinational logic Design: Comparators, Multiplexers, Demultiplexer, Encoder, Decoder, Arithmetic Circuit Design, Barrel Shifter, ALU. (6Hours)
Unit VI	Sequential logic Design: Sequential Logic Design Latches, Flip flop – S-R, J-K, D, T and Master-Slave JK FF, counters, Shift registers. (6Hours)
Text Books	
1	Digital Electronic Principles, By Malvino PHI, 3 Edition.
2	Modern Digital Electronics, R. P. Jain, McGraw Hill Education, 2009.
Reference Books	
1	Digital logic and Computer design, M. M. Mano, Pearson Education India, 2016.
Useful links	
1	https://onlinecourses.nptel.ac.in/noc22_ch27/preview

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Program: B.Tech in Electrical Engineering

Semester	Course Code	Name of the course	L	T	P	Credits
V	EE5E002(C)	Elective II(Electrical Machine Design)	3	0	0	3

Prerequisites for the course	
1	Basic concepts studied in the subjects Electrical Machine-I like transformers,Induction motors etc.

Prior Reading Material/useful links	
1	https://onlinecourses.nptel.ac.in/noc22_ch27/preview
2	Sawhney, A.K., 'A Course in Electrical Machine Design', DhanpatRai& Sons, New Delhi,Fifth Edition, 1984.

Course Outcomes:

Sr. No	Course outcome number	CO statement
1	CO1	Remember appropriate ratings, material, heating and cooling time constants.
2	CO2	Understand magnetic, electric materials, windings and transformers.
3	CO3	Apply concepts in design of electrical apparatus, devices and computer aided designing of transformer.
4	CO4	Analyze different materials, windings and modes of heat generation and heat dissipation in electrical machines.
5	CO5	Evaluate fault parameters in windings, voltage regulation and efficiency in transformer.
6	CO6	Design different types of transformers, heating coils and field coils.

Syllabus:

Course Contents	
Unit I	Review of material used in construction of electrical machines 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 (7Hours)
Unit II	Design of Induction Motor 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 (7Hours)

Unit III	Design of synchronous machines 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 (7Hours)
Unit IV	Design of transformer 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. (7Hours)
Unit V	Heating, Cooling and Ventilation 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. (6Hours)
Unit VI	Computer aided Design of Electrical machine Introduction, advantages various approaches of Computer Aided Designing, Computer Aided Designing of transformer, Winding of rotating Electrical Machines. Optimization of Design. (6Hours)
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
Reference Books	
1	J Pyrhonen,T. Jokinen and V.Hrabovcova, " Design of Rotating Electrical Machines" , Wiley,2009.
Useful links	
1	https://onlinecourses.nptel.ac.in/noc22_ch27/preview

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Program: B.Tech in Electrical Engineering

Semester	Course Code	Name of the course	L	T	P	Credits
V	EE5E002(D)	Elective II(Electrical Installation & Design)	3	0	0	3

	Prerequisites for the course
1	Basic concepts studied in the subject Fundamentals of Electrical Engineering like resistance ,Inductance,Capacitance,wire gauges etc.

	Prior Reading Material/useful links
1	https://onlinecourses.nptel.ac.in/noc22_ch27/preview

Course Outcomes:

Sr. No	Course outcome number	CO statement
1	CO1	To Define various terms related to electrical installation system.
2	CO2	To Illustrate methods of installation, testing and commissioning of electrical apparatus and conductors.
3	CO3	To Apply knowledge to design the distribution system for residential, commercial, industrial applications and utility distribution networks and illumination design.
4	CO4	To Examine fault level at various locations in radial networks and be able to find rating and location of series reactors.
5	CO5	Design single line diagrams with specifications for distribution networks, motor and power control centers for industrial installations and design reactive power compensation.
6	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.

Syllabus:

Course Contents	
Unit I	A.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. B.Cables, conductors & bus-bars: Construction, selection, installation, testing of LT/ HT cables, overload & short circuit ratings, rating factors; Overhead line conductors, copper and aluminiumbusbars. (7Hours)
Unit II	A.Switching & protection devices: 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. B.Symmetrical Short Circuit Calculations Determining symmetrical short circuit currents at various locations for selecting proper circuit breaker rating & determining value of series reactors for limiting short circuit current. (7Hours)
Unit III	A. Electric supply to Induction Motors in industries: Types of rotors, SLD and working of DOL/ Star-Delta/ Autotransformer starters; types, specifications, selection of power contactors, Overload relays, short circuit protective devices. B.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. (7Hours)
Unit IV	A.Transformers: Specifications, ratings, selection, installation, testing & commissioning of transformers, protective device for transformers. B.Substations: Types of Substation, Substation scheme and components, 11kV & 33 kV, indoor/ outdoor substations, plan/ elevations, Earthing Arrangements. (7Hours)
Unit V	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. Design of PCC and MCC, Definition of various terms – Referene earth, earth electrode, earth grid, earth electrode resistance, earth leakage current, earthing conductor, earth mat. (6Hours)
Unit VI	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 (6Hours)

Text Books	
1	Electric Power Distribution system by A.S.Pabla, Tata Mcgraw Hill.
2	Electrical Engineering Handbook, C. L. Wadhwa.
Reference Books	
1	Design of Electrical Installations, V.K.Jain,Amitab Bajaj, Laxmi Publications Pvt Limited, 01-Jan-1993.
Useful links	
1	https://onlinecourses.nptel.ac.in/noc22_ch27/preview

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Program: B. Tech in Electrical Engineering

Semester	Course Code	Name of the course	L	T	P	Credits
V	EE5O001	Open Elective I - Electrical Safety & Management	4	0	0	3

Prerequisites for the course	
1	Basic concepts studied in the subject Fundamentals of Electrical Engineering like resistance, current earthing, wire gauges etc.

Prior Reading Material/useful links	
1	https://onlinecourses.swayam2.ac.in/nou20_cs08/preview
2	PradeepChaturvedi, "Energy management policy, planning and utilization", Concept Publishing company, New Delhi, 1997.

Course Outcomes:

Sr. No	Course outcome number	CO statement
1	CO1	Explain the objectives and precautions of Electrical Safety, effects of Shocks and their Prevention.
2	CO2	Summarize the Safety aspects during Installation of Plant and Equipment.
3	CO3	Describe the electrical safety in residential, commercial and agricultural installations.
4	CO4	Describe the various Electrical Safety in Hazardous Areas, Equipment Earthing and System Neutral Earthing.
5	CO5	State the electrical systems safety management and IE rules.

Syllabus:

Course Contents	
Unit I	INTRODUCTION TO ELECTRICAL SAFETY, SHOCKS AND THEIR PREVENTION: Terms and definitions, objectives of safety and security measures, Hazards associated with electric current, and voltage, principles of electrical safety, approaches to prevent Accidents, scope of subject electrical safety. Primary and secondary electrical shocks, 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. (7Hours)
Unit II	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. (7Hours)
Unit III	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. (7Hours)
Unit IV	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. (7Hours)
Unit V	EQUIPMENT EARTHING AND SYSTEM NEUTRAL EARTHING: 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. (6Hours)
Unit VI	SAFETY MANAGEMENT OF ELECTRICAL SYSTEMS: 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: Standards on electrical safety, safe limits of current, voltage . The Electricity Act, 2003, (Part1, 2, 3,4& 5) (6Hours)
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.
Useful links	
1	https://onlinecourses.swayam2.ac.in/nou20_cs08/preview

Contributions for syllabus designing:

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3	Dr.V.S.Dhok	Asst.Prof.	JDCOEM,Nagpur
4	Mr.P.V.Ambade	Asst.Prof.	JDCOEM,Nagpur
5	Mr.M.S.Isasare	Asst.Prof.	JDCOEM,Nagpur
6	Mr. J. S. Joshi	Professor (EE)	RKNEC,Nagpur
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Program: B.Tech in Electrical Engineering

Semester	Course Code	Name of the course	L	T	P	Credits
V	EE5O001	Open Elective I - Industrial Instrumentation	4	0	0	4

Prerequisites for the course	
1	Basic concepts studied in the subject Electrical measurements like ,current measurement earthing,wire gauges etc.

Prior Reading Material/useful links	
1	https://onlinecourses.swayam2.ac.in/nou20_cs08/preview
2	Fundamentals of Industrial Instrumentation and Process Control: William C. Dunn, TMH Publication, 2nd edition.

Course Outcomes:

Sr. No	Course outcome number	CO statement
1	CO1	Select the instruments for measurement of various physical quantities,
2	CO2	Select a transducer based on its operating characteristics for the required application.
3	CO3	Check various available techniques and select appropriate to obtain satisfactory task for the parameter to be measured.
4	CO4	Know advantages and limitations of selected techniques.

Syllabus:

Course Contents	
Unit I	Introduction to Industrial Instrumentation: 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. (7Hours)
Unit II	Temperature and Heat Measurement: Introduction, basic terms, Temperature and heat formulas, Temperature measuring devices, Application considerations. (7Hours)
Unit III	Level Measurement&Flow Measurement: Introduction, basic terms, Level formulas, Level sensing devices, Application considerations. Flow formulas, Flow measuring instruments, Application considerations.

	(7Hours)
Unit IV	Position and motion sensing: Basic definitions, measuring devices, application considerations. Force, Torque and Load cell: Basic definitions, measuring devices, application considerations (7Hours)
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. (6Hours)
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. (6Hours)
Text Books	
1	Industrial Instrumentation: K Krushnaswamy, New Age International E.O. Doebelin, 'Measurement Systems – Application and Design', Tata McGraw Hill publishing company, 2003.
2	E.O. Doebelin, 'Measurement Systems – Application and Design', Tata McGraw Hill publishing company, 2003.
Reference Books	
1	Fundamentals of Industrial Instrumentation and Process Control: William C. Dunn, TMH Publication, 2nd edition.
Useful links	
1	https://onlinecourses.swayam2.ac.in/nou20_cs08/preview

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Program: B.Tech in Electrical Engineering

Semester	Course Code	Name of the course	L	T	P	Credits
V	EE5T004	Consumer Affairs	2	0	0	Audit

	Prerequisites for the course
1	Basic concepts of subject Engineering Economics studied in third semester

	Prior Reading Material/useful links
1	https://onlinecourses.swayam2.ac.in/nou20_cs08/preview

Course Outcomes:

Sr. No	Course outcome number	CO statement
1	CO1	Familiarize the students with their rights and responsibilities as a consumer, the social framework of consumer rights and legal framework of protecting consumer rights.
2	CO2	It also provide an understanding of the procedure of redress of consumer complaints, and the role of different agencies in establishing product and service standards.
3	CO3	The student should be able to comprehend the business firms' interface with consumers and the consumer related regulatory and business environment.

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 (7Hours)

Unit II	he Consumer Protection Law in India 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. (7Hours)
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. (7Hours)
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 Real Estate Regulatory Authority (7Hours)
Text Books	
1	Khanna,SriRam,SavitaHanspal,SheetalKapoor,andH.K.Awasthi.(2007)ConsumerAffairs,UniversitiesPress.
2	Choudhary,RamNareshPrasad(2005).ConsumerProtectionLawProvisionsandProcedure,Deepand Deep PublicationsPvtLtd.
Reference Books	
1	Misra Suresh, (Aug 2017) “Is the Indian Consumer Protected? One India OnePeople.
Useful links	
1	https://onlinecourses.swayam2.ac.in/nou20_cs08/preview

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Program: B.Tech in Electrical Engineering

Semester	Course Code	Name of the course	L	T	P	Credits
V	EE5L001	Power Electronics Lab	0	0	2	1

Prerequisites for the course	
1	Basic concepts of subject Power Electronics studied in current semester.

Prior Reading Material/useful links	
1	https://www.iitk.ac.in/new/power-electronics-laboratory

Course Outcomes:

Sr. No	Course outcome number	CO statement
1	CO1	To remember the principle of operation of various basic semiconductor devices
2	CO2	To understand the characteristics of various types of semiconductor device and its working as converters.
3	CO3	To make use of various semiconductor device for the converters operation under various load types.
4	CO4	Examine the performance of various types of converters.
5	CO5	Compare various types of converters based on performance parameter.
6	CO6	To design the converters based on real time industrial applications.

Syllabus:

List of Experiments

- To study Gate drive circuit
- To study Reverse recovery time of diode
- To study Single phase half wave controlled converter
- To study Characteristics of junction gate fet
- To study Unsymmetrical half wave bridge rectifier
- To study SCR parallel inverter
- To study Lamp dimmer using DIAC and TRIAC

- To study Simulation of 3 phase full wave controlled rectifier
- To study Simulation of 3 phase inverter
- To study Simulation of buck converter

Contributions for syllabus designing:

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Program: B.Tech in Electrical Engineering

Semester	Course Code	Name of the course	L	T	P	Credits
V	EE5L002	Control System I Lab	0	0	2	1

Prerequisites for the course	
1	Basic concepts of subject Control System studied in current semester.

Prior Reading Material/useful links	
1	https://www.iitk.ac.in/new/control-systems-laboratory

Course Outcomes:

Sr. No	Course outcome number	CO statement
1	CO1	To remember the basic concept of control system, types & effect of Feedback
2	CO2	To apply Block diagram and Signal flow graph technique
3	CO3	To apply knowledge for Time domain analysis.
4	CO4	To analyze the stability of a system & to construct Root Locus
5	CO5	To apply knowledge for Frequency domain analysis.
6	CO6	To construct state model of a system

Syllabus:

List of Experiments

- Potentiometer error detector
- Time response of second order systems
- Characteristics of synchros
- A.C. position control system
- D.C. position control system
- Determination of step & impulse response for a first order unity feedback system
- Lag and lead compensation - magnitude and phase plot

- Stability analysis (Bode, Root locus, Nyquist) of linear time invariant system using MATLAB
- State space model for classical transfer function using MATLAB

- Study the effect of addition of poles to the forward path transfer function of a closed loop system
- Effect of P, PD, PI, PID controller on second order systems

Contributions for syllabus designing:

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Program: B.Tech in Electrical Engineering

Semester	Course Code	Name of the course	L	T	P	Credits
V	EE5L003	Power System II Lab	0	0	2	1

Prerequisites for the course	
1	Basic concepts of subject Power System II studied in current semester

Prior Reading Material/useful links	
1	http://virtuallab.dei.ac.in/Dreamweaver/index.html

Course Outcomes:

Sr. No	Course outcome number	CO statement
1	CO1	Define the different parameters of power system operation.
2	CO2	Illustrate the different parameters of power system operation and control.
3	CO3	To identify the different issues related to power systems
4	CO4	Analyze the different solution methods related to power system ..
5	CO5	Choose amongst the different analytical & numerical methods for power flow solutions.
6	CO6	Solve the different problems related to cost load flow, fault, reactive power and Stability constraints in the power systems

Syllabus:

List of Experiments

- Formation of Matrix in MATLAB.
- Formation of Bus Impedance Matrix Z-BUS
- Formation of Bus Admittance Matrix Y-BUS
- Load flow study using Newton Raphson method .
- Load flow study using Gauss Seidal Iteration Method .
- To study the system stability using point by point method.
- To understand modeling and performance of medium lines

- To study steady state stability of synchronous motor.
- To study symmetrical and unsymmetrical component analysis.
- To study Economic Load Dispatch Center.

Contributions for syllabus designing:

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Program: B.Tech in Electrical Engineering

Semester	Course Code	Name of the course	L	T	P	Credits
VI	EE6T001	Microprocessor and microcontroller	3	0	0	3

Prerequisites for the course	
1	Basic concepts of Analog & Digital Circuits like signals ,amplifiers etc.

Prior Reading Material/useful links	
1	https://onlinecourses.nptel.ac.in/noc22_ee12/preview

Course Outcomes:

Sr. No	Course outcome number	CO statement
1	CO1	To remember the architecture of 8085 and 8051.
2	CO2	To understand interfacing and interrupt features of 8085 and 8051.
3	CO3	To develop program for basic applications
4	CO4	To distinguish and analyze the properties of Microprocessors & Microcontrollers
5	CO5	To explain programming logic and concepts of 8085 microprocessors and 8051 micro-controller.
6	CO6	To build strong foundation for designing real world applications using microprocessors and microcontrollers.

Syllabus:

Course Contents	
Unit I	8085 architecture: Architecture, register structure, addressing modes, instruction set of 8085, timing diagrams,Assembly Language Programming of 8085 (6Hours)
Unit II	Interfacing: 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. (6Hours)
Unit III	Interrupts and DMA: 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. (7Hours)
Unit IV	Applications: 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 power factor-Traffic light controller, Stepper motor control (7 Hours)
Unit V	Introduction to microcontroller: 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. (6Hours)
Unit VI	8051 Peripheral Functions : 8051 interrupt structures, Timer and serial functions, parallel port features : Modes of operation, Power control, features, Interfacing of 8051, Typical applications, MCS 51 family features (6Hours)
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
Useful links	
1	https://onlinecourses.nptel.ac.in/noc22_ee12/preview

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Program: B.Tech in Electrical Engineering

Semester	Course Code	Name of the course	L	T	P	Credits
VI	EE6T002	Advance Control System	3	0	0	3

	Prerequisites for the course
1	All the basic concepts of the subject Control Systems-I studied in fifth semester

	Prior Reading Material/useful links
1	https://archive.nptel.ac.in/courses/108/103/108103007/

Course Outcomes:

Sr. No	Course outcome number	CO statement
1	CO1	To remember the basic concepts of compensation, State variable analysis, Non linear Control System, Digital Control system.
2	CO2	To understand the basic concepts of compensation, State variable analysis, Nonlinear Control System, Digital Control system.
3	CO3	To apply different concepts to find controllability, observability and stability of non-linear control system, sampled data control system.
4	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
5	CO5	To evaluate various parameters of continuous time system, digital systems using the Z-transformation, and nonlinear system using various methods.
6	CO6	To design controllers to achieve desired specification

Syllabus:

Course Contents	
Unit I	COMPENSATION 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. (7Hours)
Unit II	DESIGN BY STATE VARIABLE FEEDBACK 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 (7Hours)
Unit III	OPTIMAL CONTROL SYSTEM 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. (7Hours)
Unit IV	CONTROLLER TUNING Review of analog PID controller, PID tuning methods in process control (Ziegler-Nichols tuning method), digital PID controllers. (7 Hours)
Unit V	NON LINEAR CONTROL SYSTEM (NLCS) 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 of time. (6Hours)
Unit VI	DIGITAL CONTROL SYSTEM 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. (6Hours)
Text Books	
1	Benjamin C Kuo, “Automatic Control Systems”, Prentice Hall of India.
2	M. Gopal, “Control Systems- Principle of Design”, Fourth Edition, 2012, McGraw Hill.

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.
Useful links	
1	https://archive.nptel.ac.in/courses/108/103/108103007/

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Program: B.Tech in Electrical Engineering

Semester	Course Code	Name of the course	L	T	P	Credits
VI	EE6E003(A)	Elective III- Electrical Energy Conservation &Audit	3	0	0	3

Prerequisites for the course	
1	All the basic concepts of the subject Renewable Energy Sources studied in fifth semester

Prior Reading Material/useful links	
1	https://onlinecourses.nptel.ac.in/noc21_ph25/preview
2	Principles of Energy Conservation, Archie, W Culp, Published by McGraw Hill, 1991.

Course Outcomes:

Sr. No	Course outcome number	CO statement
1	CO1	Know Present energy scenario with need of energy audit and energy conservation.
2	CO2	Classify and Manage electric and thermal energy in the industry.
3	CO3	Identify various aspects of energy audit such as planning, monitoring and implementation
4	CO4	Analyze the energy flow diagram of an industry and identify the energy wasted or a waste stream.
5	CO5	Evaluate the techno economic feasibility of the energy conservation technique adopted.
6	CO6	Choose appropriate energy conservation method to reduce the wastage of energy

Syllabus:

Course Contents	
Unit I	Basics of Energy Management and Conservation 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. (10 Hours)

Unit II	Energy Audit 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. (8Hours)
Unit III	Material & Energy balance and Waste Heat Recovery Facility as an energy system; Methods for preparing process flow; material and energy balance diagrams. Cogeneration and waste heat recovery; (8Hours)
Unit IV	Energy Action Planning, Monitoring and Targeting: 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. . (8 Hours)
Unit V	Electrical Energy Management: 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. (8Hours)
Unit VI	Thermal energy Management : Energy conservation in boilers, steam turbines and Furnaces; Application of FBC, Heat exchangers and heat pumps. (8Hours)
Text Books	
1	Energy Management, P. O'Callaghan, McGraw - Hill Book Company, 1993.
Reference Books	
1	Energy Management Handbook, Wayne C. Turner, Wiley Inter Science Publication

Useful links	
1	https://onlinecourses.nptel.ac.in/noc21_ph25/preview

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Program: B.Tech in Electrical Engineering

Semester	Course Code	Name of the course	L	T	P	Credits
VI	EE6E003(B)	Elective III- Linear Electronic Circuits	3	0	0	3

	Prerequisites for the course
1	All the basic concepts of the subject Digital Electronics studied in fourth semester

	Prior Reading Material/useful links
1	https://onlinecourses.nptel.ac.in/noc21_ph25/preview

Course Outcomes:

Sr. No	Course outcome number	CO statement
1	CO1	To understand characteristics of IC and Op-Amp and identify the internal structure.
2	CO2	To introduce various manufacturing techniques.
3	CO3	To study various op-amp parameters and their significance for Op-Amp.
4	CO4	To learn frequency response, transient response and frequency compensation techniques for Op-Amp.
5	CO5	To analyze and identify linear and nonlinear applications of Op-Amp.
6	CO6	To understand functionalities of PLL.

Syllabus:

	Course Contents
Unit I	OP-AMP Basics Block diagram of OP-AMP, Differential Amplifier configurations, Differential amplifier analysis for dual-input balanced-output configurations, Need and types of level shifter, current mirror circuits. Feedback topologies: Voltage series and voltage shunt feedback amplifier and its effect on Ri, Ro, bandwidth and voltage gain. (7 Hours)
Unit II	Linear Applications of OP-AMP Inverting and non-inverting amplifier configurations, voltage follower, summing, averaging scaling amplifier, difference amplifier, integrator, differentiator, and instrumentationamplifiers. (7Hours)
Unit III	Non-linear Applications of OP-AMP 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. (7Hours)
Unit IV	Converters using OP-AMP 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. 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. . (8 Hours)
Unit V	Oscillators 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. (6Hours)
Unit VI	Active filters and PLL Design guidelines of Active filters: Low pass, high pass, band pass and band stop filters, Block diagram of PLL and its function. (6Hours)
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.
Reference Books	
1	Bali, “Linear Integrated Circuits”, McGraw Hill 2008
2	Gray, Hurst, Lewise, Meyer, “Analysis & Design of Analog Integrated Circuits”, Wiley Publications on Education.
Useful links	
1	https://onlinecourses.nptel.ac.in/noc21_ph25/preview

Contributions for syllabus designing:

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1	Mr.Firoz Akthar	Asst.Prof.	JDCOEM,Nagpur
2	Ms.S.V.Jethani	Asst.Prof.	JDCOEM,Nagpur
3	Dr.V.S.Dhok	Asst.Prof.	JDCOEM,Nagpur
4	Mr.P.V.Ambade	Asst.Prof.	JDCOEM,Nagpur
5	Mr.M.S.Isasare	Asst.Prof.	JDCOEM,Nagpur
6	Mr. J. S. Joshi	Professor (EE)	RKNEC,Nagpur
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Program: B.Tech in Electrical Engineering

Semester	Course Code	Name of the course	L	T	P	Credits
VI	EE6E003(C)	Elective III- Introduction to AC and DC Drive	3	0	0	3

Prerequisites for the course	
1	Basic concets of Power Electronics studied in fifth semester such as AC/DC Converters,Inverters ,PWM etc.

Prior Reading Material/useful links	
1	https://onlinecourses.nptel.ac.in/noc21_ph25/preview
2	H.Partab, “Modern Electrical Traction”, 1973, PritamSurat& Brothers

Course Outcomes:

Sr. No	Course outcome number	CO statement
1	CO1	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	CO2	Select motor rating, Flywheel of common drive motors for continuous and intermittent periodic duties.
3	CO3	Analyze control circuit of ac/dc contactors and relays for automatic starting and braking of ac/dc motors.
4	CO4	Analyze the performance and suitability of motors used in ac/dc traction, their performance characteristic, and control and braking.
5	CO5	Apply digital control of electric motor, plc programming in electrical drives.
6	CO6	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.

Syllabus:

Course Contents	
Unit I	Introduction to Drives 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.

	(7 Hours)
Unit II	Rating 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. (7Hours)
Unit III	AC and DC contactors and relays 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. (7Hours)
Unit IV	Electrical Traction 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 . (8 Hours)
Unit V	Traction motor control 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. (6Hours)
Unit VI	PLC, its programming and its applications in electrical drives.Digital control of Electric motor, Block diagram arrangement, comparison with other methods of control. (6Hours)
Text Books	
1	G. K. Dubey, “Fundamentals of electrical drives”, Second edition, (sixth reprint), Narosa Publishing house, 2001
2	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.
Useful links	
1	https://onlinecourses.nptel.ac.in/noc21_ph25/preview

Contributions for syllabus designing:

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1	Mr.A.V.Joshi	Asst.Prof.	JDCOEM,Nagpur
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Program: B.Tech in Electrical Engineering

Semester	Course Code	Name of the course	L	T	P	Credits
VI	EE6E003(D)	Elective III- Electrical Power Distribution System	3	0	0	3

Prerequisites for the course	
1	Basic concepts of subject Power Systems-I such as Generation,Transmission & Distribution,voltage levels at distribution systems basic ideas of distribution system etc.

Prior Reading Material/useful links	
1	TuranGonen, "Electric Power Distribution SystemEngineering", 2nd Edition,2008,CRC Press
2	https://nptel.ac.in/courses/112104031

Course Outcomes:

Sr. No	Course outcome number	CO statement
1	CO1	Remember basic principles of distribution systems and reliability indices.
2	CO2	Understand the principle of operation of feeder, substation and data acquisition system.
3	CO3	To identify the different factors related to distribution systems.
4	CO4	Analyze the effect of various equipments on voltage control and substation protection requirements.
5	CO5	Evaluate voltage drop, power loss and line drop in distribution system
6	CO6	Solve different problems related to radial networks, reactive power requirements and substation protection

Syllabus:

Course Contents	
Unit I	Distribution systems 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 (7 Hours)
Unit II	Feeders 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. (7Hours)
Unit III	Distribution System Reliability 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. (7Hours)
Unit IV	Voltage control Equipment for voltage control, effect of series capacitors, effect of AVB/AVR, line drop calculations and compensations, Reactive power requirements, economic consideration & best location. . (8 Hours)
Unit V	Distribution Automation Introduction to Distribution Automation, Data acquisition system and decentralized control, data acquisition and protection considerations of control panel, circuit breakers, fuses, relays, earthing. (6Hours)
Unit VI	Substation 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. (6Hours)
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.
Reference Books	
1	M. K. Khedkar& G. M. Dhole., "Electric Power Distribution Automation", University Science Press.
Useful links	
1	https://nptel.ac.in/courses/112104031

Contributions for syllabus designing:

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3	Dr.V.S.Dhok	Asst.Prof.	JDCOEM,Nagpur
4	Mr.P.V.Ambade	Asst.Prof.	JDCOEM,Nagpur
5	Mr.M.S.Isasare	Asst.Prof.	JDCOEM,Nagpur
6	Mr. J. S. Joshi	Professor (EE)	RKNEC,Nagpur
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Program: B.Tech in Electrical Engineering

Semester	Course Code	Name of the course	L	T	P	Credits
VI	EE6E004(A)	Elective IV- Solar Photovoltaic Devices	3	0	0	3

Prerequisites for the course	
1	Basic concepts of Renewable Energy Systems such as PV cell,PV array,PV Panel & its types etc.

Prior Reading Material/useful links	
1	https://nptel.ac.in/courses/112104031

Course Outcomes:

Sr. No	Course outcome number	CO statement
1	CO1	Calculate and analyse solar insolation on a collecting surface by locating the sun position at anygiven location and time, interpret sun path diagrams.
2	CO2	Interpret I-V curves from the circuit model of a PV cell, understand the impact of temperature andsolar insolation on I-V curves.
3	CO3	Evaluate the algorithms used for the maximum power point tracking of PV array.
4	CO4	Understand the principle of DC-AC power conversion in Grid connected PV system
5	CO5	Design standalone PV system by estimating the load, sizing and selecting the batteries, sizing and
6	CO6	Selecting the PV modules and other components

Syllabus:

Course Contents	
Unit I	Introduction : Fossil fuel energy usage and global warming; role of renewable energy in sustainable development; renewable energy sources; global potential for solar electrical energy systems. (7 Hours)
Unit II	Solar Radiation : 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. (7Hours)

Unit III	PV Cells and Modules : 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 (7Hours)
Unit IV	PV Inverters: Principle of DC-AC conversion, Working of Grid-connected PV inverter, schemes and basic control; Introduction to Grid Interfacing standards. . (8 Hours)
Unit V	PV Systems with Battery Energy Storage: 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. (6Hours)
Unit VI	System Level Issues: Design related issues; grounding, dc arcing and other safety related issues; islanding; harmonics; electro-magnetic interference; energy yield and economics of a PV installation. (6Hours)
Text Books	
1	Solar Photovoltaic: Fundamentals, Technologies and Applications: Solanki, PHI Learning Pvt Ltd, 2009
2	Photovoltaic Systems Engineering: Roger A. Messenger & Jerry Ventre, CRC Press, 2004, 2nd edition.
Reference Books	
1	Renewable and Efficient Electric Power Systems: Gilbert M. Masters, John Wiley & Sons, 2004
Useful links	
1	https://nptel.ac.in/courses/112104031

Contributions for syllabus designing:

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Program: B.Tech in Electrical Engineering

Semester	Course Code	Name of the course	L	T	P	Credits
VI	EE6E004(B)	Elective IV- High Power Semiconductor Devices	3	0	0	3

Prerequisites for the course	
1	Basic concepts of Power Electronics studied in fifth semester such as Power Electronic devices ,AC/DC Converters,Inverters ,PWM etc.

Prior Reading Material/useful links	
1	https://nptel.ac.in/courses/112104031
2	Rashid M. H., "Power Electronics Circuits, Devices and Applications", Prentice Hall India,Third Edition, New Delhi.

Course Outcomes:

Sr. No	Course outcome number	CO statement
1	CO1	To remember the principle of operation of various Power switching devices
2	CO2	To Understand the characteristics of various types of Power switching devices
3	CO3	To make use of steady state and dynamic models of Power switching devices
4	CO4	To analyse various types of Thermal Protection required for protection of Power switching devices
5	CO5	To compare various Thermal Protections and firing protection Circuits of Power switching devices
6	CO6	To design the Firing and Protecting Circuits for various Power switching devices.

Syllabus:

Course Contents	
Unit I	Power switching devices overview 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. (7 Hours)
Unit II	Current Controlled Devices: 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 and other types; series and parallel

	operation; comparison of BJT and Thyristor – steady state and dynamic models of BJT &Thyristor. (7Hours)
Unit III	Voltage Controlled Devices: 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. (7Hours)
Unit IV	Firing and Protecting Circuits: 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. . (8 Hours)
Unit V	Thermal Protection: 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 (6Hours)
Unit VI	Phase Controlled Converters: 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. (6Hours)
Text Books	
1	B.W. Williams ‘Power Electronics: Devices, Drivers, Applications and Passive Components, Tata McGraw Hill.
Reference Books	
1	Mohan, Undeland and Robins, “Power Electronics – Concepts, applications and Design, John Wiley and Sons, Singapore
Useful links	
1	https://nptel.ac.in/courses/112104031

Contributions for syllabus designing:

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Program: B.Tech in Electrical Engineering

Semester	Course Code	Name of the course	L	T	P	Credits
VI	EE6E004(C)	Elective IV- Power Semiconductor Based Drive	3	0	0	3

Prerequisites for the course	
1	Basic concepts of Power Electronics studied in fifth semester such as Power Electronic devices ,AC/DC Converters,Inverters ,PWM etc.

Prior Reading Material/useful links	
1	https://nptel.ac.in/courses/112104031

Course Outcomes:

Sr. No	Course outcome number	CO statement
1	CO1	Remember fundamental principles of power electronics and electric drives.
2	CO2	Understand the basics of construction & principle of operation ofvarious electric drives.
3	CO3	Apply suitable control methods to different motor drives.
4	CO4	Analyze the output of conventional drives and semiconductor based drives.
5	CO5	Evaluate the power factor, harmonics and ripple in motor current.
6	CO6	Solve the problems related starting, braking and speed control of motor drives.

Syllabus:

Course Contents	
Unit I	Dynamics of Electric Drives 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. (7 Hours)
Unit II	D.C. motor drives 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. (7Hours)
Unit III	Induction motor drives 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) (7Hours)
Unit IV	Synchronous Motor Drives Starting Braking of synchronous motor, variable frequency control selfcontrolled synchronous motor drive employing load commutated thyristor inverter or cycloconverter, starting oflarge synchronous motors. . (7 Hours)
Unit V	Advanced Motor Drives Brushless DC motor, stepper motor drives, Introduction tosolar and battery powered drives.Energy conservation in electric drives. (7 Hours)
Unit VI	Traction drives: 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. (7 Hours)
Text Books	
1	Rashid M. H., "Power Electronics Circuits, Devices and Applications", Prentice Hall India,Third Edition, New Delhi.
2	G. K. Dubey, "Fundamentals of Electric drives", CRC Press
Reference Books	
1	Ned Mohan, "Power Electronics", John Wiley and Sons, 3rd Edition
Useful links	
1	https://nptel.ac.in/courses/112104031

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Program: B.Tech in Electrical Engineering

Semester	Course Code	Name of the course	L	T	P	Credits
VI	EE6E004(D)	Elective IV- High Voltage DC transmission(HVDC)	3	0	0	3

Prerequisites for the course	
1	Basic concepts of Power Electronics studied in fifth semester such AC/DC Converters etc.

Prior Reading Material/useful links	
1	https://nptel.ac.in/courses/112104031

Course Outcomes:

Sr. No	Course outcome number	CO statement
1	CO1	Remember basic principles of some HVDC Systems.
2	CO2	Understand the basics of HVDC Systems and their implementation.
3	CO3	To identify the different operational characteristics related to HVDC Systems.
4	CO4	Analyze the performance of HVDC Systems.
5	CO5	Evaluate the operation & characteristics of HVDC Systems.
6	CO6	Solve the different problems related to operation of HVDC Systems.

Syllabus:

Course Contents	
Unit I	DC POWER TRANSMISSION FUNDAMENTALS Introduction, Economics of Dc Power transmission, comparison with AC system, Types of DC links, major components of converter station, planning of HVDC system. (7 Hours)
Unit II	HVDC CONVERTERS Choice of converter configuration, analysis of Gratz circuit with and without overlap, working of converter as rectifier and inverter, equivalent circuit for HVDC link. (7Hours)
Unit III	HVDC SYSTEM CONTROL 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. (7Hours)

Unit IV	CONVERTER FAULTS AND PROTECTION 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. . (7 Hours)
Unit V	Multi -Terminal DC (MTDC) Systems Introduction to MTDC Systems, Importance of Multi-Terminal HVDC Systems, Control of MTDC Systems, Interaction between AC-DC Power Systems. (7 Hours)
Unit VI	Modelling& Representation of HVDC systems Modeling Of HVDC Systems, Per Unit System, Representation for Power Flow Solution, and Representation for Stability Studies. (7 Hours)

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
Useful links	
1	https://nptel.ac.in/courses/112104031

Contributions for syllabus designing:

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Program: B.Tech in Electrical Engineering

Semester	Course Code	Name of the course	L	T	P	Credits
VI	EE6O002	Open Elective II- Electrical AUTOCAD	4	0	0	4

	Prerequisites for the course
1	Basic idea of various softwares used in Electrical Engineering and Importance of AUTOCAD.

	Prior Reading Material/useful links
1	https://nptel.ac.in/courses/112104031
2	AutoCAD: A Visual Approach 2D Basics, Steven Foster, Autodesk Press, 1997

Course Outcomes:

Sr. No	Course outcome number	CO statement
1	CO1	Understand the concept and techniques of Engineering drawing and become familiar with the AutoCAD user interface.
2	CO2	Apply basic CAD concepts to develop and construct accurate 2D geometry through creation of basic geometric constructions.
3	CO3	Create advanced drafting and modifying tools in AutoCAD
4	CO4	Apply elements of drafting such as layers, dimensions, hatching, annotation, drawing formats, and 2D figures in projects with a focus on ANSI industry standards.
5	CO5	Create blocks and attributes in AutoCAD
6	CO6	Understand the concept and techniques of Engineering drawing and become familiar with the AutoCAD user interface.

Syllabus:

Course Contents	
Unit I	An introduction to Engineering Drawings and AutoCAD • Introduction to Engineering Drawing • Various types of Engineering Drawing used in Electrical Industry • Introduction to AutoCAD • Exploring GUI • Workspaces • Coordinate System • Display Control • File Management Tutorials. (10 Hours)
Unit II	Drafting Basic Geometry Shapes in AUTOCAD • Basic Geometry Shapes • Setting the standards • Drafting setting • Drawing tools for basic geometry • Modify tools • Object Properties • Tutorials (10 Hours)
Unit III	Advanced Drafting and Modifying Tools in AutoCAD • Drawing Tools • Advanced Modification Tools • Project and View (12 Hours)
Unit IV	Layer Management, Hatching and Annotations • About Layers • Introduction to Hatching • Isometric Drawing • Introduction to Dimensions • Various Dimensions creation and Editing Methods • Other Commands related to dimensioning • Leader • Text Annotations • Dimension Style Manager • Tutorials . (12 Hours)
Unit V	Application of Blocks and Attributes • Introduction to Blocks • Dynamic Blocks • Attributes • Tutorials on creating blocks (12 Hours)

Text Books	
1	AutoCAD: A Visual Approach 2D Basics, Steven Foster, Autodesk Press, 1997.
2	Concurrent Engineering Design: Three-Dimensional Modeling, Analysis, and Manufacturing Workshop for Lower Division College Faculty, Ronald Barr and DavorJurisic, University of Texas Press, 1996
Reference Books	
1	Engineering Drawing and Graphic Technology, T. French, C. Vierck, and R. Foster,McGraw-Hill, Inc., 1993.
2	AutoCAD 14 for Engineering Drawing by P. Nageshwara Rao, Tata McGraw Hill Publication. .
Useful links	
1	https://nptel.ac.in/courses/112104031

Contributions for syllabus designing:

Sr. No	Name of the person	Designation	Organization
1	Mr.A.V.Joshi	Asst.Prof.	JDCOEM,Nagpur
2	Ms.S.V.Jethani	Asst.Prof.	JDCOEM,Nagpur
3	Dr.V.S.Dhok	Asst.Prof.	JDCOEM,Nagpur
4	Mr.P.V.Ambade	Asst.Prof.	JDCOEM,Nagpur
5	Mr.M.S.Isasare	Asst.Prof.	JDCOEM,Nagpur
6	Mr. J. S. Joshi	Professor (EE)	RKNEC,Nagpur
7	Dr. S. G. Tarnekar	Ex-Prof.	VNIT,Nagpur
8	Mr. Vikas Raghote	Quality Control Manager	Livspace Ltd(Alumni JDCOEM,Nagpur)
9	Mr.Vaibhav Suryawanshi	Business Development trainee	Scholar Verzo Pvt.Ltd(Alumni JDCOEM,Nagpur)

Program: B.Tech in Electrical Engineering

Semester	Course Code	Name of the course	L	T	P	Credits
VI	EE6O002	Open Elective II- Smart Grid Technology	4	0	0	4

	Prerequisites for the course
1	Basic concepts studied in subject Electrical Measurements and Instruments & Power systems-I such as measurement of fault current ,basics safety concepts in Electrical Engineering.

	Prior Reading Material/useful links
1	https://nptel.ac.in/courses/112104031

Course Outcomes:

Sr. No	Course outcome number	CO statement
1	CO1	Explain the objectives and precautions of Electrical Safety, effects of Shocks and their Prevention.
2	CO2	Summarize the Safety aspects during Installation of Plant and Equipment.
3	CO3	Describe the electrical safety in residential, commercial and agricultural installations.
4	CO4	State the electrical systems safety management and IE rules.
5	CO5	Explain the objectives and precautions of Electrical Safety, effects of Shocks and their Prevention.

Syllabus:

	Course Contents
Unit I	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. (7 Hours)

Unit II	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. (7Hours)
Unit III	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. (7Hours)
Unit IV	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. . (7 Hours)
Unit V	EQUIPMENT EARTHING AND SYSTEM NEUTRAL EARTHING: 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 (7 Hours)
Unit VI	SAFETY MANAGEMENT OF ELECTRICAL SYSTEMS: 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) (7 Hours)
Text Books	
1	S. Rao, Prof. H.L.Saluja, "Electrical safety, fire safety Engineering and safety management", Khanna Publishers. New Delhi, 1988.(units
2	www.apeasternpower.com/downloads/elecact2003.pdf (Part of unit
Reference Books	
1	Pradeep Chaturvedi, "Energy management policy, planning and utilization", Concept Publishing company, New Delhi, 1997.
Useful links	
1	https://nptel.ac.in/courses/112104031

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Program: B.Tech in Electrical Engineering

Semester	Course Code	Name of the course	L	T	P	Credits
VI	EE6T003	Research Methodology	2	0	0	Audit

	Prerequisites for the course
1	Basic Idea about what is research,its types & where it is carried out.

	Prior Reading Material/useful links
1	https://onlinecourses.nptel.ac.in/noc22_ge08/preview

Course Outcomes:

Sr. No	Course outcome number	CO statement
1	CO1	Remember the basic framework of research process.
2	CO2	Demonstrate various sources of information for research.
3	CO3	Develop an understanding of various research design and techniques.
4	CO4	Compare various sources of information for literature review and data collection.
5	CO5	Interpret the fundamental functions and working of analytical instruments used in research.
6	CO6	Discuss different methodologies and techniques used in research work.

Syllabus:

	Course Contents
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 (7 Hours)
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. (7Hours)
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
Unit IV	Methods of Data 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. . (7 Hours)
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 . (7 Hours)
Text Books	
1	C. R. Kothari, Research Methodology: Methods and Techniques, Second Re vised Edition, New Age International Publication, 2004.
2	J. Banks, J. C. Carson II, B. L. Nelson, D. M. Nicol, Discrete Event Systen Simulation, Fourth Edition, Prentice Hall of India Publication, 2006.
Reference Books	
1	K. N. Krishanaswamy, Appalyer Sivakumar, M. Mathiranjan, Managemen Research Methodology: Integration of Principles, Methods and Techniques Pearson Education, New Delhi, 2006.
Useful links	
1	https://onlinecourses.nptel.ac.in/noc22_ge08/preview

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Program: B.Tech in Electrical Engineering

Semester	Course Code	Name of the course	L	T	P	Credits
VI	EE6L001	Microprocessor and microcontroller Lab	0	0	2	1

Prerequisites for the course	
1	Digital logic concepts studied in the subject Analog & Digital circuits & programming concepts in subject Microprocessor and microcontroller.

Prior Reading Material/useful links	
1	http://vlabs.iitb.ac.in/vlabs-dev/labs_local/microprocessor/labs/

Course Outcomes:

Sr. No	Course outcome number	CO statement
1	CO1	To remember the architecture of 8085 and 8051.
2	CO2	To understand interfacing and interrupt features of 8085 and 8051.
3	CO3	To develop program for basic applications
4	CO4	To distinguish and analyze the properties of Microprocessors & Microcontrollers
5	CO5	To explain programming logic and concepts of 8085 microprocessors and 8051 micro-controller.
6	CO6	To build strong foundation for designing real world applications using microprocessors and microcontrollers.

Syllabus:

List of Experiments
• Study of architecture of 8085
• Assembly language programmes for determination of smaller and larger no
• Assembly language programmes for ascending and descending order
• Multiplication/division of numbers
• Assembly language programmes for led flashing (Interfacing of 8051 Microcontroller with various display devices.
• Programming for speed and direction control of dc motor(Interfacing of 8051 Microcontroller with DC motor.
• Programming for speed and direction of stepper motor

• Study of hexadecimal, modulo-9, BCD counter
• Write a program to move a block of data using 8085 & verify
• Write a program using 8085 & verify for :A. Addition of Two 8-Bit Numbers,B. Addition of Two 16-Bit Numbers (With Carry).
• 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)

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Program: B.Tech in Electrical Engineering

Semester	Course Code	Name of the course	L	T	P	Credits
VI	EE6L003	Computer Aided Design Lab	0	0	2	1

	Prerequisites for the course
1	Basic idea of various softwares used in Electrical Engineering and Importance of AUTOCAD.

	Prior Reading Material/useful links
1	http://vlabs.iitkgp.ac.in/tcad/

Course Outcomes:

Sr. No	Course outcome number	CO statement
1	CO1	Understand the concept and techniques of Engineering drawing and become familiar with the AutoCAD user interface.
2	CO2	Apply basic CAD concepts to develop and construct accurate 2D geometry through creation of basic geometric constructions.
3	CO3	Create advanced drafting and modifying tools in AutoCAD
4	CO4	Apply elements of drafting such as layers, dimensions, hatching, annotation, drawing formats, and 2D figures in projects with a focus on ANSI industry standards.
5	CO5	Create blocks and attributes in AutoCAD
6	CO6	Understand the concept and techniques of Engineering drawing and become familiar with the AutoCAD user interface.

Syllabus:

List of Experiments
• Introduction to CAD
• Study of AutoCAD software basics - GUI, limits and units, drawing tools, editing tools, annotations etc.
• 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.
• 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.
• Study and create drawing by using Geometry modifying tools: fillet, chamfer, scale, stretch.
• Study and create drawing by using copying tools like array, mirror, block and offset.
• Draw regular solids: Cube, Prism, Pyramid, Cylinder, Cones
• Study and draw 3D drawing of the given object by using AutoCAD commands and tools.
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Program: B.Tech in Electrical Engineering

Semester	Course Code	Name of the course	L	T	P	Credits
VII	EE7T001	Switch gear and protection	3	0	0	3

	Prerequisites for the course
1	Basic concepts studied in subject Power systems-I such as measurement of fault current ,relays ,C.Bs etc.

	Prior Reading Material/useful links
1	https://onlinecourses.nptel.ac.in/noc21_ee110/preview
2	Switchgear protection and power system by Sunil S. Rao, Khanna Publishers, 13th edition, 2008..
3	Power System Relaying: Stanley H Horowitz, A G Phadke; Willey

Course Outcomes:

Sr.No	Course outcome number	CO statement
1	CO1	Remember basic features of protection system and its components.
2	CO2	Select the different components of protection system such as CT, PT, circuit breakers, relays etc
3	CO3	Apply principles of overcurrent relaying and achieve relay coordination for low and medium voltage distribution feeders
4	CO4	Apply distance relaying techniques to High Voltag Transmission lines.
5	CO5	Design protection schemes for equipment such as transformers, generators, motors etc.
6	CO6	Solve different problems related to relay, circuit breaker and equipment protection.

Syllabus:

Course Contents	
Unit I	Need of protection, protection principles,desirable attributes of protection,Faults, Primary & backup protection, Instrument transformers, basic trip circuit. Classification of relays, Review of electromechanical relays, induction relays, Setting characteristics of over current; directional, differential, percentage differential and distance (impedance, reactance, mho) relays, numerical, introduction to static relays, advantages & disadvantages. (5Hours)
Unit II	Review of calculation of fault currents, C. B. selection, fuse protection, over current protection, PSM and TMS setting, phase relay coordination, earth fault protection using over current relays, introduction to directional over-current relays.,Numerical overcurrent relays. (5Hours)
Unit III	Over current relaying, directional- over current relay, Protective zones, Distance protection,setting and coordination of distance relays,pilot protection with distance relays,Numerical distance relays,carrier distance Schemes, Unit carrier schemes. (4Hours)
Unit IV	Protection of generator, transformer and bus Bars by differential relaying and other relays,restricted earth fault protection, incipient faults, Buchholz relay,Protection of Induction Motors against overloads, short circuits, thermal relays. (5Hours)
Unit V	arc voltage, arc interruption, resistance switching, interruption of capacitive and inductive current, transient recovery voltage (TRV), circuit breaker ratings, classification of C.B.s - air break, air blast, vacuum, minimum oil and bulk oil, SF6 C.B. L.T. switchgear: - MCB, MCCB, ELCB, HRC fuses, type construction and application. (5Hours)
Text Books	
1	Fundamentals of power system protection by Y. G. Paithankar, S. R. Bhide., Prentice hall, India, second edition, 2010.".
2	Power System Protection and Switchgear- Badri Ram, Vishwakarma, McGraw Hill
3	Power System Protection and Switchgear-B. Ravindranath and M Chander,Wiley Eastern Ltd, New Delhi
Reference Books	
1	Switchgear protection and power system by Sunil S. Rao, Khanna Publishers, 13th edition, 2008..
Useful links	
1	https://onlinecourses.nptel.ac.in/noc21_ee110/preview

Contributions for syllabus designing:

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Program: B.Tech in Electrical Engineering

Semester	Course Code	Name of the course	L	T	P	Credits
III	EE7T002	High Voltage Engineering	3	0	0	3

Prerequisites for the course	
1	Basic concepts studied in subject Power systems-I such as Types of Insulators ,different voltage levels in power systems,breakdown voltage etc.

Prior Reading Material/useful links	
1	https://archive.nptel.ac.in/courses/108/104/108104013/
2	High Voltage Engineering Fundamentals by E. Kuffel, W. S. Zaengl, J. KuffelNewnes Publication, ISBN-0-7506-3634-3
3	High Voltage and Electrical Insulation Engineering by Ravindra Arora, Wolf Gang Mosch New Age International Publishers Ltd. Wiley Eastern Ltd., ISBN-978-0-470- 60961-3

Course Outcomes:

Sr.No	Course outcome number	CO statement
1	CO1	The proper insulating medium / system; based on the insulation strength of the material for applying to high voltage systems
2	CO2	Over voltage phenomenon in power system with protection and insulation coordination
3	CO3	Generation & measurement techniques of high voltage and current for testing purpose.
4	CO4	HV tests carry out on various equipment's e. g. Cables, CBs, Insulators etc, using relevant testing IS and be able to give analysis of the test results.

Syllabus:

Course Contents	
Unit I	Breakdown in Uniform gap, non-uniform gaps, Ionization processes in gaseous dielectrics, Townsend's criterion for break-down, break-down in electro-negative gases, time lag for break-down, Streamer theory of break-down in gases, Paschen's law, break-down in non-uniform fields, practical considerations in using gases for insulation purpose; break-down in vacuum, Corona discharge (7Hours)
Unit II	Breakdown in pure and commercial liquids, Solid dielectrics and composite dielectrics, intrinsic breakdown, electromechanical breakdown and thermal breakdown, Partial discharge, applications of insulating materials (7Hours)
Unit III	Lightning mechanism, types of lightning strokes, parameter and characteristics of lightning strokes, protection of power system against lightning over voltages,

	types of lightning arresters, surge absorbers; types of switching over voltages and their causes, protection against switching over voltages; Insulation coordination, BIL and SIL. (7Hours)
Unit IV	Generation of high D.C. voltage by rectifier, voltage doublers and multiplier circuit, generation of high AC voltage by cascade transformers, resonant transformer; generation of high frequency AC high voltage; impulse waveform, generation of impulse voltage, tripping and control of impulse generator; generation of switching surges; generation of impulse current. (7Hours)
Unit V	Measurement of high AC and DC voltages by micro ammeter, generating voltmeters, resistance and capacitance potential divider, series impedance voltmeter, CVT, magnetic type potential transformers, electrostatic voltmeter, peak reading AC voltmeters, sphere gap arrangement; measurement of impulse voltage by potential dividers and peak reading voltmeters; measurement of high AC, DC and impulse currents. (7Hours)
Unit VI	Non-destructive Testing: Significance of non-destructive testing, measurement of DC resistivity, measurement of dielectric constant and loss-factor, partial discharge phenomenon and measurement, discharge detection in power cables. High Voltage Testing of Electrical Apparatus: Various standards for HV Testing of electrical apparatus, IS, IEC standards, Testing of insulators, bushings, isolators, circuit breakers, cables, transformers, lightning arresters and power capacitors. (7Hours)
Text Books	
1	High Voltage Engineering by M. S. Naidu, V. Kamaraju, Tata McGraw Hill Publication Co. Ltd New Delhi, 2013, ISBN-978-1-25-906289-6
2	High Voltage Engineering by C. L. Wadhwa, New Age International Publishers Ltd.
3	High Voltage Engineering by Prof. D. V. Razevig Translated from Russian by Dr.M. P. Chourasia Khanna Publishers, New Delhi.
Reference Books	
1	High Voltage Engineering Fundamentals by E. Kuffel, W. S. Zaengl, J. Kuffel-Newnes Publication, ISBN-0-7506-3634-3
2	High Voltage and Electrical Insulation Engineering by Ravindra Arora, Wolf Gang Mosch New Age International Publishers Ltd. Wiley Eastern Ltd., ISBN-978-0-470- 60961-3
3	Various IS standards for HV Laboratory Techniques and Testing
4	Fundamentals of High Voltage Engineering: S. K. Singh, Dhanpatrai& Co.
Useful links	
1	https://archive.nptel.ac.in/courses/108/104/108104013/

Contributions for syllabus designing:

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Program: B.Tech in Electrical Engineering

Semester	Course Code	Name of the course	L	T	P	Credits
VII	EE7E005(B)	Flexible AC Transmission Systems	3	0	0	3

	Prerequisites for the course
1	Basic concepts studied in subject Power systems-I such as active & Reactive power etc. and in subject Power Electronics such as Converters,Inverters etc.

	Prior Reading Material/useful links
1	https://onlinecourses.nptel.ac.in/noc23_ee58/preview
2	Thyristor Based FACTS controllers for Electrical Transmission System R. Mohan Mathur and Rajiv K. Verma (IEEE Press)

Course Outcomes:

Sr.No	Course outcome number	CO statement
1	CO1	Remember basic principles of operation of various types of compensators used for VAR generation in the power systems
2	CO2	Understand the problems and constraints related with stability of large interconnected systems and to study their solutions using different FACTS controllers
3	CO3	To identify the different issues related to the stability, active and reactive power control in power systems
4	CO4	Analyse the operation, characteristics and working of different FACTS controllers.
5	CO5	Evaluate the operation, characteristics and working of different FACTS controllers
6	CO6	Solve the different problems related to controlling the various parameters of transmission lines using different types of FACTS controllers

Syllabus:

	Course Contents
Unit I	FACTS concept and general system consideration: Transmission interconnection, flow of power in an AC System, factors affecting the loading capacity, power flow and dynamic stability consideration of transmission interconnection, relative importance of controllable parameters, facts controller. (7 Hours)

Unit II	Static shunt compensators: SVC And STATCOM Objective of shunt compensation, midpoint voltage regulation voltage instability prevention, improvement of transient stability. Power oscillation damping methods of controllable Var Generation, static Var compensators SVC And STATCOM, Comparison between STATCOM and SVC, Static VAR System (7 Hours)
Unit III	Static Series Compensators: GCS, TSSC,TCSC and SSSC Objective of series compensation, improvement of transient stability, power oscillation damping, Variable impedance type series compensators, Switching Converter type series Compensators (only SSSC), external (System) control for series reactive compensators. Application of SSSC in load Flow and transient stability studies. (7Hours)
Unit IV	Static Voltage and phase angle regulators: TCVR and TCPAR Objective of voltage and phase angle regulators, approaches to thyristor-controlled voltage and phase angle regulators (TCVR and TCPARs), switching converter-based, voltage and phase angle regulator, hybrid phase angle regulators. (7Hours)
Unit V	Combined Compensators (UPFC,IPFC) and special purpose Facts controllers The UPFC, operating principal V-I characteristics UPFC principal of operation modes of operation application.NGH-SSR damping scheme,Thyristor –controlled braking Resistor(TCBR). (5Hours)
Unit VI	Combined Compensators (UPFC, IPFC) and special purpose Facts controllers The UPFC, operating principal V-I characteristics UPFC principal of operation modes of operation application.NGH-SSR damping scheme,Thyristor–controlled braking Resistor(TCBR). (7Hours)
Text Books	
1	Understanding FACTS, Naryan G. Hingorani and Laszlo Gyugyi (Standard Publishers).
2	Flexible AC Transmission System (FACTS) by K.R.Padiyar(New Age Publications)
Reference Books	
1	Flexible AC Transmission System (FACTS)'Yong Hua Song and Johns (IEEE Publishers).
2	Thyristor Based FACTS controllers for Electrical Transmission System R. Mohan Mathur and Rajiv K. Verma (IEEE Press)
Useful links	
1	https://onlinecourses.nptel.ac.in/noc23_ee58/preview

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Program:B.Tech in Electrical Engineering

Semester	Course Code	Name of the course	L	T	P	Credits
VII	EE7E005(C)	Utilization of Electrical Energy and Traction	3	0	0	3

	Prerequisites for the course
1	Basic concepts studied in subject Electrical Power Utilization and Practice such as Illumination & basics of Traction.

	Prior Reading Material/useful links
1	https://nptel.ac.in/courses/108102047
2	Utilization of Electrical Power by Dr. N. Suryanarayan, Wiley Eastern Ltd, Age International
3	Utilization of Electrical Energy by E.Openshaw Taylor, Orient Longman

Course Outcomes:

Sr.No	Course outcome number	CO statement
1	CO1	Remember the types of electrical heating and welding processes
2	CO2	Understand concepts of illumination in indoor and factory lighting systems.
3	CO3	Apply energy saving mechanisms in pumping system and DG Set
4	CO4	Analyze the characteristics of DC and AC traction motor
5	CO5	Evaluate the performance of lighting systems and compressors.
6	CO6	Discuss methods of control and braking in electric traction

Syllabus:

	Course Contents
Unit I	Electric Heating i) Electric Heating : Types and methods of electrical heating, advantages of electrically produced heat, types & application of electric heating equipments, transfer of heat. ii) Resistance Ovens : General constructions, design of heating elements, efficiency & losses, radiant heating. iii) Induction heating: Core type & core less induction furnace, indirect induction oven, medium and high frequency eddy - current heating. iv) Dielectric heating: Principle and application. v) Arc furnace : Direct & indirect arc furnace, power supply, characteristics & control.

	(6Hours)
Unit II	Electric Welding i) Importance, Advantages & Disadvantages of welding, classification of welding processes. ii) Resistance welding, Butt welding, Spot welding, Projection welding, Seam welding. iii) Electric arc welding: Carbon arc welding, metal arc welding, submerged arc welding, Stainless Steel welding iv) Ultrasonic welding, electron beam welding, laser beam welding. (6 Hours)
Unit III	Illumination Nature of light, terms used in illumination, solid angle, laws of illumination, polar curves, Colour Rendering Index (CRI), Design of illumination systems, indoor lighting systems, factory lighting, outdoor lighting design, flood lighting, street lighting, energy saving in lighting systems. (7Hours)
Unit IV	Fans and Pumps Fans and Blowers: Fan types, fan performance evaluation & efficient system operation, fan design & selection criteria, flow control strategies, fan performance assessment, energy saving opportUnit Ies. Pumps: Pump types, system characteristics. Pump curves, factors affecting pump performance, efficient pumping system operation, flow control strategies, energy conservation opportUnit Ies in pumping system. (7Hours)
Unit V	Compressors and DG sets Compressors: Compressor types, Compressor efficiency, Compressed air system components. Diesel Generating Systems: Introduction, selection and installation factors, operational factors, energy performance assessment in DG sets, energy saving measures for DG sets. (7Hours)
Unit VI	Electrical Traction System of traction, System of Track electrification, Running Characteristics of DC and AC traction motor. Control of motor: Tapped field control, Rheostatic control, Series parallel control, Metadyne control. Braking: Regenerative Braking, Braking with 1-phase series motor, Magnetic Braking. Speed- Time curve for train movement, crest speed, average speed and schedule speed, simplified speed-time curve. (7Hours)
Text Books	
1	Utilization of Electric Power & Electric Traction by J. B. Gupta, Kataria& Sons
2	Utilization of Electrical Power by R. K. Rajput, Laxmi Publications Pvt. Ltd.
Reference Books	
1	Utilization of Electrical Power by Dr. N. Suryanarayan, Wiley Eastern Ltd, Age International
2	Utilization of Electrical Energy by E.Openshaw Taylor, Orient Longman
Useful links	
1	https://nptel.ac.in/courses/108102047

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3	Prof A.V. Joshi	Asst.Prof.	JDCOEM,Nagpur
4	Mr. J. S. Joshi	Professor (EE)	RKNEC,Nagpur
5	Dr. S. G. Tarnekar	Ex-Prof.	VNIT,Nagpur
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Program: B.Tech in Electrical Engineering

Semester	Course Code	Name of the course	L	T	P	Credits
VII	EE7E005(D)	Power system dynamics and control	3	0	0	3

	Prerequisites for the course
1	Basic concepts studied in the subject Power System II such as Load angle ,Power vs Load angle curve,Equal Area Criterion etc.

	Prior Reading Material/useful links
1	https://archive.nptel.ac.in/courses/108/101/108101004/
2	Power System Dynamics: K R Padiyar, B.S. Publishers, 2003, 2nd Edition.

Course Outcomes:

Sr.No	Course outcome number	CO statement
1	CO1	Toremember basic concepts of power system stability, operation and control
2	CO2	To understand concepts of power system stability, operation and control
3	CO3	To apply knowledge of active and reactive power control, synchronous machine modeling, excitation system in any power system
4	CO4	To examine power system stability and control its variables under different operating conditions.
5	CO5	To justify about system stability and its controlling operations
6	CO6	To modify any system for its stable operation

Syllabus:

	Course Contents
Unit I	Concept of Power system stability, Types of stability, Classical model of single machine connected to infinite bus and a multi machine system, mathematical modeling of power system elements for stability studies. (6 Hours)
Unit II	Small Signal Analysis, Fundamental concepts of Stability of Dynamic Systems, Small Signal Stability of Single Machine Infinite Bus(SMlB) System, Effects on Excitation system,Block diagram representation with exciter and AVR, Power System Stabiliser (PSS), State matrix including PSS, Small Signal Stability of Multi Machine Systems. (7 Hours)

Unit III	Rotor angle stability, classical method of rotor angle stability, equal area criteria for SMIB system, two machine systems, Numerical solution of swing equation, Multi-machine stability, factor affecting transient stability. (7 Hours)
Unit IV	Voltage stability & Voltage Collapse, Reactive power and voltage control, Voltage stability analysis, different criteria for voltage stability. (7 Hours)
Unit V	Unit Commitment Constraints in unit commitment – Spinning reserve – Thermal unit constraints – Other constraints – Solution using Priority List method, Dynamic programming method - Forward DP approach Lagrangian relaxation method – adjusting . (7 Hours)
Unit VI	Economic Dispatch Control Incremental cost curve- co-ordination equations with loss included (No derivation of Bmn coefficient) solution of co- ordination equations using Bmn co-efficient by iteration method Base point & participation factors. (6 Hours)
Text Books	
1	Power System Stability and Control by P.Kundur , EPRI Publications, California
2	Power System Operation and Control by A.J Wood and B.F Wollenberg, John Wiley and Sons
Reference Books	
1	Power system Stability and Control: P Kundur, , McGraw-Hill Inc., 1994
2	Power System Dynamics and Stability: P W Sauer & M A Pai, Pearson, 2003
Useful links	
1	https://archive.nptel.ac.in/courses/108/101/108101004/

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Program:B.Tech in Electrical Engineering

Semester	Course Code	Name of the course	L	T	P	Credits
III	EE7E006(A)	Introduction to Green Energy	3	0	0	3

	Prerequisites for the course
1	Basics of PV Cell,PV array ,OC voltage SC current etc studied in the subject Renewable Energy Sources.

	Prior Reading Material/useful links
1	https://onlinecourses.nptel.ac.in/noc21_ph25/preview
2	Jerry Yudelson Green building Through Integrated Design. McGraw Hill, 2009.
3	Fundamentals of Integrated Design for Sustainable Building By Marian Keeler, Bill Burke

Course Outcomes:

Sr.No	Course outcome number	CO statement
1	CO1	Remember the types of solar cells and geothermal energy sites
2	CO2	Understand concepts of wind energy conversion system
3	CO3	Apply green building measures for energy management
4	CO4	Analyze the characteristics of wind energy conversion systems
5	CO5	Evaluate the energy demand and renewable energy potential
6	CO6	Discuss concepts of energy generation using hydro power and geothermal energy.

Syllabus:

	Course Contents
Unit I	**Energy sources**: Introduction to nexus between Energy, Environment and Sustainable Development; Energy transformation from source to services; Energy sources, sun as the sourceof energy; biological processes; photosynthesis; food chains, classification of energy sources,quality and concentration of energy sources; fossil fuel reserves - estimates, duration; theory ofrenewability, renewable resources; overview of global/ India's energy scenario. (8 Hours)
Unit II	**Solar Energy:** Basic theory of flat plate collectors, solar heating of buildings, solar still, solar

	water heaters, solar driers; conversion of heat energy in to mechanical energy, solar thermal power generation systems. Solar Photovoltaic: Principle of photovoltaic conversion of solar energy, types of solar cells. Roof top solar PV systems. **Wind Energy:** Atmospheric circulations, classification, factors influencing wind, wind shear, turbulence, wind speed monitoring, Betz limit, WECS: classification, characteristics, and applications. (8 Hours)
Unit III	**Ocean Energy:** Ocean energy resources-ocean energy routes - Principles of ocean thermal energy conversion systems- ocean thermal power plants- Principles of ocean wave energy conversion and tidal energy conversion. **Other Sources:** Hydropower, Nuclear fission and fusion-Geothermal energy: Origin, types ofgeothermal energy sites, site selection, geothermal power plants; Magneto-hydro-dynamic (MHD) energy conversion. (8 Hours)
Unit IV	**Green Buildings** :Environmental implications of buildings energy, carbon emissions, water use, waste disposal;Building materials: sources, methods of production and environmental Implications. EmbodiedEnergy in Building Materials: Transporation Energy for Building Materials; Maintenance Energyfor Buildings. Green Composites for buildings: Concepts of Green Composites. Water Utilisation in Buildings, Management of Solid Wastes.Urban Environment and Green Buildings. Green Cover and Built Environment (8 Hours)
Unit V	**Policy Issues:** The United Nations Framework Convention on Climate Change (UNFCCC). The Intergovernmental Panel on climate change (IPCC), the Kyoto Protocol. Energy Demand: Global and Indian trends - Determinants of energy demand; energy productivity and management of energy demand - Policy toward Electricity in India: pricing, implications of state subsidies, case for and against privatization in electricity generation and distribution; relevance to India of California experience in privatization of electricity distribution - Potential for renewable energy use in India (solar and wind energy) (8 Hours)
Text Books	
1	Energy and the Environment, 2nd Edition, John Wiley, 2006, Authors: Ristinen, RobertA. Kraushaar, Jack J. AKraushaar, Jack P. Ristinen, Robert A., Publisher: Wiley, Location: New York, 2006.
2	Fundamentals of Solar Cells: PV Solar Energy Conversion, Alan L Fahrenbruch and Richard H Bube Academic Press, New York , 1983
3	Wind and Solar Power Systems , Mukund R. Patel, CRC Press; (1999)

Reference Books	
1	Jerry Yudelson Green building Through Integrated Design. McGraw Hill, 2009.
2	Fundamentals of Integrated Design for Sustainable Building By Marian Keeler, Bill Burke
Useful links	
1	https://onlinecourses.nptel.ac.in/noc21_ph25/preview

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Program:B.Tech in Electrical Engineering

Semester	Course Code	Name of the course	L	T	P	Credits
VII	EE7E006	Digital Signal Processing	3	0	0	3

Prerequisites for the course	
1	Basics signaling concepts studied in the subject Analog & Digital Electronics.

Prior Reading Material/useful links	
1	https://onlinecourses.nptel.ac.in/noc21_ee20/preview
2	Digital signal processing Theory & Applications: N.G.Palan, Tech Max Publication, Prows and Manolakis, PHI Ltd, 3rd Edition.

Course Outcomes:

Sr.No	Course outcome number	CO statement
1	CO1	Remember different types of signals and systems
2	CO2	Understands signals mathematically in continuous and discrete-time, and in the frequency domain.
3	CO3	Analyze discrete-time systems using z-transform
4	CO4	Solve DFT using various FFT algorithms
5	CO5	Represent and design digital filters for various application
6	CO6	Apply digital signal processing for the analysis of real-life signals

Syllabus:

Course Contents	
Unit I	Introduction to Digital Signal Processing Frequency domain description of signals & systems, Advantages of Digital over Analog Signal Processing, Classification of signal and systems: Linearity, causality, stability, static dynamic, Time Invariance Time variance. Linear convolution, circular convolution, Analog-to-Digital and Digital-to-Analog Conversion. (7 Hours)
Unit II	Discrete-Time Signals and Systems Discrete time signals and systems: Sequences; representation of signals on orthogonal basis; Representation of discrete systems using difference equations, Sampling and reconstruction of signals - aliasing; Sampling theorem and Nyquist rate, Discrete-Time Systems Described by Difference Equations. Solutions of linear difference equations. (7

	Hours)
Unit III	The Z –Transform And Its Applications Definition. Properties of the region of convergence for the Z- transformer, Z - transform properties, Inverse Z - transform using contour integration, partial fraction expansion, Parseval'stheorem,Interpretation of stability in z-domainSolutions of difference equations. (6 Hours)
Unit IV	: Discrete Fourier Transform Frequency Domain Analysis, Discrete Fourier Transform (DFT), Properties of DFT, Convolution of signals, Fast Fourier Transform Algorithm, Implementation of Discrete Time Systems. (7 Hours)
Unit V	Filter Design Techniques Design of discrete time IIR filters from continuous time filters. Frequency transformations of low pass IIR filters, Direct form I, Direct form II, Cascade and parallel structure for IIR and FIR Filter, Design of FIR filters by windowing method, FIR filter design by Fourier series method method. (7 Hours)
Text Books	
1	Digital signal processing Theory & Applications: N.G.Palan, Tech Max Publication, Prows and Manolakis, PHI Ltd, 3rd Edition.
2	Digital Signal Processing- A computer based approach: S. K. Mitra, McGraw Hill, 2011.
Reference Books	
1	Theory and Application of Digital Signal Processing: L. R. Rabiner and B. Gold, Prentice Hall, 1992.
2	Digital Signal Processing: S Salivahanan, AVallavaraj, Mc. Graw Hill Publication. 2nd Edition 2. Discrete time signal processing.
3	Introduction to Digital Signal Processing: J. R. Johnson, Prentice Hall, 1992.
4	S.K.Mitra, "Digital Signal Processing", TMH Pub
Useful links	
1	https://onlinecourses.nptel.ac.in/noc21_ee20/preview

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Program:B.Tech in Electrical Engineering

Semester	Course Code	Name of the course	L	T	P	Credits
VII	EE7E006(C)	Electrical Vehicle	3	0	0	3

	Prerequisites for the course
1	Basic concepts of Electrical Drives such as Converter based Induction Motor & DC moror Drives.

	Prior Reading Material/useful links
1	https://onlinecourses.nptel.ac.in/noc23_ee01/preview
2	Modern Electric, Hybrid Electric, and Fuel Cell Vehicles - Fundamentals, Theory, and Design: M.Ehsani, Y. Gao, S. E. Gay and A. Emadi, CRC Press, 2004.
3	Electric and Hybrid Vehicles: T. Denton, Routledge, 2016 .

Course Outcomes:

Sr.No	Course outcome number	CO statement
1	CO1	To remember the basics of electric vehicles, and fundamentals
2	CO2	To Understand the models and architecture, technologies to describe electric vehicles
3	CO3	To apply the basic concepts to describe electric vehicles and their performance
4	CO4	To Analyze the different possible ways of energy storage
5	CO5	To Compare the different strategies related to energy storage systems.

	Course Contents
Unit I	Introduction : Conventional Vehicles: Basics of vehicle performance, vehicle power source, Characterization, transmission characteristics (7 Hours)
Unit II	Hybrid and Electric Vehicle: Introduction to Hybrid Electric Vehicles: History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies, Hybrid Electric Drive-trains: Basic concept of hybrid traction, introduction to various hybrid drive train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis.

	. (8 Hours)
Unit III	Electric Trains :Electric Drive-trains: Basic concept of electric traction, introduction to various electric drive-train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis. Electric Propulsion unit: Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives . (8 Hours)
Unit IV	Energy Storage: Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis . (8 Hours)
Unit V	Energy Management Strategies: Energy Management Strategies: Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy management strategies. (8 Hours)
Text Books	
1	Hybrid Electric Vehicles - Principles and Applications with Practical Perspectives: C. Mi, M. A.Masrur and D. W. Gao, John Wiley & Sons, 2011
2	. Hybrid Electric Vehicles - Energy Management Strategies: S. Onori, L. Serrao and G. Rizzoni,Springer, 2015.
Reference Books	
1	Modern Electric, Hybrid Electric, and Fuel Cell Vehicles - Fundamentals, Theory, and Design: M.Ehsani, Y. Gao, S. E. Gay and A. Emadi, CRC Press, 2004.
2	Electric and Hybrid Vehicles: T. Denton, Routledge, 2016 .
Useful links	
1	https://onlinecourses.nptel.ac.in/noc23_ee01/preview

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Program: B.Tech in Electrical Engineering

Semester	Course Code	Name of the course	L	T	P	Credits
VII	EE7E006(D)	Power Quality	3	0	0	3

	Prerequisites for the course
1	Basic concept of FACTS devices such as DVR,DSTATCOM etc.

	Prior Reading Material/useful links
1	https://onlinecourses.nptel.ac.in/noc21_ee103/preview
2	Electrical power system quality – R. C. Dugan, Mark F. McGranghan, Surya santoso, H. Wayne Beaty, Second edition, McGraw Hill
3	Understanding power quality problems, voltage sag and interruptions - M. H.J. Bollen, IEEE press, 2000, series on power engineering

Course Outcomes:

Sr.No	Course outcome number	CO statement
1	CO1	Remember the basic principles related to Power quality
2	CO2	Understand the problems and constraints related with quality of power in large interconnected power systems
3	CO3	To identify the different issues related to the power quality in power systems.
4	CO4	Analyse the characteristics of different power quality problems
5	CO5	Evaluate the operation, and working of different mitigation methods for power quality problems.
6	CO6	Solve the different problems related to different power quality issues by controlling the various parameters in distribution systems

Course Contents	
Unit I	Introduction to Electric Power Quality, Power Quality standards, Different Power Quality terms and definitions (6 Hours)
Unit II	Voltage Sag and Interruptions, Sources of Voltage sag and interruptions, type and characteristics of voltage sag and interruptions, Factors affecting characteristics of voltage sag and interruptions, behavior of different equipments during voltage sag, concept of area of vulnerability, CBEMA and ITI Curves . . (7 Hours)
Unit III	Voltage Swell and transient over voltage, sources of over voltage like capacitor switching, load switching, lighting etc, various causes of voltage flicker and their effects. Short term and long term flickers, various means to reduce flickers, Transient over voltages, sources, impulsive transients, switching transients, Effect of surge impedance and line termination, control of transient voltages. . (7 Hours)
Unit IV	Harmonic distortions, voltage and current harmonics, THD, sources of harmonics, ill effects of harmonics, interharmonics, harmonics filters, IEEE 519-1992 definitions, reactive power under harmonics, K-rated transformer.(7 Hours)
Unit V	Need of power quality monitoring and approaches followed in power quality monitoring. Power quality monitoring objectives and requirements. Initial site survey. Power quality Instrumentation. Selection of power quality monitors, selection of monitoring location and period. System wide and discrete power quality monitoring. Setting thresholds on monitors, data collection and analysis. Selection of transducers. Harmonic monitoring, Transient monitoring, event recording and flicker monitoring, Mitigation techniques at different environments. (6 Hours)
Text Books	
1	Electrical power system quality – R. C. Dugan, Mark F. McGranghan, Surya santoso, H. Wayne Beaty, Second edition, McGraw Hill
2	Understanding power quality problems, voltage sag and interruptions - M. H.J. Bollen, IEEE press, 2000, series on power engineering
3	Power Quality: C.Sankaran, CRC Press
Reference Books	
1	IEEE std 519-1992/ IEEE std 1159 IEEE recommended practices and require-ments for harmonics control in electrical power system
2	Power system quality assessment: J. Arrillaga, M.R. Watson, S. Chan, John Wiley and sons. .
Useful links	
1	https://onlinecourses.nptel.ac.in/noc21_ee103/preview

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Program: B.Tech in Electrical Engineering

Semester	Course Code	Name of the course	L	T	P	Credits
VII	EE7O003	Wind and Hydro Power Systems	4	0	0	4

	Prerequisites for the course
1	Basic concepts studied in subject Renewable Energy Systems such as Wind & Hydro power generation.

	Prior Reading Material/useful links
1	https://archive.nptel.ac.in/courses/121/106/121106014/
2	Paul Gipe , Karen Perez, (1999); Wind Energy Basics: A Guide to Small and Micro WindSystems, Chelsea Green Publishing Company

Course Outcomes:

Sr.No	Course outcome number	CO statement
1	CO1	Remember the basic principles related to Power quality
2	CO2	Understand the problems and constraints related with quality of power in large interconnected power systems
3	CO3	To identify the different issues related to the power quality in power systems.
4	CO4	Analyse the characteristics of different power quality problems
5	CO5	Evaluate the operation, and working of different mitigation methods for power quality problems.
6	CO6	Solve the different problems related to different power quality issues by controlling the various parameters in distribution systems

Course Contents	
Unit I	Introduction to wind energy, Atmospheric circulations, Factors influencing wind, Variation of wind speed with height and time, Turbulence, Causes of turbulence, Power estimation in wind, Wind energy conversion principles, Components of wind energy Conversion Systems (WECS),Classification of WECS, Wind Turbine Aerodynamics. (10Hours)
Unit II	Horizontal Axis Wind Turbine (HAWT) & Vertical Axis Wind Turbine (VAWT), Power Developed, Maximum power coefficient (Betz Limit), Thrust, Efficiency, Rotor selectionRotor design considerations, Diameter of the Rotor. (10Hours)
Unit III	Wind Pumps: Design and working, Principle of wind Energy electricity generation: Stand Alone, Grid connected and hybrid WECS. Environmental Benefits and problems of wind energy. Economics of wind energy: Factors influencing the cost of energy generation, Life cycle cost analysis. Current Status and future prospects of wind energy, Wind energy in India case studies. (10 Hours)
Unit IV	Basics of Hydro Energy and is Availability: Energy in water, basic hydro energy conversion, energy conversion calculations and efficiency, categorization of hydroelectric power plants, viz. micro, small and large, decentralized hydroelectric plants, types of turbines and their applications in small hydro technologies, site requirements for hydro power, availability of sites globally and in India, environmental impact of various capacity hydroelectric plants... (10 Hours)
Unit V	Introduction to Small Hydro Power Technologies: Scale of turbines being considered, technologies for small hydro, turbine designs and efficiencies, control systems, safety, design considerations for a small hydro power plant, components of small hydro power plants, stand alone and grid interactive plants, operation and maintenance, standards and certification, manufacturing, quality assurance and testing . (10 Hours)
Unit VI	Small Hydro Power Plants: Typical design of small hydro power plants, design considerations for components, decentralized plants, generator designs, operation and maintenance, site requirements, environmental impact assessment, manufacturing and assembly, quality assurance, standards and certification . Economics of Small Hydro Power Plants: Cost of small hydro power plants, technology wise difference in costing, site development costs, environmental impact costs, life cycle costing, return on investment; impact of scale on the economics (10 Hours)
Text Books	
1	SirajAhmed:"Wind Energy-Theory and Practice" Second Edition, PHI Learning Pvt. Ltd, New Delhi, 2011.

Reference Books	
1	Garg L Johnson: "Wind Energy Systems" Prentice Hall. Inc, New Jersey,1985
Useful links	
1	https://archive.nptel.ac.in/courses/121/106/121106014/

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Program: B.Tech in Electrical Engineering

Semester	Course Code	Name of the course	L	T	P	Credits
VII	EE7O003 (B)	Industrial Electrical System	4	0	0	4

	Prerequisites for the course
1	Basic concepts of Isolators, relays & C.Bs studied in subject Switchgear and Protection.

	Prior Reading Material/useful links
1	https://archive.nptel.ac.in/courses/108/105/108105064/
2	Design of Electrical Installation: V.K. Jain & A. Bajaj

Course Outcomes:

Sr.No	Course outcome number	CO statement
1	CO1	Assess the electrical load and select the conductors suitable to carry load currents
2	CO2	Calculate the short circuit current at different locations and select proper switchgear
3	CO3	Design and select suitable components of starters for induction motor, understand its operation and select capacitors for reactive power management. .
4	CO4	Select and understand procedures for installation, testing and commissioning practices for transformers, substations & UPS Systems.
5	CO5	Design PCC & MCCs for residential, commercial and industrial installations.
6	CO6	Understand important features of IS 3043 for earthing, protection of building against Lightening & IE Rules.

Course Contents	
Unit I	Assessment of Electrical Load & Selection of Cables & Conductors : Electrical load assessment: Categories & types of electrical load, preparing load list, connected load, demand/ diversity/ load/power factor, TOD tariff, and industrial electric bills. Cables, conductors & bus bar: Construction, selection, installation, testing of LT/HT cables, overload and short circuit ratings, rating factors, overhead line conductors, aluminium & copper bus bar. (10 Hours)
Unit II	Symmetrical Short Circuit Calculations, Switching & Protective Devices :Symmetrical short circuit calculations: Determining symmetrical short circuit currents for selecting appropriate switchgear, determining specifications of current limiting series reactor. Switching & Protective devices: Types, specifications and selection of isolators, switches, switch fuse units, ELCB, MCB, MCCB, ACB,VCB and SF6 circuit breakers; dropout/horn gap fuses, AB switches, power contactors, capacitor duty contactors. (10 Hours)
Unit III	Electric Supply to Induction Motors and Reactive Power Management in Industries : Electric supply to induction motors: Power & control circuit for manual/automatic DOL, star-delta and autotransformer starters, working of these starters, selection of contactors, overload relays, short-circuit protective devices for induction motors. Reactive power management in industries: Determining kVAr rating of PF improvement by using power triangle, calculation of payback period of capital cost of capacitor installation against reduction in system losses.. (10 Hours)
Unit IV	Transformers, Substations, DG, UPS and Batteries: Transformers: Specifications, ratings, selection, installation, testing & commissioning. Substations: 11 & 33 kV, indoor/outdoor substations; plan/elevation/clearances UPS and Batteries: UPS systems, battery banks, sizing and selection of UPS and battery banks. (10 Hours)
Unit V	Design of Residential, Commercial and Industrial Installations :Design of PCC, MCC, APFC Panels; selection of all associated electrical apparatus, busbars, cables, switchgear, protective devices, instruments, testing, commissioning. Introduction to lightening protection of buildings. (10 Hours)
Unit VI	Earthing, & IE Rules: Earthing& IE Rules/ CEA Regulations: Earthing (IS 3043): Necessity of earthing, concept of system and equipment earthing, definition of various terms, types of earthing, earth tester, and measurement of earth resistance. IE Rules: Important IE rules applicable to residential, commercial and industrial installations. Central Electricity Authority (Measures relating to Safety and Electric supply) regulations 2010. (10 Hours)

Text Books	
1	. Electric Power Distribution: A.S. Pabla
2	Residential Commercial and Industrial Systems: H. Joshi, McGraw Hill Education
3	Handbook of Electrical Power Distribution: G. Ramamurthy
Reference Books	
1	Indian Electricity Rules latest edition
2	IS 3043 Code of practice for earthing
3	Manufacturers' catalogues
Useful links	
1	https://archive.nptel.ac.in/courses/108/105/108105064/
2	

Contributions for syllabus designing:

Sr.No	Name of the person	Designation	Organization
1	Dr. V. S. Dhok	Asst.Prof.	JDCOEM,Nagpur
2	Prof A.V. Joshi	Asst.Prof.	JDCOEM,Nagpur
3	Prof M. Isasare	Asst.Prof.	JDCOEM,Nagpur
4	Mr. J. S. Joshi	Professor (EE)	RKNEC,Nagpur
5	Dr. S. G. Tarnekar	Ex-Prof.	VNIT,Nagpur
6	Ms.Shreya Ramteke	Technical Recruiter	Collabera Pvt.Ltd. (Alumni batch JDCOEM,Nagpur)
7	Ms.Snehal Tembhurne	Business Development Executive	Byjus Pvt.Ltd. (Alumni JDCOEM,Nagpur)

Program:B.Tech in Electrical Engineering

Semester	Course Code	Name of the course	L	T	P	Credits
VII	EE8O004 (A)	Automation with PLC	4	0	0	4

Prerequisites for the course	
1	Basic Idea of Microcontrollers and Automation using Microcontrollers.

Prior Reading Material/useful links	
1	https://nptel.ac.in/courses/108105088
2	Programmable Logic Controllers: John Hacworth and Frederick D. Hackworth Jr, Pearson publisher
3	Programmable Logic Controllers: W. Bolton ,Newnes an imprint of Elesevier, 6th edition.

Course Outcomes:

Sr.No	Course outcome number	CO statement
1	CO1	Understand automation tools & its components.
2	CO2	Apply logic with ladder diagram for the industry application.
3	CO3	Understand the functioning of PLC . . .
4	CO4	Apply knowledge of PLC for design of Industrial Automation

Course Contents	
Unit I	Introduction to PLC : Technical Definition, advantages, chronological Evolution, Types of PLCs, Block Diagram, processor software/Executive software. PLC vs PC (10 Hours)
Unit II	Ladder diagram fundamentals : Introduction to basic components and their symbols, development of relay and contactor logic, Concept of PCC, MCC, Control desk , No, NC switches, limit switches, relay, contactor, timer, voltage to current converter, current to voltage converter, selection of sensor, Hydraulic motor control, fundamentals of Ladder Diagrams. (10 Hours)

Unit III	Fundamental PLC programming : Ladder diagram, physical component vs program components, examples (10 Hours)
Unit IV	**I**ndustrial Communication and networking : Evolution of Industrial Communication technology, types of communication interfaces, synchronization and timing in communication. . (10 Hours)
Unit V	Introduction to Industrial Automation : Industrial automation components, smart sensors, PLC, DCS and SCADA. Introduction to SCADA. Examples of some simple automated systems. (10 Hours)
Text Books	
1	. Programmable Logic Controllers and Industrial Automation: An Introduction MadhuchchandaMitra, SamarjitSengupta (Author), 2nd Edition
Reference Books	
1	Programmable Logic Controllers: John Hacworth and Frederick D. Hackworth Jr, Pearson publisher
2	Programmable Logic Controllers: W. Bolton ,Newnes an imprint of Elesevier, 6th edition.
Useful links	
1	https://nptel.ac.in/courses/108105088

Contributions for syllabus designing:

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3	Prof M. Isasare	Asst.Prof.	JDCOEM,Nagpur
4	Mr. J. S. Joshi	Professor (EE)	RKNEC,Nagpur
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Program:B.Tech in Electrical Engineering

Semester	Course Code	Name of the course	L	T	P	Credits
VII	EE8O004	Solar PV Systems Engineering	4	0	0	4

Prerequisites for the course	
1	Basic idea of PV systems studied in subject Renewable Energy Systems in fifth semester.

Prior Reading Material/useful links	
1	https://onlinecourses.nptel.ac.in/noc21_ph25/preview
2	Renewable and Efficient Electric Power Systems: Gilbert M. Masters, John Wiley & Sons, 2004

Course Outcomes:

Sr.No	Course outcome number	CO statement
1	CO1	Remember the basics of Solar PV Systems
2	CO2	Understand circuit model of PV cell and interpret I-V curves under different operating conditions.
3	CO3	Identify various algorithms used for the maximum power point tracking of PV array.
4	CO4	Analyze the principle of power conversions used in PV system
5	CO5	Explain the various applications of PV systems
6	CO6	Design PV system by estimating the load, sizing and selecting the batteries, sizing and selecting the PV modules and other components

Course Contents	
Unit I	Introduction : Fossil fuel energy usage and global warming; role of renewable energy in sustainable development; renewable energy sources; global potential for solar electrical energy systems (10 Hours)
Unit II	Solar radiation : Extra-terrestrial and terrestrial solar spectrum; clear sky direct-beam radiation; total clear sky insulation on a collecting surface; radiation on the collector in tracking systems; calculation of average monthly insolation from measured data. (10 Hours)
Unit III	PV cells and modules : 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; schemes for maximum power point tracking (10 Hours)
Unit IV	Maximum Power Point Tracking: Maximum Power Point Tracking and MPPT algorithms . (10 Hours)
Unit V	Power converters in Photovoltaic system: Introduction to DC-DC converter, DC-AC Converter, PV Grid Interface (10 Hours)
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
Useful links	
1	https://onlinecourses.nptel.ac.in/noc21_ph25/preview

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Program: B.Tech in Electrical Engineering

Semester	Course Code	Name of the course	L	T	P	Credits
VII	EE7L002	Computer Applications in Electrical Engineering Lab	0	0	2	1

Prerequisites for the course	
1	Basic idea regarding various softwares used in Electrical Engineering like MATLAB,PSIM,PCAD etc.

Prior Reading Material/useful links	
1	http://vlabs.iitkgp.ac.in/tcad/

Course Outcomes:

Sr.No	Course outcome number	CO statement
1	CO1	Remember the basic operations of various power plants.
2	CO2	Understand and interpret the requirements and basics of power plant installation and site selection.
3	CO3	Apply knowledge to Economic Operation of Power Systems and the knowledge related with its need.
4	CO4	Analyze various electric power plants operations and distinguish between properties.
5	CO5	Evaluate thermal, hydro, nuclear, gas power plant also able to Explain its fundamentals.
6	CO6	Design Economic Operation of Power Systems and also able to give solutions implementation of power plant on its basics.

Syllabus:

List of Experiments
1. To model transmissionlines using MATLAB 2. To find optimum loading of generators neglecting transmission losses using MATLAB 3. To find optimum loading of generators with penaltyfactors using MATLAB 4. SIMULINK model of single area load frequency control with and withoutPIcontroller andwithoutPIcontroller inSIMULINK. 5. Simulinkmodelfortwoareaload frequencycontrol 6. Simulink model for evaluating transient stability of single machineconnected to in-finitebus 7. To study impulse generator 8. To measure the dielectric strength of transformer oil. 9. To study the use of sphere gap as a voltmeter for measurement of high voltages. Formation of Z bus matrix using MATLAB

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Member Secretary

Chairperson

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., 2008

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.

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.

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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Department of Artificial Intelligence
"A Place to Learn, A Chance to Grow"
Session: 2021-22

Course Structure and Syllabus (Autonomous)

For

Semester V & VI (Third Year)

B.Tech. Artificial Intelligence Program

Course Structure and Syllabus

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	PCC	AI5T001	AI & Cognitive Robotics	3	0	0	20	20	60	100	3
2	PCC	AI5T002	Digital Image Techniques and Analysis	3	1	0	20	20	60	100	4
3	PCC	AI5T003	Machine Learning & Deep Learning	3	1	0	20	20	60	100	4
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	Internship/Mini Project	0	0	2	0	0	50	50	1
10	IED	AI5T008	Innovation and Entrepreneurship Development	2	0	0	10	15	25	50	Audit
				17	**2**	**8**	**290**	**115**	**495**	**900**	**21**

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AI5T001	AI & Cognitive Robotics	3 Credit

Course Objectives:

1. Study the concepts of Artificial Intelligence.
2. Learn the methods of solving problems using Artificial Intelligence.
3. Introduce the concepts of Expert Systems and Machine learning.

Course Outcome: The Student will be able to

1.Apply the various searching techniques, constraint satisfaction problem and example problemsgame playing techniques.
2.Analyze important historical and current trends addressing artificial intelligence.
Summarize the learning methods adopted in AI.
3.Design the main types of cognitive robots and their driving requirements (engineering operations, navigation, cooperation).
4. Apply advanced methods for creating highly capable cognitive robots.

Course Contents

Unit-I **[7Hrs]**

Introduction of AI

AI History and applications, Overview of AI application areas, game playing, automated reasoning and theorem proving, expert systems, natural language understanding, planning and robotics, machine learning and Alan Turing Test, Intelligent Agents.

Unit-II **[7Hrs]**

AI Learning Models: Concept of learning, learning automation, Knowledge-Based Classification Inductive Learning, Deductive Learning: Feedback Based Classification Unsupervised Learning, Supervised Learning, Semi-supervised learning and Reinforcement Learning

Unit III **[7Hrs]**

Cybernetic View of Robot Cognition And Perception: Introduction to the Model of Cognition, Visual Perception, Visual Recognition, Machine Learning, Soft Computing Tools and Robot Cognition.

Unit IV **[7Hrs]**

Randomized Path Planning : Introduction, Representation of the Robot's Environment, Review of configuration spaces, Visibility Graphs, Voronoi diagrams, Potential Fields and Cell

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Decomposition, Planning with moving obstacles, Probabilistic Roadmaps, Rapidly exploring random trees, Execution of the Quad tree-Based Path Planner Program.

[8Hrs]

Unit V

Introduction to Cognitive robotics and Human Robot Interaction: Introduction to Cognitive Robotics, Overview of robot technologies, sensors and actuators, Robot platforms, Machine learning for robotics, Developmental Robotics, Neuro-robotics, Evolutionary and swarm robotics, Social robotics and human-robot interaction, Language learning and speech interfaces, Robot tutors for children, Ethics for robotics and AI

Text Books:

1. E. Rich and K. Knight, "Artificial intelligence", TMH, 2nd ed., 1992.
2. N.J. Nilsson, "Principles of AI", Narosa Publ. House, 1990.
3. D.W. Patterson, "Introduction to AI and Expert Systems", PHI, 1992.

Reference Books:

1.R.J. Schalkoff, "Artificial Intelligence -an Engineering Approach", McGraw Hill Int. Ed., Singapore, 1992.

2. John J. Craig, "Introduction to Robotics Mechanics and Control", Pearson Education Inc.,

3. Artificial Intelligence: A Modern Approach, Stuart Russell and Peter Norvig, Prentice Hall, 3rd edition 2009 PGAI&ML102T: Natural Language Processing Teaching Scheme Examination Sch.,

4. Cognitive Robotics: by Hooman Samani, Released October 2015 Publisher(s): CRC Press, ISBN: 9781482244571

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Course Learning Objectives:

1. Use their learned skills, knowledge and abilities to learn digital image processing.
2. To learn digital image processing techniques including representation, sampling and quantization.
3. To treat the 2D systems as an extension of 1D system design and discuss techniques specific to 2D systems.
4. To learn about basic concepts of filters and noises.
5. To make the students confident in designing software project on image processing.

Course Outcomes: After completing the course,

CO1: Students will able to develop computer architecture.
CO2: Students will know the Interpret image storage, sampling, and frequency domain processing operations.
CO3: Students will evaluate current technologies and issues that are specific to image processing systems.
CO4: Students will analyse different motion compensation techniques.
CO5: Students will integrate concepts of various image processing algorithms.

Course Contents:

Unit 1: **[7Hrs]**

Fundamentals : Need for DIP- Fundamental steps in DIP – Elements of visual perception - Image sensing and Acquisition – Image Sampling and Quantization – Imaging geometry, discrete image mathematical characterization.

Unit 2: **[6Hrs]**

Image Transforms :Two dimensional Fourier Transform- Properties – Fast Fourier Transform – Inverse FFT, Discrete cosine transform and KL transform.-Discrete Short time Fourier Transform- Wavelet Transform- Discrete wavelet Transform- and its application in Compression.

Unit 3: **[8Hrs]**

Image Enhancement Spatial Domain: Basic relationship between pixels- Basic Gray level Transformations – Histogram Processing – Smoothing spatial filters- Sharpening spatial filters. **Frequency Domain**: Smoothing frequency domain filters- sharpening frequency domain filters Homomorphic filtering.

Unit 4: **[6Hrs]**

Image Restoration: Overview of Degradation models –Unconstrained and constrained restorations-Inverse Filtering ,WienerFilter.

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Unit 5: **[8Hrs]**

Feature Extraction: Detection of discontinuities – Edge linking and Boundary detection- Thresholding- -Edge based segmentation-Region based Segmentation- matching-Advanced optimal border and surface detection- Use of motion in segmentation. Image Morphology – Boundary descriptors- Regional descriptors.

Image Reconstruction from Projections: Need- Radon Transform – Back projection operator- Projection Theorem- Inverse Radon Transform.

Text Book :

1. Rafael C.Gonzalez & Richard E.Woods – Digital Image Processing – Pearson Education-2/e – 2004.
2. Anil.K.Jain – Fundamentals of Digital Image Processing- Pearson Education-2003.

Reference Books:

1. B.Chanda & D.Dutta Majumder – Digital Image Processing and Analysis – Prentice Hall of India – 2002
2. William K. Pratt – Digital Image Processing – John Wiley & Sons-2/e, 2004

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AI5T003	Machine Learning & Deep Learning	4 Credit

Course Learning Objectives:

1. To understand the basic concepts and methods of machine learning and Deep 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. Basic neuron models: McCulloch-Pitts model and the generalized one, distance or similarity based neuron model, radial basis function model, etc.
5. Basic neural network models: multilayer perceptron, distance or similarity based neural networks, associative memory and self-organizing feature map, radial basis function based multilayer perceptron, neural network decision trees, etc.

Course Outcomes: After completing the course, the students will be able to

1. Apply the mathematical foundations of neural network models
2. Design and implement neural network systems to solve real world problems.
3. To demonstrate knowledge of the machine learning literature.
4. To describe how and why machine learning methods work.
5. To select and apply appropriate machine learning methods to a selected problem.
6. To implement machine learning algorithms on real datasets.

Unit 1: **[7Hrs]**

Introduction to Machine Learning: Machine Learning, Types of Machine Learning, Issues in Machine Learning, Application of Machine Learning, Steps in developing a Machine Learning Application.

Unit 2: **[6Hrs]**

Learning with Regression and trees: Learning with Regression : Linear Regression, Logistic Regression. Learning with Trees: Decision Trees, Constructing Decision Trees using Gini Index, Classification and Regression Trees (CART).

Unit 3:Learning with Classification and clustering: **[8Hrs]**

Classification: Rule based classification, classification by Bayesian Belief networks, Hidden Markov Models. **Support Vector Machine**: Maximum Margin Linear Separators, Quadratic Programming solution to finding maximum margin separators, Kernels for learning non-linear functions.
Clustering: Expectation Maximization Algorithm, Supervised learning after clustering, Radial Basis functions.

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[7Hrs]

Unit 4:

Structure of biological neurons relevant to ANNs. Models of ANNs; Feedforward & feedback networks; learning rules; Hebbian learning rule, perception learning rule, delta learning rule, Widrow-Hoff learning rule, correction learning rule, Winner –lake all elarning rule, etc.

[7Hrs]

Unit 5:

Classification model, Features & Decision regions; training & classification using discrete perceptron, algorithm, single layer continuous perceptron networks for linearly seperable classifications. Linearly non-seperable pattern classification, Delta learning rule for multi-perceptron layer, Generalized delta learning rule, Error back-propagation training, learning factors, Examples.

Linear Association, Basic Concepts of recurrent Auto associative memory: rentrieval algorithm, storage algorithm; By directional associative memory, Architecture, Association encoding & decoding, Stability.

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

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Course Objective:

The objective of this course is to provide a foundation to the fast growing field of AR and make the students aware of the various AR devices.

Course Outcomes: On completion of the course, learner will be able to–

CO1: Describe how AR systems work and list the applications of AR.
CO2: Understand and analyse the hardware requirement of AR.
CO3: Use computer vision concepts for AR and describe AR techniques
CO4: Analyse and understand the working of various state of the art AR devices
CO5: Acquire knowledge of mixed reality

Course Contents:

Unit 1 - Introduction to Augmented Reality (A.R) **[7Hrs]**

What Is Augmented Reality - Defining augmented reality, history of augmented reality, The Relationship Between Augmented Reality and Other Technologies-Media, Technologies, Other Ideas Related to the Spectrum Between Real and Virtual Worlds, applications of augmented reality .

Augmented Reality Concepts- How Does Augmented Reality Work? Concepts Related to Augmented Reality, Ingredients of an Augmented Reality Experience.

Unit 2 Augmented Reality Hardware **[6Hrs]**

Augmented Reality Hardware – Displays – Audio Displays, Haptic Displays, Visual Displays, Other sensory displays, Visual Perception , Requirements and Characteristics, Spatial Display Model. Processors – Role of Processors, Processor System Architecture, Processor Specifications.

Tracking & Sensors - Tracking, Calibration, and Registration, Characteristics of Tracking Technology, Stationary Tracking Systems, Mobile Sensors, Optical Tracking, Sensor Fusion

Unit 3 Computer Vision for Augmented Reality & A.R. Software **[6Hrs]**

Computer Vision for Augmented Reality - Marker Tracking, Multiple-Camera Infrared Tracking, Natural Feature Tracking by Detection, Simultaneous Localization and Mapping, Outdoor Tracking

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Augmented Reality Software - Introduction, Major Software Components for Augmented Reality Systems, Software used to Create Content for the Augmented Reality Application.

Unit 4: AR Techniques- Marker based & Markerless tracking **[6Hrs]**

Marker-based approach- Introduction to marker-based tracking, types of markers, marker camera pose and identification, visual tracking, mathematical representation of matrix multiplication

Marker types- Template markers, 2D barcode markers, imperceptible markers.

Marker-less approach- Localization based augmentation, real world examples Tracking methods- Visual tracking, feature based tracking, hybrid tracking, and initialisation and recovery.

Unit 5: AR Devices & Components **[11 Hrs]**

AR Components – Scene Generator, Tracking system, monitoring system, display, Game scene

AR Devices – Optical See- Through HMD, Virtual retinal systems, Monitor bases systems, Projection displays, Video see-through systems

Beyond A. R. - Mixed Reality

Introduction to mixed reality, Applications of mixed reality, Input and Output in Mixed reality, Computer Vision and Mixed Reality, simultaneous localization and mapping (SLAM), variants of SLAM - dense tracking and mapping (DTAM), parallel tracking and mapping (PTAM) and semi-direct monocular visual odometry (SVO).

TEXT BOOKS:

1. Allan Fowler-AR Game Development, 1st Edition, A press Publications, 2018, ISBN 978- 1484236178
2. Augmented Reality: Principles & Practice by Schmalstieg / Hollerer, Pearson Education India; First edition (12 October 2016),ISBN-10: 9332578494

REFERENCES BOOKS:

1. Designing for Mixed Reality, Kharis O'Connell Published by O'Reilly Media, Inc., 2016, ISBN: 9781491962381
2. Sanni Siltanen- Theory and applications of marker-based augmented reality. Julkaisija – Utgivare Publisher. 2012. ISBN 978-951-38-7449-0

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AI5TE01B	Elective –I(Block Chain)	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 distibutrd consensus
4. To Build a applications based on blockchain technology

Course Outcome:

CO1: Apply 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

CO5: To design applications based on blockchain technology for E-Governance, Land Registration, Medical Information Systems, and others

Unit I: Introduction : **[7Hrs]**

Blockchain-History,Myths, Benefits,Limitations and Challenges of Blockchain,Wallet-Structure of Blocks, Miners, Merkle tree ,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

Unit II: Blockchain Architecture and Cryptographic: **[6Hrs]**

Crypto Primitives, Permissioned Blockchain, Consensus mechanism , Cryptographic -Hash Function, Properties of a hash function-pointer. Introduction to cryptographic concepts required, Public key cryptosystems , private vs public blockchain,Digital Signature and use cases.

Unit III: Bitcoin Consensus: **[7Hrs]**

Introduction to Bitcoin Blockchain, Transactions, Bitcoin limitations, Bitcoin Consensus, Proof of Work (PoW)- HashcashPoW , Bitcoin PoW, 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.

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Unit IV: Cryptocurrency and Smart Contracts **[6 Hrs]**

Introduction, Ethereum blockchain, Elements of the Ethereum blockchain, IOTA, Namecoin. Legal Aspects Cryptocurrency Exchange, Black Market and Global Economy. Blockchaim 2.0-Smart Contracts: Definition, DAO ,Ricardian contracts, Precompiled contracts.

Unit V: Hyperledger Fabric: **[10Hrs]**

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, Truffle Design and issue Crypto currency, Mining, DApps, DAO

Blockchain Applications :

Uses of Blockchain in E-Governance, Land Registration, Medical Information Systems, Finance, and others

Text Books:

1. Mastering Blockchain - Distributed ledgers, decentralization and smart contracts explained, Author- Imran Bashir, Packt Publishing Ltd, Second Edition, ISBN 978-1-78712-544-5, 2017
2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016
3. Josh Thompson, 'Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming', Create Space Independent Publishing Platform, 2017.
4. Draft version of "S. Shukla, M. Dhawan, S. Sharma, S. Venkatesan, 'Blockchain Technology: Cryptocurrency and Applications', Oxford University Press, 2019.

Reference Books

1. Nicola Atzei, Massimo Bartoletti, and Tiziana Cimoli, A survey of attacks on Ethereum smart contracts
2. Joseph Bonneau et al, SoK: Research perspectives and challenges for Bitcoin andcryptocurrency, IEEE Symposium on security and Privacy, 2015.
3. Nakamoto, Satoshi, Bitcoin: A peer-to-peer electronic cash system, Research Paper

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AI5TE01C	Elective –I(3D PRINTING & DESIGN)	3 Credit

Course Outcomes:

CO1:-Knowledge on 3D Printing approach and basic terminology

CO2:-Understanding the advantages and limitations of 3D Printing for different applications

CO3:- Knowledge on how to access online service bureaus or platforms for estimating printing costs and placing orders for manufacturing the desired object

CO4:- Understanding the advantages and limitations of 3D Printing for different applications

CO5:- Understand how problems and defects can occur in components produced by AM processes as well as the preventative measures

Course Contents:

Unit I: Introduction **[7Hrs]**

Survey of students and 3D animation experience Overview of course plan and objectives Sample work In class Lego design challenge, Prototyping and Printing Technologies, History of 3D Printing Overview of 3D Printing technologies Selective Laser Sintering (SLS) Direct Metal Laser Sintering (DMLS) Fused Deposition Modeling (FDM) Stereolithography (SLA) Laminated Object Manufacturing (LOM) Electron Beam Melting (EBM), 3D Printing (3DP)

Unit II: – Intermediate Polygon Modeling and Clean up **[6Hrs]**

Combining, merging, and sewing up polygon meshes Understanding two-manifold vs. non-manifold geometry Identifying, predicting, and fixing non-manifold geometry Freezing transforms and deleting history Exporting geometry, Laying out a simple model on a stage for print. Hollow forms and the importance of reducing volume Cost of size, cost of volume, cost of detail, cost of time

Unit III: – Intermediate Modeling **[7Hrs]**

Understanding NURBS NURBS Surfaces advantages Similarities and differences between NURBS and CAD drawings Curve and surface construction Clean and uniform topology, Best Practices for NURBS Illustrator, IGES, and other import/export pipelines

Advanced Surfacing with NURBS:- Modeling workflows for NURBS and Polygons Conversion techniques NURBS to Polygons Polygons to NURBS Subdivision surfaces, Best practices for geometry conversion Texturing coordinates Preserving UV texturing coordinates throughout conversion

Unit IV: Accurate Measurement and Part Negatives **[4Hrs]**

Modeling workflows for NURBS and Polygons Conversion techniques NURBS to Polygons Polygons to NURBS Subdivision surfaces, Texturing coordinates Preserving UV texturing coordinates throughout conversion

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Unit V:- Modeling for design and production **[12Hrs]**

Moving Parts and Articulation Hinges Ball and sockets Flexibility and elasticity Locks, bolts, and fasteners Threading (taps and dies) Interfacing, support, and reinforcement, Form and function Visualizing the assembly process Complex interactions and motorizations Creating a part negative

Embedding detail:- Non-linear animation tools How rigging, shading, dynamics, fluids, and other Maya 3D toolsets can be applied to creating manufacturable and printable objects. Painterly tools (Sculpt Geometry Tool, etc.) Workflows with other programs (ZBrush, Mudbox, etc.)

3D Modeling software vs. CAD:

An overview of CAD software packages Introduction to Fusion 360 Drawing based workflow Drawing constraints Surfacing operations, Sketch/drawing based workflows Similarities and differences between CAD and NURBS Broad overview of manufacturing techniques

Text Books:

1. Make: Design for 3D Printing by Released October 2015 Publisher(s): Make: Community ISBN: 9781457187360

2. Recommended: Manufacturing Processes for Design Professionals by Rob Thompson, Hardcover: 528 pages, (ISBN-13: 978-0500513750).

3. Functional Design for 3D Printing: Designing 3d printed things for everyday use - 3rd edition by Clifford T Smyth

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AI5L004	Machine Learning & Deep Learning LAB	1 Credit

Course Outcomes: After completing the course, the students will be able to

1. Understand the implementation procedures for the machine learning algorithms.
2. Design Java/Python programs for various Learning algorithms.
3. Apply appropriate data sets to the Machine Learning algorithms.
4. Identify and apply Machine Learning algorithms to solve real world problems.

List of Practicals :

1. Write a program to find mean mode and median of given user input.
2. Study of Python Basic Libraries such as Statistics, Math, Numpy and Scipy.
3. Write a Python program to implement Simple Linear Regression.
4. Write a program to demonstrate the working of the decision tree based ID3 algorithm.
5. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set
6. Implementation of K-Means Clustering
7. Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.
8. Performance analysis of Classification Algorithms on a specific dataset (Mini Project)

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AI5L005	Digital Image Techniques & Analysis (Lab)	1 Credit

Course Learning Objectives:

1. Use their learned skills, knowledge and abilities to learn digital image processing.
2. To learn digital image processing techniques including representation, sampling and quantization.
3. To treat the 2D systems as an extension of 1D system design and discuss techniques specific to 2D systems.
4. To learn about basic concepts of filters and noises.
5. To make the students confident in designing software project on image processing.

Course Outcomes: After completing the course

CO1: Students will become familiar with MATLAB Software

CO2: Students will know the basic concepts of image processing.

CO3: Students will become familiar with various methods of edge detection.

CO4: Students will come to know how the images are process by applying techniques.

CO5: Students will able to develop a project on Image Processing.

Practical List:

1. To study Digital Image Processing and MATLAB Software
2. Write a program to display an image as a grayscale image.
3. Write a program to display any image as a histogram
4. Write a program to enhance an image properties using combination of spatial filters.
5. Write a program to display an image in RED, Grayscale, GREEN and BLUE.
6. Write a program to show salt and pepper noise, Gaussian noise in an image
7. Write a program to implement Negative image transformation and
8. Write a program to apply flip operation in an image.
9. Write a program to detect face from an image.
10. Write a program to show First order edge detection using prewitt operator, canny operator, sobel operator

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AI5L006	AI & Cognitive Robotics (Lab)	1 Credit

Course Objectives:

1. To introduce different types of robotics and demonstrate them to identify different parts and components. Getting a robot to figure out, at the highest level, what it should be doing.
2. To write programming for simple operations
3. Introduces the programming language ERGO, and the ideas behind its programs.

Course Outcomes:

Upon Completion of the course, the students will be able to:
1:Use of any robotic simulation software to model the different types of robots and calculate work volume for different robots
2.Traditional robot programming might come to an end once all the basic behaviours of the robot are realized in code

LIST OF EXPERIMENTS

1. Define ERGO program.
2. Determine ERGO programming language and its datatypes.
3. Describe sum-up and cube function with their functions in advanced programming.
4. Understand the concept of language primitives of Scheme- Numbers,Strings,Lists,symbols, Boolean values, Hash Table, Vectors and Arrays.
5. Deterministic programming- The: act and : begin primitives. The:act and :begin primitives, The:while and :for-all primitives
6. Write an ERGO program to get to an arbitrary room by first calculating the shortest path.
7. Understand programming concept of LEGO Robot.
8. Perform a program for the robotic version of the Towers of Hanoi.
9. Perform the program for JoyRide car to be controlled by ERGO.
10.Perform the odd bar problem, with 12 bars and 3 weighings allowed.

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Course Structure and Syllabus

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	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	0	0	20	20	60	100	3
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	4	25	0	25	50	2
10	IPR	AI6T007	Intellectual Property Rights	2	0	0	10	15	25	50	Audit
11	PROJECT	CS6P007	CRT(Campus Recruitment Training)	0	0	2	50	0	0	50	1
12	PROJECT	CS6P008	Skill Development	0	0	2	15	0	35	50	1
				15	2	12	315	115	470	900	22

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AI6T001	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 Object recognition techniques.
5. Analyze structural pattern recognition and feature extraction techniques.
6. Explain various image models

Unit 1 **[8Hrs]**

Image Formation Models: Monocular imaging system, Orthographic & Perspective Projection, Cameras – lenses, projections, sensors, Radiometry –Measuring Light, light and surfaces Representation – color spaces, Camera model and Camera calibration, Binocular imaging systems, Sources, Shadows and Shading.

Unit 2 **[6Hrs]**

2D/3D Vision: Filters, Binary Images, Features, Edge Detection, Texture, Shape, Segmentation, Clustering, Model Fitting, Probabilistic, 3D Vision:Multiview geometry, Stereo, Shape from X,3D data

Unit 3 **[6Hrs]**

Image Processing and Feature Extraction: Image representations (continuous and discrete), Linear Filters, Texture, Edge detection.

Unit 4 **[10Hrs]**

Motion Estimation: Regularization theory, Optical computation, Stereo Vision, Motion estimation, Structure from motion. Shape Representation and Segmentation: Deformable curves and surfaces, Snakes and active contours, Level set representations, Fourier and wavelet descriptors, Medial representations, Multiresolution analysis.

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Unit 5 **[6Hrs]**

Object recognition: Hough transforms and other simple object recognition methods, Shape correspondence and shape matching, Principal component analysis, Shape priors for recognition

Text Books

1. Computer Vision: A Modern Approach by D. A. Forsyth and J. Ponce, Prentice Hall, 2003/2011
2. Computer Vision by Linda Shapiro and George Stockman, Prentice-Hall, 2001

Reference Books

1. Robot Vision, by B. K. P. Horn, McGraw-Hill. 1986

2. Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, March 2004.

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AI6T002	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 **[8 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 **[7Hrs]**

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 **[7Hrs]**

Exploratory Data Analytics : Descriptive Statistics, Mean, Standard Deviation, Skewness and Kurtosis, Box Plots, Pivot Table, Heat Map, Correlation Statistics.

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Unit 4 **[7 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. Cambridge University Press.
3. Laura Igual and Santi Segui, Introduction to Data Science: A Python Approach to Concepts, Techniques

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AI6TE02A	Elective –II Cloud Computing	3 Credit

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 **[8Hrs]**

Introduction: Distributed Computing and Enabling Technologies, Cloud Fundamentals: Cloud Definition, Evolution, Architecture, Applications, Deployment models and service models.

Virtualization: Issues with virtualization, Virtualization technologies and architectures, Internals of virtual machine monitors/hypervisors, Virtualization of data centres and Issues with Multi-tenancy.

UNIT II [7Hrs]

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.

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UNIT III [7Hrs]

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 IV [7Hrs]

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 V [7Hrs]

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, Andrzej Goscinski, "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.

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5. Marc Farley, "Building Storage Networks", Tata McGraw Hill, Osborne, 1st Edition, 2001.

AI6TE02B	Elective –II Angular JS	3 Credit

Course Learning Objectives:

1. Creating Angular components
2. Binding data and events
3. Creating and validating Angular forms
4. Adding routes to Angular applications
5. Unit Testing Angular components
6. Combining REST and observables
7. Building Angular directives

Course Outcomes: After completing the course

CO1: Students will develop an understanding of the formalistic (aesthetic) aspects of Angular 5 Build Automation, Angular Component Based Approach
CO2: Students will demonstrate cross-platform (web, mobile, broadcast, print) storytelling skills.
CO3: Students will become familiar with graphic design Typescript Essentials Component Life Cycle.
CO4: Students will develop and understanding of information design and usability as it applies to interactive media projects.
CO5: Students will utilize coding and software tools to analyse and present data in a professional manner that could be translated to web-based or app-based media.
CO6: Students will write at a level suitable for a public audience in an area related to interactive media

Course Content:

Unit 1

Angular JS **[7Hrs]**

What Are Single Page Applications, Angular vs. AngularJS, One Framework, All Platforms, Introducing Typescript, Creating Components, Displaying Data with One-Way Data Binding, Binding Methods and Events, Updating Data with Two-Way Data Binding, Enumerating Data with *ngFor , Creating Angular Modules

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Unit 2 **[7Hrs]**

Angular Components

Testing Angular ,Principles of Unit Testing, Testing Angular Using the Karma Framework, Introducing the Routing Module, Adding Routes, Passing Parameters, Programmatic navigation

Unit 3 **[7Hrs]**

Routing

Introducing the Routing Module. Adding Routes, Passing Parameters, Programmatic Navigation, Template vs. Model-Driven Forms, Validation in Template-Driven Forms, Creating Functional Reactive Forms, Validation in Model-Driven Forms, Styling Forms to Reflect Control State

Unit 4 **[8Hrs]**

Pipes and Services, Observables and REST

Transforming Data with Pipes ,Creating Custom Pipes ,Creating Reusable Services, Using Services From Components , Introduction to Observables ,Using the Angular HTTP Service ,Making Calls to Web Services ,Returning Observables and Promises,Filtering and Debouncing for Performance

Unit 5 **[7Hrs]**

Directives , Animations

Creating Custom Directives, Attribute Directives, Structural Directives and Templates , Animating State Transitions,Defining Triggers,Controlling Animation Timing ,Keyframe Animations , Deploying to Production

Text Books:

1. Angular in Action Mannig Publication , ISBN 1617293318
2. Angular 6 for Enterprise-Ready Web Applications: Deliver production-ready and cloud-scale Angular web apps 1st Edition, Kindle Edition ,
3. Angular: Up and Running: Learning Angular, Step by Step 1st Edition, Kindle Edition , ISBN 978-1491999837

ReferenceBooks:

1. Pro AngularJS (Expert's Voice in Web Development), Web Publishing .
2. Angular: From Theory To Practice: Build the web applications of tomorrow using the Angular web framework from Google. Kindle Edition.

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AI6TE02C	Elective –II Middleware Technologies	3 Credit

Course Outcomes:

1. To study the set of services that a middleware system constitutes of.
2. To understand how middleware facilitates the development of distributed applications in heterogeneous environments.
3. To study how it helps to incorporate application portability, distributed application component interoperability and integration.
4. To learn the object oriented middleware basics through the example of the following CORBA objects.
5. To understand the basics of Web services that is the most oft-used middleware technique.

Course Contents:

UNIT-I **[8Hrs]**

Introduction to client server computing: Evolution of corporate computing models from centralized to distributed computing, client server models. Benefits of client server computing, pitfalls of client server programming. CORBA with Java: Distributed programming with Java RMI; Overview of CORBA, CORBA IDL.

UNIT-II **[6Hrs]**

XML TECHNOLOGY AND SOAP : XML Technology XML – Name Spaces – Structuring With Schemas and DTD – Presentation Techniques – Transformation – XML Infrastructure. SOAP: Overview of SOAP – HTTP – XML-RPC – SOAP

UNIT-III **[8Hrs]**

WEBSERVICES OVERVIEW : XML Technology XML – Name Spaces – Structuring With Schemas and DTD – Presentation Techniques – Transformation – XML Infrastructure.SOAP: Overview of SOAP – HTTP – XML-RPC – SOAP: Protocol – Message Structure – Intermediaries – Actors – Design Patterns And Faults – SOAP With Attachments.

UNIT-IV **[5Hrs]**

AGENT COMMUNICATION AND COLLABORATION : Agent Communication and Collaboration: Overview of Agent Oriented Programming

UNIT-V **[8Hrs]**

Agent Communication Language - Agent Based Framework of Interoperability - Agents for Information Gathering - Open Agent Architecture - Communicative Action for Artificial Agent

AGENT ARCHITECTURE Agent Architecture: Agents for Information Gathering - Open Agent Architecture – Communicative Action for Artificial Agent

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Text Books:

1. Frank. P. Coyle , "XML, Web Services and The Data Revolution", 1st Edition, Pearson Education, 2002.

2. Jeffrey M. Bradshaw , "Software Agents", 1st Edition, PHI, 2010.

References:

1. M.L.Liu , "Distributed Computing, Principles and applications", 1st Edition, Pearson Education, 2008.

2. Ramesh Nagappan, Robert Skoczylas and Rima Patel Sriganesh , "Developing Java Web Services" , 1st Edition, Willey Publiscation

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AI6TE02D	Elective-II Human Computing	3 Credit

Course Objectives:

Students will gain theoretical knowledge of and practical experience in the fundamental aspects of human perception, cognition, and learning as relates to the design, implementation, and evaluation of interfaces

Course Outcomes: After completing the course, the students will be able to

1. Critically discuss common methods in the user-centered design process and the appropriateness of individual methods for a given problem.
2. Use, adapt and extend classic design standards, guidelines, and patterns.
3. Employ selected design methods and evaluation methods at a basic level of competence.
4. Build prototypes at varying levels of fidelity, from paper prototypes to functional, interactive prototypes.
5. Demonstrate sufficient theory of human computer interaction, experimental methodology and inferential statistics to engage with the contemporary research literature in interface technology and design.

Unit 1 **[7Hrs]**

Introduction : Importance of user Interface – definition, importance of 8 good design. Benefits of good design. A brief history of Screen design. The graphical user interface – popularity of graphics, the concept of direct manipulation, graphical system, Characteristics, Web user – Interface popularity, characteristics- Principles of user interface

Unit 2 **[6Hrs]**

Design process: Human interaction with computers, importance of 8 human characteristics human consideration, Human interaction speeds, understanding business junctions.

Unit 3 **[9Hrs]**

Screen Designing : Design goals – Screen planning and purpose, 8 organizing screen elements, ordering of screen data and content – screen navigation and flow – Visually pleasing composition – amount of information – focus and emphasis – presentation information simply and meaningfully – information retrieval on web – statistical graphics – Technological consideration in interface design.

Unit 4 **[7Hrs]**

Windows : New and Navigation schemes selection of window, 8 selection of devices based and screen based controls. Components – text and messages, Icons and increases – Multimedia, colors, uses problems, choosing colors

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Unit 5

[7Hrs]

Software tools : Specification methods, interface – Building Tools. 8 Interaction Devices – Keyboard and function keys – pointing devices – speech recognition digitization and generation – image and video displays – drivers.

Text Books

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale Human Computer Interaction, 3rd Edition Prentice Hall, 2004.
2. Jonathan Lazar Jinjuan Heidi Feng, Harry Hochheiser, Research Methods in Human Computer Interaction, Wiley, 2010.
3. Ben Shneiderman and Catherine Plaisant Designing the User Interface: Strategies for Effective Human-Computer Interaction (5th Edition, pp. 672, ISBN 0- 321-53735-1, March 2009), Reading, MA: Addison-Wesley Publishing Co.

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AI6TE03A	Elective-III Brain Machine Interface & Interaction	3 Credit

Course 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 **[7Hrs]**

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 **[7Hrs]**

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 **[5Hrs]**

Non-invasive Electromagnetic Methods for Brain Monitoring: A Technical Review Introduction, Human Brain Anatomy, Brain Diseases, Non-invasive Brain Monitoring, Electromagnetic Brain Monitoring Methods.

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[7Hrs]

Unit 4

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.

[10Hrs]

Unit 5

Applications for Brain-Computer Interfaces: Introduction, BCIs for Assistive Technology, BCIs for Recreation, BCIs for Cognitive Diagnostics and Augmented Cognition, Rehabilitation and Prosthetics.

A brief introduction to brain –computer interaction. Interactive systems, interface and interaction. Elementary tasks and interaction techniques. Theory of action feedback, Usability, Properties of BCIs from the perspective of Brain Computer Interaction, BCI interaction loop, BCI interaction loop

Text Books:

1. Brain-Machine Interfaces Methods and Perspectives, Maureen Clerc,Laurent Bougrain, Fabien Lotte, ISBN: 978-1-848-21826-0, Wiley-ISTE.

Reference Books

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

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AI6TE03B	Elective-III Computer Forensic	3 Credit

Course Objective:

1. To correctly define and cite appropriate instances for the application of computer forensics Correctly collect and analyze computer forensic evidence
2. Identify the essential and up-to-date concepts, algorithms, protocols, tools, and methodology of Computer Forensics
3. To understand the basic digital forensics and techniques for conducting the forensic examination on different digital devices.
4. To understand how to examine digital evidences such as the data acquisition, identification analysis.

Course Outcomes:

1. Know how to apply forensic analysis tools to recover important evidence for identifying computer crime.
2. To be well-trained as next-generation computer crime investigators.
3. Students will explain and properly document the process of digital forensics
4. Students will understand the inner workings of file systems.
5. Students will be introduced to the current research in computer forensics. This will encourage them to define research problems and develop effective solutions.

Course Content:

Unit-I: Cyber Crime and computer crime : [7Hrs]

Introduction to Digital Forensics, Definition and types of cybercrimes, electronic evidence and handling, electronic media, collection, searching and storage of electronic media, introduction to internet crimes, hacking and cracking, credit card and ATM frauds, web technology, cryptography, emerging digital crimes and modules

Unit-II: Basics of Computer: [6Hrs]

Computer organisation, components of computer- input and output devices, CPU, Memory hierarchy, types of memory, storage devices, system softwares, application softwares, basics of computer languages.

Unit-III: Computer Forensics Definition and Cardinal Rules: [7Hrs]

Data Acquisition and Authentication Process, Windows Systems-FAT12, FAT16, FAT32 and NTFS, UNIX file Systems, mac file systems, computer artifacts, Internet Artifacts, OS Artifacts and their forensic applications

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Unit-IV: Forensic Tools and Processing of Electronic : [10Hrs]

Evidence Introduction to Forensic Tools, Usage of Slack space, tools for Disk Imaging, Data Recovery, Vulnerability Assessment Tools, Encase and FTK tools, Anti Forensics and probable counters, retrieving information, process of computer forensics and digital investigations, processing of digital evidence, digital images, damaged SIM and data recovery, multimedia evidence, retrieving deleted data: desktops, laptops and mobiles, retrieving data from slack space, renamed file, ghosting, compressed files.

Unit: V Computer forensic cases: [6Hrs]

Developing Forensic Capabilities – Searching and Seizing Computer Related Evidence – Processing Evidence and Report Preparation – Future Issues.

Text Books:

1. John R. Vacca, "Computer Forensics: Computer Crime Scene Investigation", Cengage Learning, 2nd Edition, 2005. (CHAPTERS 1 – 18). (UNIT I – IV)
2. Marjie T Britz, "Computer Forensics and Cyber Crime: An Introduction", Pearson Education, 2nd Edition, 2008. (CHAPTERS 3 – 13). (UNIT IV – V)

Reference Books:

1. C. Altheide & H. Carvey Digital Forensics with Open Source Tools, Syngress, 2011. ISBN: 9781597495868.
2. Selected readings from various sources as assigned
3. Online Course management System: https://esu.desire2learn.com/ Syllabus - Semester First COMPUTER FORENSIC
4. Vacca, J, *Computer Forensics, Computer Crime Scene Investigation*, 2nd Ed, Charles River Media, 2005, ISBN: 1-58450-389.

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AI6TE03C	Elective-III Deep Learning	3 Credit

Course Learning Objectives:

1. To understand the theoretical foundations, algorithms and methodologies of Neural Network.
2. To design and develop an application using specific deep learning models.
3. To provide the practical knowledge in handling and analysing real world applications.

Course Outcomes: After completing the course, the students will be able to

1. Recognize the characteristics of deep learning models that are useful to solve real-world problems.
2. Understand different methodologies to create application using deep nets.
3. Identify and apply appropriate deep learning algorithms for analyzing the data for variety of problems.
4. Implement different deep learning algorithms.
5. Design the test procedures to assess the efficacy of the developed model.
6. Combine several models in to gain better results.

Course Contents

Unit 1: Machine Learning Basics **[8Hrs]**

Learning algorithms, Maximum likelihood estimation, Building machine learning algorithm, Neural Networks Multilayer Perceptron, Back-propagation algorithm and its variants Stochastic gradient decent, Curse of Dimensionality

Unit 2: Deep Learning Architectures **[8Hrs]**

Machine Learning and Deep Learning, Representation Learning, Width and Depth of Neural Networks, Activation Functions: RELU, LRELU, ERELU, Unsupervised Training of Neural Networks, Restricted Boltzmann Machines, Auto Encoders, Deep Learning Applications.

Unit 3: Convolutional Neural Networks **[6Hrs]**

Architectural Overview, Motivation, Layers, Filters, Parameter sharing, Regularization, Popular CNN Architectures: ResNet, AlexNet - Applications

Unit 4: Transfer Learning **[7Hrs]**

Transfer learning Techniques, Variants of CNN: DenseNet, PixelNet.

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Unit 5: Sequence Modelling – recurrent and Recursive Nets **[7Hrs]**

Recurrent Neural Networks, Bidirectional RNNs, Encoder-decoder sequence to sequence architectures - BPTT for training RNN, Long Short Term Memory Networks.

Text Books:

1. Ian Goodfellow, YoshuaBengio and Aaron Courville, " Deep Learning", MIT Press, 2017
2. Josh Patterson, Adam Gibson "Deep Learning: A Practitioner's Approach", O'Reilly Media, 2017
3. Umberto Michelucci "Applied Deep Learning. A Case-based Approach to Understanding Deep Neural Networks" April 2018.

Reference Books:

1. Kevin P. Murphy "Machine Learning: A Probabilistic Perspective", The MIT Press, 2012.
2. EthemAlpaydin,"Introduction to Machine Learning", MIT Press, Prentice Hall of India, Third Edition 2014.
3. Giancarlo Zaccone, Md. RezaulKarim, Ahmed Menshawy "Deep Learning with TensorFlow: Explore neural networks with Python", Packt Publisher, 2017. Antonio Gulli, Sujit Pal "Deep Learning with Keras", Packt Publishers, 2017. Francois Chollet "Deep Learning with Python", Manning Publications, 2017.

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AI6TE03D	Elective-III Quantum Computing	3 Credit

Course Objectives:

1. To impart knowledge about the quantum-mechanical phenomena such as superposition and entanglement to perform computation.
2. To introduce the fundamental concepts, Quantum Computing.
3. To enable the students to understand the quantum computing and quantum information indepth.

Course Outcomes: After completing the course, the students will be able to

CO1:Identify the fundamental notations of quantum mechanics.
CO2:Describe the fundamental elements needed to perform quantum computation.
CO3:Apply elementary operations to develop more sophisticated applications of quantum computing

Unit 1 **[7Hrs]**

Introduction to Quantum Computing, need quantum computing, Quantum mechanics, The Circuit Model, Linear operators and spectral decomposition, Matrices as linear operators, Operations on matrices, Eigenvalues and eigenvectors, Spectral decomposition

Unit 2 **[7Hrs]**

Operator functions and tensor products, Tensor product, Direct sum, Postulates of quantum mechanics, State of a system, Evolution of the system, Measurement of the system, POVM, Composite Systems

Unit 3 **[7Hrs]**

Computation, quantum and classical, Classical circuits, Quantum circuits, Basic quantum algorithms, Deutsch-Jozsa algorithm, Bernstein-Vazirani algorithm, Fourier transform, Quantum discrete Fourier transform, The classical discrete Fourier transform, Phase estimation

Unit 4 **[7Hrs]**

Factorization on a quantum computer, Simon's algorithm, Classical algorithms for Simon's problem, Order finding algorithm, Examples of quantum noise and quantum operations

Unit 5 **[8Hrs]**

Quantum noise and quantum operations, Classical noise and Markov processes Quantum operations Distance measures for quantum information.

Introduction Quantum error-correction, The Shor code, Theory of quantum error-correction, Constructing quantum codes, Stabilizer codes, Fault-tolerant quantum computation

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Text Books:

1. Quantum Computation and Quantum Information, Michael A. Nielsen & Isaac L. Chuang
2. An Introduction to Quantum Computing, P Kaye, R Laflamme and M Mosca.

Reference Books:

1. Quantum Field Theory by C. Itzykson and J. B. Zuber, McGraw-Hill Book Co.
2. Quantum Field Theory by L. H. Ryder, Cambridge University Press.
3. The Quantum Theory of Fields Vol I, by S. Weinberg, Cambridge University Press.
4. Introduction to The Theory of Quantum Fields by N. N. Bogoliubov and D. V. Shirkov, Interscience.
5. An Introduction to Quantum Field Theory by M. E. Peskin and D. V. Schroeder, Westview Press

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AI6L003	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.

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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

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AI6L004	Advanced Computer Vision Lab	1 Credit

Course Objective:

This laboratory aims to introduce image processing in MATLAB context.

In this laboratory you will:

1.Become familiar with the MATLAB and Image Processing Toolbox software package.

2.Experiment with the point processing operations of contrast stretching and histogram equalization.'

3. Evaluate how different Gaussian and median filters are suitable for noise removal.

4.Become familiar with the frequency domain operations

5.Understand imaging geometry.

Course Outcomes:

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

1.To decompose visual tasks into sequences of image analysis operations, representations, specific algorithms, and inference principles

2.Understand the roles of image transformations and their invariances in pattern recognition and classification

3.To describe key aspects of how biological visual systems encode, analyse, and represent visual information to understand a typical graphics pipeline.

4.To think of ways in which biological visual strategies might be implemented in machine vision, despite the enormous differences in hardware

5.To understand in depth at least one important application domain, such as face recognition, detection, or interpretation

List of Experiments:

1. Basic Statistical Analysis of Images
2. Basic Image Segmentation
3. Image Enhancement for Performance
4. Feature Extraction from Images
5. Texture, colour, stereo, and motion descriptors. Disambiguation.
6. 2D → 3D inference
7. Shape description. Codons; superquadrics and surface geometry
8. Bayesian inference in vision. Classifiers; probabilistic methods

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AI6L005	Big Data Tools & Techniques(LAB)	1 Credit

Course Objectives:

1. To provide an overview of an exciting growing field of big data analytics.

2. To introduce the tools required to manage and analyze big data like Hadoop, NoSql Map-Reduce.

3. To teach the fundamental techniques and principles in achieving big data analytics with scalability and streaming capability.

4. 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 a student will be able to:

1. Understand the key issues in big data management and its associated applications in intelligent business and scientific computing.

2. Acquire fundamental enabling techniques and scalable algorithms like Hadoop, Map Reduce and NO SQL in big data analytics

3. Interpret business models and scientific computing paradigms, and apply software tools for big data analytics.

4. Achieve adequate perspectives of big data analytics in various applications like recommender systems, social media applications etc.

Practical List:

Students will perform at least 8 programming exercises and implement one mini-project. The students can work in groups of 2/3.

1. Study of Hadoop ecosystem

2. 2 programming exercises on Hadoop

3. 2 programming exercises in No SQL

4. Implementing simple algorithms in Map- Reduce (3) - Matrix multiplication, Aggregates, joins, sorting, searching etc

5. Implementing any one Frequent Itemset algorithm using Map-Reduce

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6. Implementing any one Clustering algorithm using Map-Reduce

7. Implementing any one data streaming algorithm using Map-Reduce

8. Mini Project: One real life large data application to be implemented (Use standard Datasets available on the web)

a) Twitter data analysis

b) Fraud Detection

c) Text Mining etc.

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AI6P006	Mini Project	3 Credit

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 of research 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, Abstract Modules Split-up Deliverables for each review Data 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 the Head of the Department.
- The student failing to attend the project review will be subject to strict action as decided by the Head of the Department.
- 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

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Using project codes developed by someone else Using project work which is already submitted in other institute or university Such students shall be declared 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

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AI6T007	Intellectual Property Rights	Audit

Course Objectives:

After learning the course, the students should be able:

1. To recognize the importance of IP and to educate the pupils on basic concepts of Intellectual Property Rights.
2. To identify the significance of practice and procedure of Patents.
3. To make the students to understand the statutory provisions of different forms of IPRs in simple forms
4. To learn the procedure of obtaining Patents, Copyrights, Trade Marks &Industrial Design
5. To enable the students to keep their IP rights alive.

Course Outcomes: After learning the course, the students should be able:

CO 1: To Distinguish and Explain various forms of IPRs.
CO 2: To Identify criteria's to fit one's own intellectual work in particular form of IPRs.
CO 3: To Apply statutory provisions to protect particular form of IPRs.
CO 4: To Analyse rights and responsibilities of holder of Patent, Copyright, Trademark, Industrial Design etc.
CO 5: To Identify procedure to protect different forms of IPRs national and international level

Course Content:

UNIT1 **7 Hrs.**

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 **7 Hrs.**

Nature of Copyright - Subject matter of copyright: original literary, dramatic, musical, artistic works; cinematograph films and sound recordings - Registration Procedure, Term of protection, Ownership of copyright, Assignment and licence of copyright - Infringement, Remedies & Penalties – Related Rights - Distinction between related rights and copyrights.

UNIT3: **7 Hrs.**

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Patents - Elements of Patentability: Novelty , Non Obviousness (Inventive Steps), Industrial Application - Non - Patentable Subject Matter - Registration Procedure, Rights and Duties of Patentee, Assignment and licence , Restoration of lapsed Patents, Surrender and Revocation of Patents, Infringement, Remedies & Penalties – Patent office and Appellate Board

UNIT IV **7 Hrs.**

Trademarks - Different kinds of marks (brand names, logos, signatures, symbols, well known marks, certification marks and service marks) - Non Registrable Trademarks - Registration of Trademarks

Design: meaning and concept of novel and original - Procedure for registration, effect of registration and term of protection

UNIT V **8 Hrs.**

International Treaties and Conventions on IPRs, TRIPS Agreement, PCT Agreement, Patent Act of India, Patent Amendment Act, Design Act, Trademark Act, Geographical Indication Act. Introduction to competition Law, Anti-competitive agreements, Abuse of dominance, Regulation of combinations,

TEXT BOOKS:

1. V. Scople Vinod, Managing Intellectual Property, Prentice Hall of India pvt Ltd, 2012

2. S. V. Satakar, "Intellectual Property Rights and Copy Rights, Ess Publications, New Delhi, 2002

REFERENCE BOOKS:

1. Deborah E. Bouchoux, "Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets", Cengage Learning, Third Edition, 2012.

2. Prabuddha Ganguli,"Intellectual Property Rights: Unleashing the Knowledge Economy", McGraw Hill Education, 2011.

3. Edited by Derek Bosworth and Elizabeth Webster, The Management of Intellectual Property, Edward Elgar Publishing Ltd., 2013.

E-resources:

1. Subramanian, N., & Sundararaman, M. (2018). Intellectual Property Rights – An Overview. Retrieved from http://www.bdu.ac.in/cells/ipr/docs/ipr-eng-ebook.pdf

2. World Intellectual Property Organisation. (2004). WIPO Intellectual property Handbook. Retrieved from https://www.wipo.int/edocs/pubdocs/en/intproperty/489/wipo_pub _489.pdf

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CS6P007	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

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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.

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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

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CS6P08/IT6P08	Skill Development	1 Credit

I) Online Privacy

Unit I: Introduction; Various Privacy breaches, and its effects; Why Online privacy has become an important topic; Privacy cases / litigations, and outcomes,Definition & forms of Privacy; Difference between data security & data privacy, Trade-off between privacy and freedom of speech; Trade-off between privacy and utility; Contextual integrity theory and applications

Unit II: Privacy Attitudes & Awareness,Social Media Privacy,Social Media Privacy,Data anonymity:K-anonymity, L-diversity, T-closeness, Differential privacy

Unit III: Image & Location privacy; Ethics about studying online privacy:Institutional Review Board / Ethics Committee, Conducting {User, Lab, and Online} Studies; Privacy from 3rd party trackers & advertisers, Image & Location privacy; Ethics about studying online privacy:Institutional Review Board / Ethics Committee; Conducting {User, Lab, and Online} Studies; Privacy from 3rd party trackers & advertisers

Unit IV: User behaviour & Usable privacy; Privacy in National projects like Aadhaar, NATGRID; Differential privacy in US census, Apple; PDP Bill / Srikrishna commission report / GDPR: Implications, User behaviour & Usable privacy; Privacy in National projects like Aadhaar, NATGRID; Differential privacy in US census, Apple; PDP Bill / Srikrishna commission report / GDPR: Implications.

Unit V: Privacy policies: Length, readability, legality, cost of reading privacy policies; Nutrition labels of Privacy policies: How to make the policies simple and user friendly, Privacy policies: Length, readability, legality, cost of reading privacy policies, Nutrition labels of Privacy policies: How to make the policies simple and user friendly

Online Course Link: https://onlinecourses.nptel.ac.in/noc22_cs37

CS6P08/IT6P08	Skill Development	1 Credit

II) Ethical Hacking

Unit I: Introduction to ethical hacking. Fundamentals of computer networking. TCP/IP protocol stack, IP addressing and routing, TCP and UDP. IP subnets, Routing protocols. IP version 6.

Unit II: Vulnerability assessment: OpenVAS, Nessus, etc, System hacking: password cracking, penetration testing, Social engineering attacks, Malware threats, penetration testing by creating backdoors.

Unit III: Introduction to cryptography, private-key encryption, public-key encryption, Cryptographic hash functions, digital signature and certificate, applications, Steganography, biometric authentication, network-based attacks, DNS and Email security.

Unit IV: Sniffing: Wireshark, ARP poisoning, DNS poisoning, Hacking wireless networks, Denial of service attacks, Elements of hardware security: side-channel attacks, physical inclinable functions, hardware trojans.

Unit V: Hacking web applications: vulnerability assessment, SQL injection, cross-site scripting, Case studies: various attacks scenarios and their remedies.

Online Course Link: https://onlinecourses.nptel.ac.in/noc22_cs13

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CS6P08/IT6P08	Skill Development	1 Credit

III) Programming, Data Structures and Algorithms Using Python

Unit I: Informal introduction to programming, algorithms and data structures, variables, operations, control flow - assignments, conditionals, loops, functions, Python: types, expressions, strings, lists, tuples, Python memory model: names, mutable and immutable values, List operations: slices etc

Unit II: Binary search Inductive function definitions: numerical and structural induction ,Elementary inductive sorting: selection and insertion sort In-place sorting

Unit III: Basic algorithmic analysis: input size, asymptotic complexity, O() notation, Arrays vs lists, Merge sort, Quick sort, Stable sorting, Dictionaries, More on Python functions: optional arguments, default values, Passing functions as arguments, Higher order functions on lists: map, lter, list comprehension

Unit IV: Exception handling, Basic input/output, Handling files, String processing, Backtracking: N Queens, recording all solutions, Scope in Python: local, global, nonlocal names, Nested functions, Data structures: stack, queue Heaps

Unit V: Abstract data types, Classes and objects in Python, "Linked" lists: find, insert, delete .Binary search trees: find, insert, delete, Height-balanced binary search trees, Efficient evaluation of recursive definitions: memorization, Dynamic programming: examples, Other programming languages: C and manual memory management, Other programming paradigms: functional programming.

Online Course Link: https://onlinecourses.nptel.ac.in/noc22_cs26

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JAIDEV EDUCATION SOCIETY'S
J D COLLEGE OF ENGINEERING AND MANAGEMENT
KATOL ROAD, NAGPUR
SESSION 2021-22

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							

Education to Eternity

JAIDEV EDUCATION SOCIETY'S
J D COLLEGE OF ENGINEERING AND MANAGEMENT
SESSION 2021-22

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	Teaching			Evaluation 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

JAIDEV EDUCATION SOCIETY'S
J D COLLEGE OF ENGINEERING AND MANAGEMENT
SESSION 2021-22

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

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JAIDEV EDUCATION SOCIETY'S
J D COLLEGE OF ENGINEERING AND MANAGEMENT
SESSION 2021-22

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**
3	PROJECT	CS8P001	Internship	0	0	0	100	0	100	200	7
4	PROJECT	CS8P002	Project phase-II	0	0	4	50	0	50	100	3
				0	**0**	**4**	**150**	**0**	**150**	**300**	**10**

OR

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	IT8P002	Major Project	0	0	6	75	0	75	150	3
				6	1	6	155	40	175	350	10

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