Education to Eternity

॥ज्ञानम् सर्वार्थ साधनम्॥

VISION	MISSION
To be a well-known center for shaping professional leaders of Global Standards in Civil Engineering	Provide quality education and excellent learning Environment for overall development of students. Making Sustainable efforts for integrating academics with Industry.

1.1.3 Details of courses offered by the institution that focus on employability/ entrepreneurship/ skill development during the year.

1.2.1 Details of courses introduced across all programmes offered during the year

Name of the Course	Course Code	Activities/Content with a direct bearing on Employability/ Entrepreneurship/ Skill development
Soft Skills Development	BTHM303	Regular Session on weekly basis.
Field Training / Internship/Industrial Training Evaluation (from semester II)	BTCVF312	After Completion of II Semester
Product Design Engineering	BTID405	Regular Session on weekly basis.

Employability	
Entrepreneurship	
Skill Development	

HoD, Civil
JDCOEM, Nagpur

Course Structure

for Degree Programme

B. Tech. in Civil Engineering

with effect from AY 2018-19

Dr. Babasaheb Ambedkar Technological University

Lonere 402 103, Dist- Raigad, Maharashtra, INDIA

Detailed Syllabus

Semester III

Sr. No.	Subject Code	Subject	Contact Hours			Credit
			L	T	P	
Theory						
01	BTBSC301	Mathematics – III	3	1	-	4
02	BTCVC302	Mechanics of Solids	3	1	✓	4
03	BTCVC303	Hydraulics I	2	1	✓	3
04	BTCVC304	Surveying I	2	1	✓	3
05	BTCVC305	Building Construction	2	-	✓	2
06	BTCVC306	Engineering Geology	2	-	✓	2
07	BTHM303	Soft Skills Development	2	-	-	AU
Practical / Drawing and/or Design						
08	BTCVL307	Hydraulics Laboratory I	-	-	2	1
09	BTCVL308	Surveying Laboratory I	-	-	2	1
10	BTCVL309	Building Construction - Drawings Laboratory	-	-	2	1
11	BTCVL310	Engineering Geology Lab	-	-	2	1
12	BTCVS311	Seminar on Topic of Field Visit to Foundation Work	-	-	1	AU
13	BTCVF312	Field Training / Internship/Industrial Training Evaluation (from semester II)	-	-	-	1
		Sub-Total	16	4	09	
		Total	**29**			**23**

Semester- IV

Sr. No.	Subject Code	Subject	Contact Hours L	T	P	Credit
Theory						
01	BTCVC401	Hydraulics II	2	1	✓	3
02	BTCVC402	Surveying – II	2	1	✓	3
03	BTCVC403	Structural Mechanics-I	3	1	-	4
04	BTID405	Product Design Engineering	1	2	-	3
05	CV E1	**Elective I**	3	-	-	3
06	BTCVC406	Engineering Management	1	-	-	AU
07	BTHM3401	Basic Human Rights	2	-	-	AU
Practical / Drawing and/or Design						
8	BTCVL407	Hydraulics Laboratory II	-	-	2	1
09	BTCVL408	Surveying Laboratory II	-	-	4	2
10	BTCVL409	Mechanics of Solids Laboratory	-	-	2	1
11	BTCVM410	Mini Project	-	-	2	1
12	BTCVF411	Seminar on Topic of Field Visit to works involving Superstructure Construction	-	-	1	1
		Sub-Total	**14**	**5**	11	
		Total	**31**			**22**
Elective I						
	BTCVE404A BTCVE404B BTCVE404C	Numerical Methods in Engineering Planning for Sustainable Development Instrumentation & Sensor Technologies for Civil Engineering Applications	3	-	-	3

Semester- V

Sr. No	Subject Code	Subject	Contact Hours L	T	P	Credit
		Theory				
01	BTCVC 501	Design of Steel Structures	2	2	-	4
02	BTCVC 502	Structural Mechanics-II	2	1	-	3
03	BTCVC 503	Soil Mechanics	3	1	✓	4
04	BTCVC 504	Environmental Engineering	2	-	✓	2
05	BTCVC 505	Transportation Engineering	2	-	✓	2
06	CV E2	**Elective II**	3	-	-	3
07	BTHM507	Essence of Indian Traditional Knowledge	1	-	-	AU
		Practical / Drawing and/or Design				
08	BTCVL508	Soil Mechanics Laboratory	-	-	2	1
09	BTCVL509	Environmental Engineering Laboratory	-	-	2	1
10	BTCVL510	Transportation Engineering Laboratory	-	-	2	1
11	BTCVS511	Seminar on Topic of Field Visit to works related to Building Services	-	-	1	AU
		Sub-Total	**15**	**4**	**7**	
		Total	**26**			**1**
	BTCVE506A BTCVE506B BTCVE506C BTCVE506D	**Elective II** Materials, Testing & Evaluation Computer Aided Drawing Development Engineering Business Communication & Presentation Skills	3	-		3

Semester- VI

$:Students should register for the CVF 705 in Semester VI to undergo training during vacation after semester VI and appear at examination in Semester VII. Result shall appear in Grade-sheet of Semester VII

Sr. No.	Subject Code	Subject Title	Contact hours			Credit
			L	T	P	
01	BTCVC601	Design of Concrete Structures I	3	1	-	3
02	BTCVC602	Foundation Engineering	2	1	-	3
03	BTCVC603	Concrete Technology	2	-	✓	2
04	BTCVC604	Project Management	2	1	-	2
05	CVE3	**Elective III**	3	-	-	3
06	BTCVC606	Building Planning and Design	2	-	✓	2
		Practical / Drawing and/or Design				
07	BTCVL607	Concrete Technology Laboratory	-	-	2	1
08	BTCVL608	Building Planning, Design and Drawing Laboratory	-	-	4	2
09	BTCVM609	Community Project (Mini Project)	-	-	2	1
10	BTCVS610	Seminar on Topic of Field Visit Road Construction	-	-	1	AU
11	BTCVF611	Industrial Training$	-	-	2	--
		Sub-Total	**14**	**3**	**11**	
		Total	**28**			**19**
		Elective III				
	BTCVE605A BTCVE605B BTCVE605C BTCVE605D BTCVE605E BTCVE605F	Waste Water Treatment Operations Research Geographic Data Analysis and Applications Advanced Engineering Geology Advanced Soil Mechanics Design of Masonry and Timber Structures				

Rashtrasant Tukdoji Maharaj Nagpur University, Nagpur

Faculty of Engineering & Technology

CIVIL ENGINEERING

Scheme of Examination & Evaluation - CBS

Semester: Seventh

Subject Code	Course	Teaching Scheme (Clock Hours/ Week)					Evaluation Scheme								Duration of University Theory Exam (Hrs)
							Assessment of Marks for Theory				Assessment of Marks for Practical				
		Theory hrs/week	Tutorial hrs/week	Practical hrs/week	Total hrs/week	Credits	College Assessment (CA)	University Exam	Total Marks	Min. Marks	Internal	External	Total Marks	Min. Marks	
BECVE701T	Advanced Concrete Structures	3	1		4	4	20	80	100	40					4
BECVE701P	Advanced Concrete Structures			2	2	1					25	25	50	25	
BECVE702T	Estimating and Costing	3	1		4	4	20	80	100	40					4
BECVE702P	Estimating and Costing			2	2	1					50	50	100	50	
BECVE703T	Elective -I	3	1		4	4	20	80	100	40					3
BECVE704T	Construction Management and Law	4			4	4	20	80	100	40					3
BECVE705T	Transportation Engineering - II	3	1		4	4	20	80	100	40					3
BECVE706P	Industrial Case Study and Project Seminar			3	3	3					50	50	100	50	
Total		**16**	**4**	**7**	**27**	**25**	**100**	**400**	**500**		**125**	**125**	**250**		

Note: 1. External Practical Evaluation of "Estimating & Costing" shall be performance based (Manual or using suitable Software) on assigned problem by the External Examiner

2. Evaluation of Summer Training – 2 (ST-2) shall be done as Industrial Case Study Component & minimum two seminar should be delivered as continuous college assessment for project seminar component.

Rashtrasant Tukdoji Maharaj Nagpur University, Nagpur

Faculty of Engineering & TechnologyCIVIL ENGINEERING

Scheme of Examination & Evaluation – CBS

Semester: Eighth

Subject Code	Course	Teaching Scheme (Clock Hours/ Week)					Evaluation Scheme								Duration of University Theory Exam (Hrs)
							Assessment of Marks for Theory				Assessment of Marks for Practical				
		Theory hrs/week	Tutorial hrs/week	Practical hrs/week	Total hrs/week	Credits	College Assessment (CA)	University Exam	Total Marks	Min. Marks	Internal	External	Total Marks	Min. Marks	
BECVE801T	Irrigation Engineering	3	2		5	5	20	80	100	40					3
BECVE802T	Elective - II	3	1		4	4	20	80	100	40					3
BECVE803T	Elective - III	4			4	4	20	80	100	40					3
BECVE803P	Elective - III			2	2	1					25	25	50	25	
BECVE804T	Construction Economics and Finance	3	1		4	4	20	80	100	40					3
BECVE805P	Project			6	6	6					75	75	150	75	
Total		**13**	**4**	**8**	**25**	**24**	**80**	**320**	**400**		**100**	**100**	**200**		

Note: Internal Evaluation of Project shall be based on the academic contribution of a student and delivery of minimum one seminar on the project work.

BECVE804T - Construction Economics and Finance subject shall be dealt by Board of Basic Science and Humanities.

Rashtrasant Tukdoji Maharaj Nagpur University, Nagpur
Faculty of Engineering & Technology
CIVIL ENGINEERING

Absorption Scheme for Students of Semester Pattern to Credit Based Semester Pattern

VII Semester

Code No.	Name of Subject in **Semester Pattern**		Code No.		Name of Equivalent Subject in **Credit Based Semester Pattern**
7CE01	Structural Analysis – III (T)		BECVE501T		Structural Analysis – II
7CE02	Advanced Concrete Structures (T)		BECVE701T		Advanced Concrete Structures
7CE02	Advanced Concrete Structures (P)			BECVE701P	Advanced Concrete Structures
7CE03	Irrigation Engineering (T)		BECVE801T		Irrigation Engineering
7CE03	Irrigation Engineering (P)			BECVE801T	Irrigation Engineering
7CE04	Maintenance and Rehabilitations of Civil Engineering Structures (T)		BECVE802T		Elective – II (Maintenance and Rehabilitations of Civil Engineering Structures)
7CE05	Elective – I (T)		BECVE703T		Elective – I
7CE06	Industrial Case Study (P)			BECVE706P	Industrial Case Study & Project Seminar
7CE07	Project and Seminar (P)			BECVE706P	Industrial Case Study & Project Seminar

VIII Semester

Code No.	Name of Subject in **Semester Pattern**		Code No.		Name of Equivalent Subject in **Credit Based Semester Pattern**
8CE01	Estimating and Costing (T)		BECVE702T		Estimating and Costing
8CE01	Estimating and Costing (P)			BECVE702P	Estimating and Costing
8CE02	Transportation Engineering – II (T)		BECVE705T		Transportation Engineering – II
8CE03	Elective – II (T)		BECVE802T		Elective – II
8CE04	Elective – III (T)		BECVE803T		Elective – III
8CE04	Elective – III (P)			BECVE803P	Elective – III
8CE05	Project (P)			BECVE805P	Project

Note: Any student willing to opt for CBS Semester pattern shall be absorbed as per the RTMNU's relevant ordinance.

B. Tech (Electronics & Telecommunication Engineering) / B. Tech (Electronics Engineering)

Curriculum for Semester III [Second Year]

Sr. No.	Course Code	Course Title	Hours Per Week			Evaluation Scheme			Total Marks	Credits
			L	T	P	MSE	CA	ESE		
1	BTBSC301	Engineering Mathematics-III	3	1	0	20	20	60	100	4
2	BTEXC302	Analog Circuits	2	1	0	20	20	60	100	3
3	BTEXC303	Electronic Devices & Circuits	2	1	0	20	20	60	100	3
4	BTEXC304	Network Analysis	2	1	0	20	20	60	100	3
5	BTEXC305	Digital Logic Design	2	1	0	20	20	60	100	3
6	BTHM3401	Basic Human Rights	2	0	0	--	50	--	50	(Audit)
7	BTEXL307	Analog Circuits Lab	0	0	2	--	60	40	100	1
8	BTEXL308	Electronic Devices & Circuits Lab	0	0	2	--	60	40	100	1
9	BTEXL309	Network Analysis Lab	0	0	2	--	60	40	100	1
10	BTEXL310	Digital Logic Design Lab	0	0	2	--	60	40	100	1
11	BTEXW311	Electronics Workshop	0	0	2	--	60	40	100	1
12	BTES211P	Field Training/ Internship/Industrial Training Evaluation	--	--	--	--	--	50	50	1
		Total	**13**	**05**	**10**	**100**	**450**	**550**	**1100**	**22**

B. Tech (Electronics & Telecommunication Engineering) / B. Tech (Electronics Engineering)

Curriculum for Semester IV [Second Year]

Sr. No	Course Code	Course Title	Hours Per Week			Evaluation Scheme			Total Marks	Credits
			L	T	P	MSE	CA	ESE		
1	BTEXC401	Electrical Machines and Instruments	2	1	0	20	20	60	100	3
2	BTEXC402	Analog Communication Engineering	2	1	0	20	20	60	100	3
3	BTEXC403	Microprocessor	2	1	0	20	20	60	100	3
4	BTEXC404	Signals and Systems	2	1	0	20	20	60	100	3
5	BTID405	Product Design Engineering	1	0	2	30	30	40	100	2
6	BTBSC406	Numerical Methods and Computer Programming	2	1	0	20	20	60	100	3
7	BTEXL407	Electrical Machines and Instruments Lab	0	0	2	--	60	40	100	1
8	BTEXL408	Analog Communication Engineering Lab	0	0	2	--	60	40	100	1
9	BTEXL409	Microprocessor Lab	0	0	2	--	60	40	100	1
10	BTEXL410	Signals and Systems Lab	0	0	2	--	60	40	100	1
11	BTHML411	Soft-Skill Development	0	0	2	--	60	40	100	1

12	BTEXF412	Field Training/ Internship/Industrial Training (Minimum 4 weeks which can be completed partially in third semester or fourth semester or in at one time)	--	--	--	--	--	--	--	1 (To be evaluated in V^{th} Semester)
		Total	**11**	**05**	**12**	**130**	**430**	**540**	**1100**	**22**

BTBSC301	Engineering Mathematics-III	4 Credits

Second Year B. Tech Classes (Common to all Branches) Semester: III

Prerequisites: Differential and Integral Calculus, Taylor series and Infinite series, Differential equations of first order and first degree, Fourier series, Vector algebra, Algebra of complex numbers.

Course Objectives:

After completion of the course, students will have adequate background, conceptual clarity and knowledge of appropriate solution techniques related to:

1. Linear differential equations of higher order using analytical methods and numerical methods applicable to Control systems and Network analysis.
2. Transforms such as Fourier transform, Laplace transform and applications to Communication systems and Signal processing.
3. Vector differentiation and integration required in Electromagnetics and Wave theory.
4. Complex functions, conformal mappings, contour integration applicable to Electrostatics, Digital filters, Signal and Image processing.

Course Outcomes:

On completion of the course, students will be able to:

1. Solve higher order linear differential equation using appropriate techniques for modeling and analyzing electrical circuits.
2. Solve problems related to Fourier transform, Laplace transform and applications to Communication systems and Signal processing.
3. Obtain Interpolating polynomials, numerically differentiate and integrate functions, numerical solutions of differential equations using single step and multi-step iterative methods used in modern scientific computing.
4. Perform vector differentiation and integration, analyze the vector fields and apply to Electromagnetic fields.
5. Analyze conformal mappings, transformations and perform contour integration of complex functions in the study of electrostatics and signal processing.

UNIT - 1	07 Hours

Laplace Transform

Definition – conditions for existence ; Transforms of elementary functions ; Properties of Laplace transforms - Linearity property, first shifting property, second shifting property, transforms of functions multiplied by t^n, scale change property, transforms of functions divided by t, transforms of integral of functions, transforms of derivatives ; Evaluation of integrals by using Laplace transform ; Transforms of some special functions- periodic function, Heaviside-unit step function, Dirac delta function.

UNIT - 2	07 Hours

Inverse Laplace Transform

Introductory remarks ; Inverse transforms of some elementary functions ; General methods of finding inverse transforms ; Partial fraction method and Convolution Theorem for finding inverse Laplace transforms ; Applications to find the solutions of linear differential equations and simultaneous linear differential equations with constant coefficients.

UNIT - 3	07 Hours

Fourier Transform

Definitions – integral transforms ; Fourier integral theorem (without proof) ; Fourier sine and cosine integrals ; Complex form of Fourier integrals ; Fourier sine and cosine transforms ; Properties of Fourier transforms ; Parseval's identity for Fourier Transforms.

UNIT - 4	07 Hours

Partial Differential Equations and Their Applications

Formation of Partial differential equations by eliminating arbitrary constants and functions; Equations solvable by direct integration; Linear equations of first order (Lagrange's linear equations); Method of separation of variables – applications to find solutions of one dimensional heat flow equation $\left(\frac{\partial u}{\partial t} = c^2 \frac{{}^2u}{\partial x^2}\right)$, and two dimensional heat flow equation (i.e. Laplace equation : $\frac{{}^2u}{\partial x^2} + \frac{{}^2u}{\partial y^2} = 0$).

UNIT - 5	07 Hours

Functions of Complex Variables (Differential calculus)

Limit and continuity of f(z); Derivative of f(z) ; Analytic functions; Cauchy- Riemann equations in Cartesian and polar forms; Harmonic functions in Cartesian form; Mapping: Translation, magnification and rotation, inversion and reflection , bilinear transformation; Conformal mapping.

UNIT - 6	07 Hours

Functions of Complex Variables (Integral calculus)

Cauchy's integral theorem; Cauchy's integral formula; Residues; Cauchy's residue theorem (All theorems without proofs).

TEXT BOOKS

1. Higher Engineering Mathematics by B. S. Grewal, Khanna Publishers, New Delhi.
2. Advanced Engineering Mathematics by Erwin Kreyszig, John Wiley & Sons, New York.
3. A Course in Engineering Mathematics (Vol III) by Dr. B. B. Singh, Synergy Knowledge ware, Mumbai.
4. A Text Book of Applied Mathematics (Vol I & II) by P. N. Wartikar and J. N. Wartikar, Pune Vidyarthi Griha Prakashan, Pune.
5. Higher Engineering Mathematics by H. K. Das and Er. Rajnish Verma, S. Chand & CO. Pvt. Ltd., New Delhi.

REFERENCE BOOKS

1. Higher Engineering Mathematics by B. V. Ramana, Tata McGraw-Hill Publications, New Delhi.
2. A Text Book of Engineering Mathematics by Peter O' Neil, Thomson Asia Pte Ltd., Singapore.
3. Advanced Engineering Mathematics by C. R. Wylie & L. C. Barrett, Tata Mcgraw-Hill Publishing Company Ltd., New Delhi.
4. Integral Transforms and Their Engineering Applications by Dr. B. B. Singh, Synergy . Knowledge ware, Mumbai.

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

GENERAL INSTRUCTIONS

1. The tutorial classes in Engineering Mathematics-III are to be conducted batch wise. 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.

BTEXC302	Analog Circuits	3 Credits

Course Objectives:

1. To understand characteristics of IC and Op-Amp and identify the internal structure.
2. To introduce various manufacturing techniques.
3. To study various op-amp parameters and their significance for Op-Amp.
4. To learn frequency response, transient response and frequency compensation techniques for Op-Amp.
5. To analyze and identify linear and nonlinear applications of Op-Amp.
6. To understand functionalities of PLL.

Course Outcomes:

On completion of the course, students will be able to:

1. Understand the characteristics of IC and Op-Amp and identify the internal structure.
2. Understand and identify various manufacturing techniques.
3. Derive and determine various performances based parameters and their significance for Op-Amp.
4. Comply and verify parameters after exciting IC by any stated method.
5. Analyze and identify the closed loop stability considerations and I/O limitations.
6. Analyze and identify linear and nonlinear applications of Op-Amp.
7. Understand and verify results (levels of V & I) with hardware implementation.
8. Implement hardwired circuit to test performance and application for what it is being designed.
9. Understand and apply the functionalities of PLL.

UNIT - 1	06 Hours

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 R_i, R_o, bandwidth and voltage gain.

UNIT - 2	06 Hours

Linear Applications of OP-AMP

Inverting and non-inverting amplifier configurations, voltage follower, summing, averaging scaling amplifier, difference amplifier, integrator, differentiator, and instrumentation amplifiers.

UNIT - 3	06 Hours

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.

UNIT - 4	06 Hours

Converters using OP-AMP

V-F, I-V and V-I converter, Digital-to-analog converters (DAC): Weighted resistor, R-2R ladder, resistor string etc. Analog-to-digital converters (ADC): Single slope, dual slope, successive approximation, flash type.

UNIT - 5	06 Hours

Oscillators

Principle of Oscillators, Barkhausen criterion, Oscillator types: RC oscillators (design of phase shift, Wien bridge etc.), LC oscillators (design of Hartley, Colpitts, Clapp etc.), non-sinusoidal oscillators, and voltage controlled oscillators.

UNIT - 6	06 Hours

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.

TEXT/REFERENCE BOOKS

1. Ramakant A. Gaikwad, "Op Amps and Linear Integrated Circuits", Pearson Education 2000.
2. Salivahanan and Kanchana Bhaskaran, "Linear Integrated Circuits", Tata McGraw Hill, India 2008.
3. George Clayton and Steve Winder, "Operational Amplifiers", 5th Edition Newnes.
4. Sergio Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", Tata McGraw Hill.
5. Bali, "Linear Integrated Circuits", McGraw Hill 2008.
6. Gray, Hurst, Lewise, Meyer, "Analysis & Design of Analog Integrated Circuits", Wiley Publications on Education.

BTEXC303	Electronic Devices & Circuits	3 Credits

Prerequisites:

Basic knowledge of Semiconductor Physics.

Course Objectives:

1. To introduce semiconductor devices FET and MOSFET, their characteristics, operations, circuits and applications
2. To introduce concepts of both positive and negative feedback in electronic circuits
3. To analyze and interpret FET and MOSFET circuits for small signal at low and high frequencies
4. To simulate electronics circuits using computer simulation software and verify desired results
5. To study the different types of voltage regulators.

Course Outcomes:

On completion of the course, students will be able to:

1. Comply and verify parameters after exciting devices by any stated method.
2. Implement circuit and test the performance.
3. Analyze small signal model of FET and MOSFET.
4. Explain behavior of FET at low frequency.
5. Design an adjustable voltage regulator circuits.

UNIT - 1	06 Hours

JFET

Introduction to JFET, Types, Construction, Operation, Static Characteristics, Pinch off voltage, FET Volt-Ampere characteristics, FET Configurations (CS/CD/CG) and their Comparison. Biasing of FET (Self).FET as an amplifier and its analysis (CS) and its frequency response, Small signal model, FET as High Impedance circuits

UNIT - 2	06 Hours

MOSFET& its DC Analysis

Basics of MOS Transistor operation, Construction of n-channel E-MOSFET, E-MOSFET characteristics & parameters, non-ideal voltage current characteristics viz. Finite output resistance, body effect, sub-threshold conduction, breakdown effects and temperature effects. 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, Voltage references, Basic principle of band gap reference, CMOS Inverter as amplifier: Active load, Current source and Push pull configurations.

UNIT - 3	06 Hours

Electronics Amplifiers

Classification of amplifiers, Fundamentals of Low noise and Power amplifiers. Feedback amplifiers: Feedback concept and topologies, Effect of feedback on terminal characteristics of amplifiers, feedback amplifier analysis, cascade amplifiers, DC Amplifiers.

UNIT - 4	06 Hours

Oscillators

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.

UNIT - 5	06 Hours

Multivibrators

IC555 Block diagram, Types of Multivibrators: Astable, Monostable and Bistable, Operation of Multivibrators using FETs and IC555. Applications of IC555 in Engineering.

UNIT - 6	06 Hours

Voltage Regulator

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/REFERENCE BOOKS

1. Millman Halkias, "Integrated Electronics-Analog and Digital Circuits and Systems", Tata McGraw Hill, 2000
2. Donald Neaman, "Electronic Circuit Analysis and Design", 3rd Edition, Tata McGraw Hill
3. Brijesh Iyer, S. L. Nalbalwar, R. Dudhe, "Electronics Devices & Circuits", Synergy Knowledgeware Mumbai, 2017. ISBN:9789383352616
4. David A. Bell, "Electronic Devices and Circuits",5th Edition, Oxford Press
5. R. L. Boylstad, L. Nashlesky, "Electronic Devices and circuits Theory", 9thEdition, Prentice Hall of India, 2006.

BTEXC304	Network Analysis	3 Credits

Course Objectives:

1. To learn about the basic laws of electric circuits as well as the key fundamentals of the communication channels, namely transmission lines.
2. To understand the need of simplification techniques of complicated circuits
3. To learn about the comprehensive insight into the principle techniques available for characterizing circuits, networks and their implementation in practice.
4. To learn about the use of mathematics, need of different transforms and usefulness of differential equations for analysis of networks.
5. To train the students for handling analog filter design through theory of NA along with practical, this is basic requirement of signal processing field.

Course Outcomes:

On completion of the course, students will be able to:

1. Apply knowledge of mathematics to solve numerical based on network simplification and it will be used to analyze the same.
2. Design passive filters and attenuators theoretically and practically. To apply knowledge for design of active filters as well as digital filters and even extend this to advance adaptive filters.
3. Identify issues related to transmission of signals, analyze different RLC networks.
4. Find technology recognition for the benefit of the society.

UNIT - 1	06 Hours

Basic Circuit Analysis and Simplification Techniques

Basic circuit elements, Simplification of networks, Equivalent ‘T’ and ‘Π’ networks of any complicated network, Voltage and Current laws (KVL/KCL), Network Analysis: Mesh, Super mesh, Node and Super Node analysis. Principle of duality, Source transformation and source shifting, Network Theorems such as Superposition, Thevenin’s, Norton’s and Maximum Power Transfer Theorems.

***Note**: Above circuit analysis, mentioned in this Unit-1, is for AC network only.*

UNIT - 2	06 Hours

Frequency Selective Networks

Significance of Quality factor, Series Resonance: Resonating frequency, Reactance curves, Variation of circuit parameters such as impedance, phase angle, voltage and current with frequency; Bandwidth, Selectivity, Magnification factor, Parallel resonance: Resonant frequency, Variation circuit parameters such as admittance, phase angle, voltage and current with frequency; Bandwidth and selectivity. Analysis of parallel resonating circuit with resistance present in both branches (inductive and capacitive branches) and tank circuit, Effect of generator resistance on BW & Selectivity, Comparison and applications of series and parallel resonant circuits.

UNIT - 3	06 Hours

Electrical Network Parameters and Passive Filters

Classifications: Symmetrical and Asymmetrical networks. Properties of two port Network :(i) Symmetrical Networks (T and Π only): Characteristics impedance and propagation constant in terms of circuit components, open and short circuit parameters (ii) Asymmetrical

Networks: Image Impedance and Iterative Impedance. Passive Filters: Filter fundamentals, Introduction to Neper and Decibel, Relation between Neper and Decibel, Constant K-LPF, HPF, BPF and BSF, m-derived LPF and HPF, Terminating half sections, Concept of composite filters. Attenuators: Symmetrical T and Π type attenuators, Ladder attenuator.

UNIT - 4	06 Hours

Steady State and Transient Response

DC and AC response of R-L, R-C and RLC circuits, Analysis of electrical circuits using Laplace Transform.

UNIT - 5	06 Hours

Two Port Network Parameters and Functions

Terminal characteristics of network: Z, Y, h, ABCD Parameters; Reciprocity and Symmetry conditions, Applications of the parameters. Network functions for one port and two port networks, Pole-zeros of network functions and network stability.

UNIT - 6	06 Hours

Transmission Line Theory

Types of Transmission lines, Transmission Line Equation, Equivalent circuits, Primary and Secondary line constants, Terminations of transmission lines, VSWR and Reflection Coefficient, Impedance matching, Transmission line measurements using Smith chart.

TEXT/REFERENCE BOOKS

1. D Roy Choudary, "Network and Systems" 1st edition, New Age International, 1988
2. John D. Ryder, "Network Lines and Fields" 2nd edition, PHI, 1955
3. C. P. Kuriakose, "Circuit Theory Continuous and Discrete Time System, Elements of Network Synthesis" PHI
4. W.H. Hayt Kemmerly, "Engineering Circuit Analysis", 5th Edition, Tata McGraw Hill Publications, 1993.
5. M. E. Van Valkenburg, "Network Analysis", 3rd Edition, Pearson, 2004. 6. Boylestead, "Introductory Circuit Analysis", 4th edition, Charles & Merrill, 1982. 7. Royal Signal Handbook on Line Communication.

BTEXC305	Digital Logic Design	3 Credits

Course Objectives:

1. To acquaint the students with the fundamental principles of two-valued logic and various devices used to implement logical operations on variables.
2. To lay the foundation for further studies in areas such as communication, VHDL, computer.

Course Outcomes:

On completion of the course, students will be able to:

1. Use the basic logic gates and various reduction techniques of digital logic circuit in detail.
2. Design combinational and sequential circuits.
3. Design and implement hardware circuit to test performance and application.
4. Understand the architecture and use of VHDL for basic operations and Simulate using simulation software.

UNIT - 1	06 Hours

Combinational Logic Design

Standard representations for logic functions, k map representation of logic functions (SOP and POS forms), minimization of logical functions for min-terms and max-terms (upto 4 variables), don‘t care conditions, Design Examples: Arithmetic Circuits, BCD - to - 7 segment decoder, Code converters. Adders and their use as subtractor, look ahead carry, ALU, Digital Comparator, Parity generators/checkers, Design of Multiplexers and De-multiplexers, Decoders.

UNIT - 2	06 Hours

Sequential Logic Design

1 Bit Memory Cell, Clocked SR, JK, MS J-K flip flop, D and T flip-flops. Use of preset and clear terminals, Excitation Table for flip flops, Conversion of flip flops. Application of Flip-flops: Registers, Shift registers, Counters (ring counters, twisted ring counters), Sequence Generators, ripple counters, up/down counters, synchronous counters, definitions of lock out, Clock Skew, and Clock jitter.

UNIT - 3	06 Hours

State Machines

Basic design steps- State diagram, State table, State reduction, State assignment, Mealy and Moore machines representation, Implementation, finite state machine implementation, Sequence detector.

UNIT - 4	06 Hours

Digital Logic Families

Classification of logic families, Characteristics of digital ICs-Speed of operation, power dissipation, figure of merit, fan in, fan out, current and voltage parameters, noise immunity, operating temperatures and power supply requirements. TTL logic, Operation of TTL NAND gate, active pull up, wired AND, open collector output, unconnected inputs. Tri-State logic. CMOS logic – CMOS inverter, NAND, NOR gates, unconnected inputs, wired logic, open drain output. Interfacing CMOS and TTL, Comparison table of Characteristics of TTL, CMOS, ECL, RTL, I^2L and DCTL

UNIT - 5	06 Hours

Programmable Logic Devices and Semiconductor Memories

Programmable logic devices: Detail architecture, Study of PROM, PAL, PLA, Designing combinational circuits using PLDs. General Architecture of FPGA and CPLD Semiconductor memories: memory organization and operation, expanding memory size, Classification and characteristics of memories, RAM, ROM, EPROM, EEPROM, NVRAM, SRAM, DRAM.

UNIT - 6	06 Hours

Introduction to VHDL

Behavioral – data flow, and algorithmic and structural description, lexical elements, data objects types, attributes, operators; VHDL coding examples, combinational circuit design examples in VHDL and simulation.

TEXT/REFERENCE BOOKS

1. R.P. Jain, ―Modern digital electronics‖, 3rd edition, 12threprint Tata McGraw Hill Publication, 2007.

2. M. Morris Mano, ―Digital Logic and Computer Design‖ 4th edition, Prentice Hall of India, 2013.
3. Anand Kumar, ―Fundamentals of digital circuits‖ 1st edition, Prentice Hall of India, 2001.
4. Pedroni V.A., "Digital Circuit Design with VHDL", Prentice Hall India, 2nd 2001 Edition.

BTHM3401	Basic Human Rights	Audit

Course Objectives:

1. To work for ensuring that basic human rights are respected everywhere.
2. To cooperate to avoid compromising on human rights for economic or political expediency
3. To recognize democratic institutions as a fundamental human right
4. To work towards the sovereignty and self-determination of entities with historical, cultural and ecological identity.
5. To actively engage with the Government of India and other countries to promote human rights education.
6. To bring diplomatic and commercial pressures on regimes that violates human rights, to ensure that they respect the basic rights of their citizens.
7. To keep the interests of disempowered communities foremost in all dealings with countries in which human rights violations occur
8. To develop a more distinctive and effective role for the International Court of Justice in the field of human rights
9. To promote a culture for educating the citizenry that cultivation and promotion of human rights culture is the sine qua non for the smooth functioning of the organs of a democratic State and for the kind of development that results into overall development of the society.
10. To train the young men and women for facing the challenges of the pluralistic society and the rising conflicts and tensions in the name of particularistic loyalties to caste, religion, region and culture
11. To study the effects of draconian laws and unlawful use of State's machinery and force by the enforcement agencies.

Course Outcomes:

On completion of the course, students will be able to:

1. Simply put, human rights education is all learning that develops the knowledge, skills, and values of human rights.
2. Strengthen the respect for human rights and fundamental freedoms.
3. Enable all persons to participate effectively in a free society.
4. Learn about human rights principles, such as the universality, indivisibility, and interdependence of human rights.
5. Learn about regional, national, state, and local law that reinforces international human rights law.
6. Learn and know about and being able to use global, regional, national, and local human rights instruments and mechanisms for the protection of human rights.

UNIT - 1	06 Hours

The Basic Concepts

Individual, Group, Civil Society, State, Equality, Justice, Human Values: - Humanity, Virtues, Compassion.

UNIT - 2	06 Hours

Human Rights and Human Duties

Origin, Civil and Political Rights, Contribution of American Bill of Rights, French Revolution, Declaration of Independence, Rights of Citizen, Rights of working and Exploited people, Fundamental Rights and Economic program, India's Charter of freedom

UNIT - 3	06 Hours

Society, Religion, Culture, and their Inter-Relationship

Impact of Social Structure on Human behavior, Roll of Socialization in Human Values, Science and Technology, Modernization, Globalization, and Dehumanization.

UNIT - 4	06 Hours

Social Structure and Social Problems

Social and Communal Conflicts and Social Harmony, Rural Poverty, Unemployment, Bonded Labour, Migrant workers and Human Rights Violations, Human Rights of mentally and physically challenged

UNIT - 5	06 Hours

State, Individual Liberty, Freedom and Democracy

The changing of state with special reference to developing countries, Concept of development under development and Social action, need for Collective action in developing societies and methods of Social action, NGOs and Human Rights in India: - Land, Water, Forest issues.

UNIT - 6	06 Hours

Human Rights in Indian Constitution and Law

The constitution of India:

(i) Preamble

(ii) Fundamental Rights

(iii) Directive principles of state policy

(iv) Fundamental Duties

(v) Some other provisions

Universal declaration of Human Rights and Provisions of India, Constitution and Law, National Human Rights Commission and State Human Rights Commission.

TEXT/REFERENCE BOOKS

1. Shastry, T. S. N., India and Human rights: Reflections, Concept Publishing Company India (P Ltd.), 2005.
2. Nirmal, C.J., Human Rights in India: Historical, Social and Political Perspectives (Law in India), Oxford India.

BTEXC401	Electrical Machines and Instruments	3 Credits

Course Objectives:

1. Model and Analyze the performance of different types of DC machines
2. Learn the applications of DC generators
3. Analyze the performance of different types of DC motors
4. Analyze the performance of different types of Sensors and Transducers

5. Familiarize with the applications of DC machines
6. To prepare students to perform the analysis of any electromechanical system.
7. To empower students to understand the working of electrical equipment used in everyday life.

Course Outcomes:

On completion of the course, students will be able to:

1. The ability to formulate and then analyze the working of any electrical machine using mathematical model under loaded and unloaded conditions.
2. The skill to analyze the response of any electrical machine.
3. The ability to troubleshoot the operation of an electrical machine.
4. The ability to select a suitable measuring instrument for a given application.
5. The ability to estimate and correct deviations in measurements due to the influence of the instrument and due to the accuracy of the instrument.

UNIT - 1	06 Hours

DC Machines

DC machines 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).

UNIT - 2	06 Hours

Induction Motor and Synchronous Motor

Induction Motor: Construction, working principle, types, torque equation, torque slip characteristics, power stages, losses and efficiency, starters speed control, breaking, applications. **Synchronous motor:** Construction, working principle, starting methods, effect of load, hunting, V-curve, synchronous condenser, applications.

UNIT - 3	06 Hours

Special Purpose Machines

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

UNIT - 4	06 Hours

Sensors and Transducers

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.

UNIT - 5	06 Hours

Industrial Measurement and Industrial Applications

Measurement of vibration, electrical telemetry thickness, 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.

UNIT - 6	06 Hours

I/O Devices

Recorder X- Y plotters and its applications, optical oscillograph.

TEXT/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. Electrical Machines by Ashfaqu Husain, Dhanpatrai and publication
4. Instrumentation Devices System edition C. S. Rajan, G. R. sharma
5. Abhijit Chakrabarti & Sudipta Debnath, “Electrical Machines”, Tata McGraw-hill Publication.
6. William H Hayt, Jack E Kimmerly and Steven M. Durbin, “Engineering Circuit Analysis”, Tata McGraw Hill.
7. A.E. Fitzgerald, Charles Kingsley & Jr. Stephen D. Umans, “Electrical Machinery”, Tata McGraw-hill Publication 6th Edition.
8. I.J Nagarath & D.P Kothari, “Electrical Machines”, Tata McGraw-hill Publication 4th Edition.

9. T. J. E. Miller, "Brushless permanent-magnet and reluctance motor drives", Oxford University Press (1989).
10. Ned Mohan, "Electric Machines and Drives": A first course, Wiley.
11. B. L. Theraja, "Electrical technology" volume 2, S. Chand.

BTEXC402	Analog Communication Engineering	3 Credits

Course Objectives:

1. To introduce the concepts of analog communication systems.
2. To equip students with various issues related to analog communication such as modulation, demodulation, transmitters and receivers and noise performance.
3. To understand the concepts of modulation and demodulation techniques of angle modulation (frequency and phase)

Course Outcomes:

On completion of the course, students will be able to:

1. Understand and identify the fundamental concepts and various components of analog communication systems.
2. Understand the concepts of modulation and demodulation techniques.
3. Design circuits to generate modulated and demodulated wave.
4. Equip students with various issues related to analog communication such as modulation, demodulation, transmitters and receivers and noise performance.
5. Understand the concepts of modulation and demodulation techniques of angle modulation (frequency and phase).
6. Explain signal to noise ratio, noise figure and noise temperature for single and cascaded stages in a communication system.
7. Develop the ability to compare and contrast the strengths and weaknesses of various communication systems.

UNIT - 1	06 Hours

Introduction to Communication System

Block schematic of communication system, Simplex and duplex systems, Modes of communication: Broadcast and point to point communication, Necessity of modulation, Classification of modulation, sampling theorem and pulse analog modulation, multiplexing: TDM, FDM.

UNIT - 2	06 Hours

Amplitude Modulation

Introduction, Mathematical analysis and expression for AM, Modulation index, Frequency spectrum and bandwidth of AM, Power calculations, Generation of AM using nonlinear property, Low and high level modulation, Balance Modulator.

Types of AM: DSB-FC, DSB-SC, SSB-SC, ISB and VSB, their generation methods and comparison.

UNIT - 3	06 Hours

Angle Modulation

Introduction, Mathematical analysis of FM and PM, Modulation index for FM and PM, Frequency spectrum and bandwidth of FM, Narrow band and wide band FM, Direct and indirect methods of FM generation, Pre emphasis and de-emphasis, Comparison of AM, FM and PM.

UNIT - 4	06 Hours

Radio Receivers and Demodulators

Introduction, Performances characteristic of receivers: Sensitivity, Selectivity, Fidelity, Image frequency and IFRR, Tracking and Double spotting, TRF, Super heterodyne receivers, RF amplifier, Local oscillator and mixer, IF amplifier, AGC.

UNIT - 5	06 Hours

AM and FM Detectors

AM Detectors: Envelop detector and practical diode detector.

FM Detectors: Slope detector, phase discriminator and ratio detector.

UNIT - 6	06 Hours

Noise

Introduction, Sources of noise, Classification of noise, Noise calculations (thermal noise), SNR, Noise figure, Noise Factor, Noise Temperature.

TEXT/REFERENCE BOOKS

1. Kennedy, "Electronics Communications Systems", McGraw-Hill New Delhi-1997, 4^{th} Edition.
2. Anokh Singh, "Principles of communication engineering" S.Chand
3. Roddy & Coolen, "Electronic communication" PHI
4. Taub & Schilling "Principles of communication systems" Tata Mc Graw Hill
5. Beasley & Miller, "Modern Electronic Communication", Prentice-Hall India-2006, 8^{th} Edition.
6. Wayne Tomasi, "Electronic Communication Systems", Pearson Education-2005, 5^{th} Edition.
7. R. G. Gupta, "Audio & Video Systems" Tata McGraw-Hill New Delhi-2008.

BTEXC403	Microprocessor	3 Credits

Course Objectives:

1. Objective of this course is to introduce to the students the fundamentals of microprocessor.
2. After learning Microprocessor course, students will get advantage to pursue higher studies in Embedded Systems or employment in core industries.
3. The learner can design microprocessor based systems and thus can become successful entrepreneur and meet needs of Indian and multinational industries.
4. The students can design and develop processor which can be used in Robotics, Automobiles, Space and many research areas.
5. The learners will acquaint optimization skills and undergo concepts design metrics for embedded systems.
6. The students will get acquainted with recent trends in microprocessor like pipelining, cache memory etc.
7. To understand the applications of Microprocessors.
8. To learn interfacing of real world input and output devices.
9. To study various hardware and software tools for developing applications.

Course Outcomes:

1. Learner gains ability to apply knowledge of engineering in designing different case studies.

2. Students get ability to conduct experiments based on interfacing of devices to or interfacing to real world applications.
3. Students get ability to interface mechanical system to function in multidisciplinary system like in robotics, Automobiles.
4. Students can identify and formulate control and monitoring systems using microprocessors.
5. Students will design cost effective real time system to serve engineering solution for Global, social and economic context.
6. This course understanding will enforce students to acquire knowledge of recent trends like superscalar and pipelining and thus finds recognition of continuous updation.
7. Learn use of hardware and software tools.
8. Develop interfacing to real world devices.

UNIT - 1	07 Hours

Fundamentals of Microprocessor

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

UNIT - 2	07 Hours

Programming with 8085

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

UNIT - 3	07 Hours

Interrupts

Interrupt structure of 8085 microprocessor, processing of vectored and non-vectored interrupts, latency time and response time; Handling multiple interrupts.

UNIT - 4	07 Hours

Interfacing

Memory Interfacing, Interfacing with 8255 Programmable Peripheral Interface, 8254 Programmable Interval Timer, 8279 Display controller, Interrupt controller 8259.

UNIT - 5	07 Hours

Introduction of 8086 Microprocessor

Detail Architecture of 8086, Addressing Modes, Assembler directives, Co-Processor

TEXT/REFERENCE BOOKS

1. Microprocessor and interfacing 8085, Douglas V Hall, Tata Mc Gram Hill.
2. Microprocessor-Architecture, programming and application with 8085, gaonkar, penram international.
3. Short K. L., "Microprocessors and Programmed Logic", 2nd Ed.,Pearson Education, 2008..
4. D V kodavade, S. Narvadkar, 8085-86 microprocessors Architecture progg and interfaces, wiley.
5. Rout 8085 microcontroller-architecture, programming and application, 2^{nd} edi, penram international.

BTEXC404	Signals and Systems	3 Credits

Course Objectives:

1. To understand the mathematical description of continuous and discrete time signals and systems.
2. To classify signals into different categories.
3. To analyze Linear Time Invariant (LTI) systems in time and transform domains.
4. To build basics for understanding of courses such as signal processing, control system and communication.
5. To develop basis of probability and random variables.

Course Outcomes:

On completion of the course, students will be able to:

1. Understand mathematical description and representation of continuous and discrete time signals and systems.
2. Develop input output relationship for linear shift invariant system and understand the convolution operator for continuous and discrete time system.

3. Understand and resolve the signals in frequency domain using Fourier series and Fourier transforms.
4. Understand the limitations of Fourier transform and need for Laplace transform and develop the ability to analyze the system in s- domain.
5. Understand the basic concept of probability, random variables & random signals and develop the ability to find correlation, CDF, PDF and probability of a given event.

UNIT - 1	06 Hours

Introduction to Signals and Systems

Introduction and Classification of signals: Definition of signal and systems, 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 (Accumulator for DT), time scaling, time shifting and time folding, Sampling Theorem and reconstruction of sampled signal, Concept of aliasing, examples on under sampled and over sampled signals.

Systems: Definition, Classification: linear and non-linear, time variant and invariant, causal and non-causal, static and dynamic, stable and unstable, invertible.

UNIT - 2	06 Hours

Time domain representation of LTI System

System modeling: Input-output relation, definition of impulse response, convolution sum, convolution integral, computation of convolution integral using graphical method, Computation of convolution sum. Properties of convolution, properties of the system based on impulse response, step response in terms of impulse response.

UNIT - 3	06 Hours

Fourier Series

Fourier series (FS) representation of periodic Continuous Time (CT) signals, Dirichlet condition for existence of Fourier series, FS representation of CT signals using exponential Fourier series, Fourier spectrum representation, properties of Fourier series, Gibbs phenomenon, Discrete Time Fourier Series and its properties.

UNIT - 4	06 Hours

Fourier transform

Fourier Transform (FT) representation of aperiodic CT signals, Dirichlet condition for existence of Fourier transform, evaluation of magnitude and phase response, FT of standard CT signals, FT of standard periodic CT signals, Introduction to Fourier Transform of DT signals, Properties of CTFT and DTFT, Fourier Transform of periodic signals. Concept of sampling and reconstruction in frequency domain, sampling of bandpass signals.

UNIT - 5	06 Hours

Laplace and Z-transform

Definition of Laplace Transform (LT), Limitations of Fourier transform and need of Laplace transform, ROC and its properties, properties of Laplace transform, Laplace transform evaluation using properties, Inverse Laplace transform based on partial fraction expansion, Application of Laplace transforms to the LTI system analysis.

Introduction to Z-transform, and its properties, Inverse Z-transform, different methods of inverse Z-transform, Z-transform for discrete time system LTI analysis.

UNIT - 6	06 Hours

Probability and Random Signals

Probability: Experiment, sample space, event, probability, conditional probability and statistical independence, Bayes theorem, Random variables: Continuous and Discrete random variables, cumulative distributive function, Probability density function, properties of CDF and PDF. Definitions: Statistical averages, mean, moments and expectations, standard deviation and variance, Introduction to Correlation: Autocorrelation, Cross correlation, and their properties.

TEXT/REFERENCE BOOKS

1. Alan V. *Oppenheim*. Alan S. Willsky and S. Hamid Nawab, “Signals and Systems”, PHI
2. Dr. S. L. Nalbalwar, A.M. Kulkarni and S.P. Sheth, “Signals and Systems”, 2nd Edition, Synergy Knowledgeware, 2017
3. Simon Haykins and Barry Van Veen, “Signals and Systems”, 2nd Edition, Wiley India.
4. Shaila Apte, “Signals and Systems-principles and applications”, Cambridge University press, 2016.

5. Mrinal Mandal and Amir Asif, Continuous and Discrete Time Signals and Systems, Cambridge University Press, 2007.
6. Peyton Peebles, "Probability, Random Variable, Random Processes", 4th Edition, Tata McGraw Hill.
7. A. Nagoor Kanni "Signals and Systems", 2nd edition, McGraw Hill.
8. NPTEL video lectures on Signals and Systems.

BTID405	Product Design Engineering	2 Credits

Teaching Scheme:	Examination Scheme:
Lecture-cum-demonstration: 1 hr/week Design Studio: 2 hr/week	Continuous Assessment 1: 30 Marks Continuous Assessment 2: 30 Marks Final Assessment: 40 Marks

- Pre-requisites: Knowledge of Basic Sciences, Mathematics and Engineering Drawing
- Design Studio : 2 hr/week to develop design sketching and practical skills, learning digital tools
- Continuous Assessment: Progress through a product design and documentation of steps in the selected product design
- Final Assessment: Product Design in Studio with final product specifications

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

1. Create simple mechanical or other designs
2. Create design documents for knowledge sharing
3. Manage own work to meet design requirements
4. Work effectively with colleagues.

UNIT - 1	04 Hours

Introduction to Engineering Product Design:

Trigger for Product/ Process/ System, Problem solving approach for Product Design, Disassembling existing Product(s) and understanding relationship of components with each other, Sketching of components, identifying materials and their processing for final product, fitting of components, understanding manufacturing as scale of the components, Reverse engineering concept, case studies of products in markets, (or in each discipline), underlying principles, Case studies of product failures, revival of failed products, Public/Society's perception of products, and its input into product design.

UNIT - 2	04 Hours

Ideation:

Generation of ideas, Funnelling of ideas, Short-listing of ideas for product(s) as an individual or group of individuals, Sketching of products, Market research for need, competitions, scale and cost, Initial specifications of products.

UNIT - 3	04 Hours

Conceptualisation:

Computer operation principles and image editing through a graphical Composition; Computer aided 2D drafting and 3D Modeling through simple exercises.

Designing of components, Drawings of parts and synthesis of a product from its component parts, Rendering the designs for 3-D visualization and to create a photo realistic image, Parametric modelling of product, 3-D Visualization of mechanical products, Detail Engineering drawings of components.

UNIT - 4	04 Hours

Detailing:

Managing assembling, Product specifications- data Sheet, Simple mechanical designs, Workshop safety and health issues, Create documents for knowledge sharing.

Hands-on Activity Charts for Use of Digital Tools

Activity 1	Learn the basic vector sketching tools.	2
Activity 2	General understanding of shading for adding depth to objects. Understanding of editing vectors	2
Activity 3	Begin developing a thought process for using digital sketching.	3
Activity 4	Create a basic shape objects sphere, box cylinders	3
Activity 5	Create Automotive wheel concepts	3
Activity 6	Understanding Navigation and Data Panel Interface	2
Activity 7	Solid and Surface modelling, Rendering 3-D models	4
Activity 8	Product market and Product Specification Sheet	3
Activity 9	Documentation for the product	2

TEXT/REFERENCE BOOKS

1. Model Curriculum for “Product Design Engineer – Mechanical”, NASSCOM (Ref. ID: SSC/Q4201, Version 1.0, NSQF Level: 7)
2. Eppinger, S., & Ulrich, K.(2015). Product design and development. McGraw - Hill Higher Education.
3. Green, W., & Jordan, P. W. (Eds.). (1999).Human factors in product design: current practice and future trends. CRC Press.
4. Sanders, M. S., & McCormick, E. J. (1993). Human factors in engineering and design McGRAW- HILL book company.

5. Roozenburg, N. F., &Eekels, J. (1995). Product design: fundamentals and methods (Vol. 2). John Wiley & Sons Inc.
6. Lidwell, W., Holden, K., & Butler, J.(2010). Universal principles of designs, revised and updated: 125 ways to enhance usability, influence perception, increase appeal, make better design decisions, and teach through design. Rockport Pub.

BTBSC406	Numerical Methods and Computer Programming	3 Credits

Course Objectives:

1. To prepare students for successful career in industries, for Post Graduate programmes 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.
5. To understand various difference operators and interpolation techniques.
6. To understand object-oriented programming fundamentals and features.
7. To mold students professionally by course contents and sufficient problem solving and programming exercises and to acquaint them with different types of numerical techniques and programming concepts.

Course Outcomes:

On completion of the course, students will be able to:

1. Able to solve algebraic and transcendental equations by using numerical techniques and will be able to compare different numerical techniques used for this purpose and also will be able to choose a proper one as per the requirement of the problem.
2. Able to solve a system of linear equations with any number of variables using different direct and iterative numerical techniques.
3. Understand the concept of interpolation, finite difference operators and their relations, and can apply different interpolation techniques on equi-spaced or non equi-spaced data values.
4. Prepare them to write computer programs for the numerical computational techniques.

5. Understand application of the NMCP course in many engineering core subjects like signal processing, digital communication, numerical techniques in electromagnetics etc.
6. Understand procedure-oriented and object oriented programming concepts.
7. Capable of writing C and C++ programs efficiently.

UNIT - 1	06 Hours

Introduction to Computational Methods and Errors

Computational Methods: General principles of computational techniques, Introduction, common ideas and concepts of computational methods, various computational techniques. Errors: Types and sources of errors, Concept in error estimation, Error propagation, Error due to floating point, Representation of errors, Elementary uses of series in calculation of errors.

UNIT - 2	06 Hours

Solution of Transcendental / Polynomial Equations and System of Linear Equation

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, Matrix triangularisation (LU decomposition), Cholesky, Gauss Seidel and Jacobi methods.

UNIT - 3	06 Hours

Interpolation and Polynomial Approximation

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.

UNIT - 4	06 Hours

Numerical Integration and Differentiation

Numerical Integration: Methods based on interpolation such as Trapezoidal rule, Simsons 1/3 and 3/8 rules. Numerical differentiation: Euler's method, Modified Euler's method, Taylor's series, Runge Kutta $2^{nd}$and 4^{th} order, Stability analysis of above methods.

UNIT - 5	06 Hours

Object Oriented Programming

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.

UNIT - 6	06 Hours

Operator Overloading and Type Conversions

Defining operator overloading, Overloading unary operators, Overloading binary operators, Manipulation of strings operators, Rules for overloading operators. Inheritance: Extending Classes: Defining derived classes, Single inheritance, multilevel inheritance, multiple inheritance, Hierarchical inheritance, Hybrid inheritance, Virtual base classes, Abstract classes, Member classes: Nesting of classes Pointers Virtual Functions and Polymorphism: Pointers to objects, Pointers to derived classes, Virtual functions, pure virtual functions Managing Console I/O Operations C++ Streams, C++ Stream Classes, Unformatted I/O Operations, Managing output with manipulators.

TEXT/REFERENCE BOOKS

1. S. S. Sastry, "Introductory Methods of Numerical Analysis", PHI, 1990, 3rd edition.
2. V. Rajaraman, "Computer Oriented Numerical Methods, PHI, New Delhi", 2000, 3rd Edition.
3. E. V. Krishnamurthy, and Sen S. K., "Numerical Algorithm: Computations in Science and Engg", Affiliated East West, New Delhi, 1996.
4. D. Ravichandran, "Programming with C++", TMH
5. E. Balagurusamy, "Object-Oriented Programming with C++", TMH, New Delhi, 2001,2ndEdition

Dr. Babasaheb Ambedkar Technological University, Lonere.

B. Tech (Electronics & Telecommunication Engineering) / B. Tech (Electronics Engineering)

Curriculum for Semester III [Second Year]

Sr. No.	Course Code	Course Title	Hours Per Week			Evaluation Scheme			Total Marks	Credits
			L	T	P	MSE	CA	ESE		
1	BTBSC301	Engineering Mathematics-III	3	1	0	20	20	60	100	4
2	BTEXC302	Analog Circuits	2	1	0	20	20	60	100	3
3	BTEXC303	Electronic Devices & Circuits	2	1	0	20	20	60	100	3
4	BTEXC304	Network Analysis	2	1	0	20	20	60	100	3
5	BTEXC305	Digital Logic Design	2	1	0	20	20	60	100	3
6	BTHM3401	Basic Human Rights	2	0	0	--	50	--	50	(Audit)
7	BTEXL307	Analog Circuits Lab	0	0	2	--	60	40	100	1
8	BTEXL308	Electronic Devices & Circuits Lab	0	0	2	--	60	40	100	1
9	BTEXL309	Network Analysis Lab	0	0	2	--	60	40	100	1
10	BTEXL310	Digital Logic Design Lab	0	0	2	--	60	40	100	1
11	BTEXW311	Electronics Workshop	0	0	2	--	60	40	100	1
12	BTES211P	Field Training/ Internship/Industrial Training Evaluation	--	--	--	--	--	50	50	1
		Total	**13**	**05**	**10**	**100**	**450**	**550**	**1100**	**22**

B. Tech (Electronics & Telecommunication Engineering) / B. Tech (Electronics Engineering)

Curriculum for Semester IV [Second Year]

Sr. No	Course Code	Course Title	Hours Per Week			Evaluation Scheme			Total Marks	Credits
			L	T	P	MSE	CA	ESE		
1	BTEXC401	Electrical Machines and Instruments	2	1	0	20	20	60	100	3
2	BTEXC402	Analog Communication Engineering	2	1	0	20	20	60	100	3
3	BTEXC403	Microprocessor	2	1	0	20	20	60	100	3
4	BTEXC404	Signals and Systems	2	1	0	20	20	60	100	3
5	BTID405	Product Design Engineering	1	0	2	30	30	40	100	2
6	BTBSC406	Numerical Methods and Computer Programming	2	1	0	20	20	60	100	3
7	BTEXL407	Electrical Machines and Instruments Lab	0	0	2	--	60	40	100	1
8	BTEXL408	Analog Communication Engineering Lab	0	0	2	--	60	40	100	1
9	BTEXL409	Microprocessor Lab	0	0	2	--	60	40	100	1
10	BTEXL410	Signals and Systems Lab	0	0	2	--	60	40	100	1
11	BTHML411	Soft-Skill Development	0	0	2	--	60	40	100	1

12	BTEXF412	Field Training/ Internship/Industrial Training (Minimum 4 weeks which can be completed partially in third semester or fourth semester or in at one time)	--	--	--	--	--	--	--	1 (To be evaluated in Vth Semester)
		Total	**11**	**05**	**12**	**130**	**430**	**540**	**1100**	**22**

BTBSC301	Engineering Mathematics-III	4 Credits

Second Year B. Tech Classes (Common to all Branches) Semester: III

Prerequisites: Differential and Integral Calculus, Taylor series and Infinite series, Differential equations of first order and first degree, Fourier series, Vector algebra, Algebra of complex numbers.

Course Objectives:

After completion of the course, students will have adequate background, conceptual clarity and knowledge of appropriate solution techniques related to:

1. Linear differential equations of higher order using analytical methods and numerical methods applicable to Control systems and Network analysis.
2. Transforms such as Fourier transform, Laplace transform and applications to Communication systems and Signal processing.
3. Vector differentiation and integration required in Electromagnetics and Wave theory.
4. Complex functions, conformal mappings, contour integration applicable to Electrostatics, Digital filters, Signal and Image processing.

Course Outcomes:

On completion of the course, students will be able to:

1. Solve higher order linear differential equation using appropriate techniques for modeling and analyzing electrical circuits.
2. Solve problems related to Fourier transform, Laplace transform and applications to Communication systems and Signal processing.
3. Obtain Interpolating polynomials, numerically differentiate and integrate functions, numerical solutions of differential equations using single step and multi-step iterative methods used in modern scientific computing.
4. Perform vector differentiation and integration, analyze the vector fields and apply to Electromagnetic fields.
5. Analyze conformal mappings, transformations and perform contour integration of complex functions in the study of electrostatics and signal processing.

UNIT - 1 **07 Hours**

Laplace Transform

Definition – conditions for existence ; Transforms of elementary functions ; Properties of Laplace transforms - Linearity property, first shifting property, second shifting property, transforms of functions multiplied by t^n, scale change property, transforms of functions divided by t, transforms of integral of functions, transforms of derivatives ; Evaluation of integrals by using Laplace transform ; Transforms of some special functions- periodic function, Heaviside-unit step function, Dirac delta function.

UNIT - 2 **07 Hours**

Inverse Laplace Transform

Introductory remarks ; Inverse transforms of some elementary functions ; General methods of finding inverse transforms ; Partial fraction method and Convolution Theorem for finding inverse Laplace transforms ; Applications to find the solutions of linear differential equations and simultaneous linear differential equations with constant coefficients.

UNIT - 3 **07 Hours**

Fourier Transform

Definitions – integral transforms ; Fourier integral theorem (without proof) ; Fourier sine and cosine integrals ; Complex form of Fourier integrals ; Fourier sine and cosine transforms ; Properties of Fourier transforms ; Parseval's identity for Fourier Transforms.

UNIT - 4 **07 Hours**

Partial Differential Equations and Their Applications

Formation of Partial differential equations by eliminating arbitrary constants and functions; Equations solvable by direct integration; Linear equations of first order (Lagrange's linear equations); Method of separation of variables – applications to find solutions of one dimensional heat flow equation $\left(\frac{\partial u}{\partial t} = c^2 \frac{{}^2u}{\partial x^2}\right)$, and two dimensional heat flow equation (i.e. Laplace equation : $\frac{{}^2u}{\partial x^2} + \frac{{}^2u}{\partial y^2} = 0$).

UNIT - 5	07 Hours

Functions of Complex Variables (Differential calculus)

Limit and continuity of f(z); Derivative of f(z) ; Analytic functions; Cauchy- Riemann equations in Cartesian and polar forms; Harmonic functions in Cartesian form; Mapping: Translation, magnification and rotation, inversion and reflection , bilinear transformation; Conformal mapping.

UNIT - 6	07 Hours

Functions of Complex Variables (Integral calculus)

Cauchy's integral theorem; Cauchy's integral formula; Residues; Cauchy's residue theorem (All theorems without proofs).

TEXT BOOKS

1. Higher Engineering Mathematics by B. S. Grewal, Khanna Publishers, New Delhi.
2. Advanced Engineering Mathematics by Erwin Kreyszig, John Wiley & Sons, New York.
3. A Course in Engineering Mathematics (Vol III) by Dr. B. B. Singh, Synergy Knowledge ware, Mumbai.
4. A Text Book of Applied Mathematics (Vol I & II) by P. N. Wartikar and J. N. Wartikar, Pune Vidyarthi Griha Prakashan, Pune.
5. Higher Engineering Mathematics by H. K. Das and Er. Rajnish Verma, S. Chand & CO. Pvt. Ltd., New Delhi.

REFERENCE BOOKS

1. Higher Engineering Mathematics by B. V. Ramana, Tata McGraw-Hill Publications, New Delhi.
2. A Text Book of Engineering Mathematics by Peter O' Neil, Thomson Asia Pte Ltd., Singapore.
3. Advanced Engineering Mathematics by C. R. Wylie & L. C. Barrett, Tata Mcgraw-Hill Publishing Company Ltd., New Delhi.
4. Integral Transforms and Their Engineering Applications by Dr. B. B. Singh, Synergy . Knowledge ware, Mumbai.

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

GENERAL INSTRUCTIONS

1. The tutorial classes in Engineering Mathematics-III are to be conducted batch wise. 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.

BTEXC302	Analog Circuits	3 Credits

Course Objectives:

1. To understand characteristics of IC and Op-Amp and identify the internal structure.
2. To introduce various manufacturing techniques.
3. To study various op-amp parameters and their significance for Op-Amp.
4. To learn frequency response, transient response and frequency compensation techniques for Op-Amp.
5. To analyze and identify linear and nonlinear applications of Op-Amp.
6. To understand functionalities of PLL.

Course Outcomes:

On completion of the course, students will be able to:

1. Understand the characteristics of IC and Op-Amp and identify the internal structure.
2. Understand and identify various manufacturing techniques.
3. Derive and determine various performances based parameters and their significance for Op-Amp.
4. Comply and verify parameters after exciting IC by any stated method.
5. Analyze and identify the closed loop stability considerations and I/O limitations.
6. Analyze and identify linear and nonlinear applications of Op-Amp.
7. Understand and verify results (levels of V & I) with hardware implementation.
8. Implement hardwired circuit to test performance and application for what it is being designed.
9. Understand and apply the functionalities of PLL.

UNIT - 1	06 Hours

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 R_i, R_o, bandwidth and voltage gain.

UNIT - 2	06 Hours

Linear Applications of OP-AMP

Inverting and non-inverting amplifier configurations, voltage follower, summing, averaging scaling amplifier, difference amplifier, integrator, differentiator, and instrumentation amplifiers.

UNIT - 3	06 Hours

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.

UNIT - 4	06 Hours

Converters using OP-AMP

V-F, I-V and V-I converter, Digital-to-analog converters (DAC): Weighted resistor, R-2R ladder, resistor string etc. Analog-to-digital converters (ADC): Single slope, dual slope, successive approximation, flash type.

UNIT - 5	06 Hours

Oscillators

Principle of Oscillators, Barkhausen criterion, Oscillator types: RC oscillators (design of phase shift, Wien bridge etc.), LC oscillators (design of Hartley, Colpitts, Clapp etc.), non-sinusoidal oscillators, and voltage controlled oscillators.

UNIT - 6	06 Hours

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.

TEXT/REFERENCE BOOKS

1. Ramakant A. Gaikwad, “Op Amps and Linear Integrated Circuits”, Pearson Education 2000.
2. Salivahanan and Kanchana Bhaskaran, “Linear Integrated Circuits”, Tata McGraw Hill, India 2008.
3. George Clayton and Steve Winder, “Operational Amplifiers”, 5th Edition Newnes.
4. Sergio Franco, “Design with Operational Amplifiers and Analog Integrated Circuits”, Tata McGraw Hill.
5. Bali, “Linear Integrated Circuits”, McGraw Hill 2008.
6. Gray, Hurst, Lewise, Meyer, “Analysis & Design of Analog Integrated Circuits”, Wiley Publications on Education.

BTEXC303	Electronic Devices & Circuits	3 Credits

Prerequisites:

Basic knowledge of Semiconductor Physics.

Course Objectives:

1. To introduce semiconductor devices FET and MOSFET, their characteristics, operations, circuits and applications
2. To introduce concepts of both positive and negative feedback in electronic circuits
3. To analyze and interpret FET and MOSFET circuits for small signal at low and high frequencies
4. To simulate electronics circuits using computer simulation software and verify desired results
5. To study the different types of voltage regulators.

Course Outcomes:

On completion of the course, students will be able to:

1. Comply and verify parameters after exciting devices by any stated method.
2. Implement circuit and test the performance.
3. Analyze small signal model of FET and MOSFET.
4. Explain behavior of FET at low frequency.
5. Design an adjustable voltage regulator circuits.

UNIT - 1	06 Hours

JFET

Introduction to JFET, Types, Construction, Operation, Static Characteristics, Pinch off voltage, FET Volt-Ampere characteristics, FET Configurations (CS/CD/CG) and their Comparison. Biasing of FET (Self).FET as an amplifier and its analysis (CS) and its frequency response, Small signal model, FET as High Impedance circuits

UNIT - 2	06 Hours

MOSFET& its DC Analysis

Basics of MOS Transistor operation, Construction of n-channel E-MOSFET, E-MOSFET characteristics & parameters, non-ideal voltage current characteristics viz. Finite output resistance, body effect, sub-threshold conduction, breakdown effects and temperature effects. 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, Voltage references, Basic principle of band gap reference, CMOS Inverter as amplifier: Active load, Current source and Push pull configurations.

UNIT - 3	06 Hours

Electronics Amplifiers

Classification of amplifiers, Fundamentals of Low noise and Power amplifiers. Feedback amplifiers: Feedback concept and topologies, Effect of feedback on terminal characteristics of amplifiers, feedback amplifier analysis, cascade amplifiers, DC Amplifiers.

UNIT - 4	06 Hours

Oscillators

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.

UNIT - 5	06 Hours

Multivibrators

IC555 Block diagram, Types of Multivibrators: Astable, Monostable and Bistable, Operation of Multivibrators using FETs and IC555. Applications of IC555 in Engineering.

UNIT - 6	06 Hours

Voltage Regulator

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/REFERENCE BOOKS

1. Millman Halkias, "Integrated Electronics-Analog and Digital Circuits and Systems", Tata McGraw Hill, 2000
2. Donald Neaman, "Electronic Circuit Analysis and Design", 3rd Edition, Tata McGraw Hill
3. Brijesh Iyer, S. L. Nalbalwar, R. Dudhe, "Electronics Devices & Circuits", Synergy Knowledgeware Mumbai, 2017. ISBN:9789383352616
4. David A. Bell, "Electronic Devices and Circuits",5^{th} Edition, Oxford Press
5. R. L. Boylstad, L. Nashlesky, "Electronic Devices and circuits Theory", 9thEdition, Prentice Hall of India, 2006.

BTEXC304	Network Analysis	3 Credits

Course Objectives:

1. To learn about the basic laws of electric circuits as well as the key fundamentals of the communication channels, namely transmission lines.
2. To understand the need of simplification techniques of complicated circuits
3. To learn about the comprehensive insight into the principle techniques available for characterizing circuits, networks and their implementation in practice.
4. To learn about the use of mathematics, need of different transforms and usefulness of differential equations for analysis of networks.
5. To train the students for handling analog filter design through theory of NA along with practical, this is basic requirement of signal processing field.

Course Outcomes:

On completion of the course, students will be able to:

1. Apply knowledge of mathematics to solve numerical based on network simplification and it will be used to analyze the same.
2. Design passive filters and attenuators theoretically and practically. To apply knowledge for design of active filters as well as digital filters and even extend this to advance adaptive filters.
3. Identify issues related to transmission of signals, analyze different RLC networks.
4. Find technology recognition for the benefit of the society.

UNIT - 1	06 Hours

Basic Circuit Analysis and Simplification Techniques

Basic circuit elements, Simplification of networks, Equivalent ‘T’ and ‘Π’ networks of any complicated network, Voltage and Current laws (KVL/KCL), Network Analysis: Mesh, Super mesh, Node and Super Node analysis. Principle of duality, Source transformation and source shifting, Network Theorems such as Superposition, Thevenin’s, Norton’s and Maximum Power Transfer Theorems.

Note*: Above circuit analysis, mentioned in this Unit-1, is for AC network only.*

UNIT - 2	06 Hours

Frequency Selective Networks

Significance of Quality factor, Series Resonance: Resonating frequency, Reactance curves, Variation of circuit parameters such as impedance, phase angle, voltage and current with frequency; Bandwidth, Selectivity, Magnification factor, Parallel resonance: Resonant frequency, Variation circuit parameters such as admittance, phase angle, voltage and current with frequency; Bandwidth and selectivity. Analysis of parallel resonating circuit with resistance present in both branches (inductive and capacitive branches) and tank circuit, Effect of generator resistance on BW & Selectivity, Comparison and applications of series and parallel resonant circuits.

UNIT - 3	06 Hours

Electrical Network Parameters and Passive Filters

Classifications: Symmetrical and Asymmetrical networks. Properties of two port Network :(i) Symmetrical Networks (T and Π only): Characteristics impedance and propagation constant in terms of circuit components, open and short circuit parameters (ii) Asymmetrical

Networks: Image Impedance and Iterative Impedance. Passive Filters: Filter fundamentals, Introduction to Neper and Decibel, Relation between Neper and Decibel, Constant K-LPF, HPF, BPF and BSF, m-derived LPF and HPF, Terminating half sections, Concept of composite filters. Attenuators: Symmetrical T and Π type attenuators, Ladder attenuator.

UNIT - 4	06 Hours

Steady State and Transient Response

DC and AC response of R-L, R-C and RLC circuits, Analysis of electrical circuits using Laplace Transform.

UNIT - 5	06 Hours

Two Port Network Parameters and Functions

Terminal characteristics of network: Z, Y, h, ABCD Parameters; Reciprocity and Symmetry conditions, Applications of the parameters. Network functions for one port and two port networks, Pole-zeros of network functions and network stability.

UNIT - 6	06 Hours

Transmission Line Theory

Types of Transmission lines, Transmission Line Equation, Equivalent circuits, Primary and Secondary line constants, Terminations of transmission lines, VSWR and Reflection Coefficient, Impedance matching, Transmission line measurements using Smith chart.

TEXT/REFERENCE BOOKS

1. D Roy Choudary, “Network and Systems” 1st edition, New Age International, 1988
2. John D. Ryder, “Network Lines and Fields” 2nd edition, PHI, 1955
3. C. P. Kuriakose, “Circuit Theory Continuous and Discrete Time System, Elements of Network Synthesis” PHI
4. W.H. Hayt Kemmerly, “Engineering Circuit Analysis”, 5th Edition, Tata McGraw Hill Publications, 1993.
5. M. E. Van Valkenburg, “Network Analysis”, 3rd Edition, Pearson, 2004. 6. Boylestead, “Introductory Circuit Analysis”, 4th edition, Charles & Merrill, 1982. 7. Royal Signal Handbook on Line Communication.

BTEXC305	Digital Logic Design	3 Credits

Course Objectives:

1. To acquaint the students with the fundamental principles of two-valued logic and various devices used to implement logical operations on variables.
2. To lay the foundation for further studies in areas such as communication, VHDL, computer.

Course Outcomes:

On completion of the course, students will be able to:

1. Use the basic logic gates and various reduction techniques of digital logic circuit in detail.
2. Design combinational and sequential circuits.
3. Design and implement hardware circuit to test performance and application.
4. Understand the architecture and use of VHDL for basic operations and Simulate using simulation software.

UNIT - 1	06 Hours

Combinational Logic Design

Standard representations for logic functions, k map representation of logic functions (SOP and POS forms), minimization of logical functions for min-terms and max-terms (upto 4 variables), don‘t care conditions, Design Examples: Arithmetic Circuits, BCD - to - 7 segment decoder, Code converters. Adders and their use as subtractor, look ahead carry, ALU, Digital Comparator, Parity generators/checkers, Design of Multiplexers and De-multiplexers, Decoders.

UNIT - 2	06 Hours

Sequential Logic Design

1 Bit Memory Cell, Clocked SR, JK, MS J-K flip flop, D and T flip-flops. Use of preset and clear terminals, Excitation Table for flip flops, Conversion of flip flops. Application of Flip-flops: Registers, Shift registers, Counters (ring counters, twisted ring counters), Sequence Generators, ripple counters, up/down counters, synchronous counters, definitions of lock out, Clock Skew, and Clock jitter.

UNIT - 3	06 Hours

State Machines

Basic design steps- State diagram, State table, State reduction, State assignment, Mealy and Moore machines representation, Implementation, finite state machine implementation, Sequence detector.

UNIT - 4	06 Hours

Digital Logic Families

Classification of logic families, Characteristics of digital ICs-Speed of operation, power dissipation, figure of merit, fan in, fan out, current and voltage parameters, noise immunity, operating temperatures and power supply requirements. TTL logic, Operation of TTL NAND gate, active pull up, wired AND, open collector output, unconnected inputs. Tri-State logic. CMOS logic – CMOS inverter, NAND, NOR gates, unconnected inputs, wired logic, open drain output. Interfacing CMOS and TTL, Comparison table of Characteristics of TTL, CMOS, ECL, RTL, I^2L and DCTL

UNIT - 5	06 Hours

Programmable Logic Devices and Semiconductor Memories

Programmable logic devices: Detail architecture, Study of PROM, PAL, PLA, Designing combinational circuits using PLDs. General Architecture of FPGA and CPLD Semiconductor memories: memory organization and operation, expanding memory size, Classification and characteristics of memories, RAM, ROM, EPROM, EEPROM, NVRAM, SRAM, DRAM.

UNIT - 6	06 Hours

Introduction to VHDL

Behavioral – data flow, and algorithmic and structural description, lexical elements, data objects types, attributes, operators; VHDL coding examples, combinational circuit design examples in VHDL and simulation.

TEXT/REFERENCE BOOKS

1. R.P. Jain, ―Modern digital electronics‖, 3rd edition, 12threprint Tata McGraw Hill Publication, 2007.

2. M. Morris Mano, ―Digital Logic and Computer Design‖ 4th edition, Prentice Hall of India, 2013.
3. Anand Kumar, ―Fundamentals of digital circuits‖ 1st edition, Prentice Hall of India, 2001.
4. Pedroni V.A., "Digital Circuit Design with VHDL", Prentice Hall India, 2nd 2001 Edition.

BTHM3401	Basic Human Rights	Audit

Course Objectives:

1. To work for ensuring that basic human rights are respected everywhere.
2. To cooperate to avoid compromising on human rights for economic or political expediency
3. To recognize democratic institutions as a fundamental human right
4. To work towards the sovereignty and self-determination of entities with historical, cultural and ecological identity.
5. To actively engage with the Government of India and other countries to promote human rights education.
6. To bring diplomatic and commercial pressures on regimes that violates human rights, to ensure that they respect the basic rights of their citizens.
7. To keep the interests of disempowered communities foremost in all dealings with countries in which human rights violations occur
8. To develop a more distinctive and effective role for the International Court of Justice in the field of human rights
9. To promote a culture for educating the citizenry that cultivation and promotion of human rights culture is the sine qua non for the smooth functioning of the organs of a democratic State and for the kind of development that results into overall development of the society.
10. To train the young men and women for facing the challenges of the pluralistic society and the rising conflicts and tensions in the name of particularistic loyalties to caste, religion, region and culture
11. To study the effects of draconian laws and unlawful use of State's machinery and force by the enforcement agencies.

Course Outcomes:

On completion of the course, students will be able to:

1. Simply put, human rights education is all learning that develops the knowledge, skills, and values of human rights.
2. Strengthen the respect for human rights and fundamental freedoms.
3. Enable all persons to participate effectively in a free society.
4. Learn about human rights principles, such as the universality, indivisibility, and interdependence of human rights.
5. Learn about regional, national, state, and local law that reinforces international human rights law.
6. Learn and know about and being able to use global, regional, national, and local human rights instruments and mechanisms for the protection of human rights.

UNIT - 1	06 Hours

The Basic Concepts

Individual, Group, Civil Society, State, Equality, Justice, Human Values: - Humanity, Virtues, Compassion.

UNIT - 2	06 Hours

Human Rights and Human Duties

Origin, Civil and Political Rights, Contribution of American Bill of Rights, French Revolution, Declaration of Independence, Rights of Citizen, Rights of working and Exploited people, Fundamental Rights and Economic program, India's Charter of freedom

UNIT - 3	06 Hours

Society, Religion, Culture, and their Inter-Relationship

Impact of Social Structure on Human behavior, Roll of Socialization in Human Values, Science and Technology, Modernization, Globalization, and Dehumanization.

UNIT - 4	06 Hours

Social Structure and Social Problems

Social and Communal Conflicts and Social Harmony, Rural Poverty, Unemployment, Bonded Labour, Migrant workers and Human Rights Violations, Human Rights of mentally and physically challenged

UNIT - 5	06 Hours

State, Individual Liberty, Freedom and Democracy

The changing of state with special reference to developing countries, Concept of development under development and Social action, need for Collective action in developing societies and methods of Social action, NGOs and Human Rights in India: - Land, Water, Forest issues.

UNIT - 6	06 Hours

Human Rights in Indian Constitution and Law

The constitution of India:

(i) Preamble

(ii) Fundamental Rights

(iii) Directive principles of state policy

(iv) Fundamental Duties

(v) Some other provisions

Universal declaration of Human Rights and Provisions of India, Constitution and Law, National Human Rights Commission and State Human Rights Commission.

TEXT/REFERENCE BOOKS

1. Shastry, T. S. N., India and Human rights: Reflections, Concept Publishing Company India (P Ltd.), 2005.
2. Nirmal, C.J., Human Rights in India: Historical, Social and Political Perspectives (Law in India), Oxford India.

BTEXC401	Electrical Machines and Instruments	3 Credits

Course Objectives:

1. Model and Analyze the performance of different types of DC machines
2. Learn the applications of DC generators
3. Analyze the performance of different types of DC motors
4. Analyze the performance of different types of Sensors and Transducers

5. Familiarize with the applications of DC machines
6. To prepare students to perform the analysis of any electromechanical system.
7. To empower students to understand the working of electrical equipment used in everyday life.

Course Outcomes:

On completion of the course, students will be able to:

1. The ability to formulate and then analyze the working of any electrical machine using mathematical model under loaded and unloaded conditions.
2. The skill to analyze the response of any electrical machine.
3. The ability to troubleshoot the operation of an electrical machine.
4. The ability to select a suitable measuring instrument for a given application.
5. The ability to estimate and correct deviations in measurements due to the influence of the instrument and due to the accuracy of the instrument.

UNIT - 1	06 Hours

DC Machines

DC machines 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).

UNIT - 2	06 Hours

Induction Motor and Synchronous Motor

Induction Motor: Construction, working principle, types, torque equation, torque slip characteristics, power stages, losses and efficiency, starters speed control, breaking, applications. **Synchronous motor:** Construction, working principle, starting methods, effect of load, hunting, V-curve, synchronous condenser, applications.

UNIT - 3	06 Hours

Special Purpose Machines

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

UNIT - 4	06 Hours

Sensors and Transducers

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.

UNIT - 5	06 Hours

Industrial Measurement and Industrial Applications

Measurement of vibration, electrical telemetry thickness, 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.

UNIT - 6	06 Hours

I/O Devices

Recorder X- Y plotters and its applications, optical oscillograph.

TEXT/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. Electrical Machines by Ashfaqu Husain, Dhanpatrai and publication
4. Instrumentation Devices System edition C. S. Rajan, G. R. sharma
5. Abhijit Chakrabarti & Sudipta Debnath, “Electrical Machines”, Tata McGraw-hill Publication.
6. William H Hayt, Jack E Kimmerly and Steven M. Durbin, “Engineering Circuit Analysis”, Tata McGraw Hill.
7. A.E. Fitzgerald, Charles Kingsley & Jr. Stephen D. Umans, “Electrical Machinery”, Tata McGraw-hill Publication 6th Edition.
8. I.J Nagarath & D.P Kothari, “Electrical Machines”, Tata McGraw-hill Publication 4th Edition.

9. T. J. E. Miller, "Brushless permanent-magnet and reluctance motor drives", Oxford University Press (1989).
10. Ned Mohan, "Electric Machines and Drives": A first course, Wiley.
11. B. L. Theraja, "Electrical technology" volume 2, S. Chand.

BTEXC402	Analog Communication Engineering	3 Credits

Course Objectives:

1. To introduce the concepts of analog communication systems.
2. To equip students with various issues related to analog communication such as modulation, demodulation, transmitters and receivers and noise performance.
3. To understand the concepts of modulation and demodulation techniques of angle modulation (frequency and phase)

Course Outcomes:

On completion of the course, students will be able to:

1. Understand and identify the fundamental concepts and various components of analog communication systems.
2. Understand the concepts of modulation and demodulation techniques.
3. Design circuits to generate modulated and demodulated wave.
4. Equip students with various issues related to analog communication such as modulation, demodulation, transmitters and receivers and noise performance.
5. Understand the concepts of modulation and demodulation techniques of angle modulation (frequency and phase).
6. Explain signal to noise ratio, noise figure and noise temperature for single and cascaded stages in a communication system.
7. Develop the ability to compare and contrast the strengths and weaknesses of various communication systems.

UNIT - 1	06 Hours

Introduction to Communication System

Block schematic of communication system, Simplex and duplex systems, Modes of communication: Broadcast and point to point communication, Necessity of modulation, Classification of modulation, sampling theorem and pulse analog modulation, multiplexing: TDM, FDM.

UNIT - 2	06 Hours

Amplitude Modulation

Introduction, Mathematical analysis and expression for AM, Modulation index, Frequency spectrum and bandwidth of AM, Power calculations, Generation of AM using nonlinear property, Low and high level modulation, Balance Modulator.

Types of AM: DSB-FC, DSB-SC, SSB-SC, ISB and VSB, their generation methods and comparison.

UNIT - 3	06 Hours

Angle Modulation

Introduction, Mathematical analysis of FM and PM, Modulation index for FM and PM, Frequency spectrum and bandwidth of FM, Narrow band and wide band FM, Direct and indirect methods of FM generation, Pre emphasis and de-emphasis, Comparison of AM, FM and PM.

UNIT - 4	06 Hours

Radio Receivers and Demodulators

Introduction, Performances characteristic of receivers: Sensitivity, Selectivity, Fidelity, Image frequency and IFRR, Tracking and Double spotting, TRF, Super heterodyne receivers, RF amplifier, Local oscillator and mixer, IF amplifier, AGC.

UNIT - 5	06 Hours

AM and FM Detectors

AM Detectors: Envelop detector and practical diode detector.

FM Detectors: Slope detector, phase discriminator and ratio detector.

UNIT - 6	06 Hours

Noise

Introduction, Sources of noise, Classification of noise, Noise calculations (thermal noise), SNR, Noise figure, Noise Factor, Noise Temperature.

TEXT/REFERENCE BOOKS

1. Kennedy, "Electronics Communications Systems", McGraw-Hill New Delhi-1997, 4th Edition.
2. Anokh Singh, "Principles of communication engineering" S.Chand
3. Roddy & Coolen, "Electronic communication" PHI
4. Taub & Schilling "Principles of communication systems" Tata Mc Graw Hill
5. Beasley & Miller, "Modern Electronic Communication", Prentice-Hall India-2006, 8th Edition.
6. Wayne Tomasi, "Electronic Communication Systems", Pearson Education-2005, 5th Edition.
7. R. G. Gupta, "Audio & Video Systems" Tata McGraw-Hill New Delhi-2008.

BTEXC403	**Microprocessor**	**3 Credits**

Course Objectives:

1. Objective of this course is to introduce to the students the fundamentals of microprocessor.
2. After learning Microprocessor course, students will get advantage to pursue higher studies in Embedded Systems or employment in core industries.
3. The learner can design microprocessor based systems and thus can become successful entrepreneur and meet needs of Indian and multinational industries.
4. The students can design and develop processor which can be used in Robotics, Automobiles, Space and many research areas.
5. The learners will acquaint optimization skills and undergo concepts design metrics for embedded systems.
6. The students will get acquainted with recent trends in microprocessor like pipelining, cache memory etc.
7. To understand the applications of Microprocessors.
8. To learn interfacing of real world input and output devices.
9. To study various hardware and software tools for developing applications.

Course Outcomes:

1. Learner gains ability to apply knowledge of engineering in designing different case studies.

2. Students get ability to conduct experiments based on interfacing of devices to or interfacing to real world applications.
3. Students get ability to interface mechanical system to function in multidisciplinary system like in robotics, Automobiles.
4. Students can identify and formulate control and monitoring systems using microprocessors.
5. Students will design cost effective real time system to serve engineering solution for Global, social and economic context.
6. This course understanding will enforce students to acquire knowledge of recent trends like superscalar and pipelining and thus finds recognition of continuous updation.
7. Learn use of hardware and software tools.
8. Develop interfacing to real world devices.

UNIT - 1	07 Hours

Fundamentals of Microprocessor

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

UNIT - 2	07 Hours

Programming with 8085

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

UNIT - 3	07 Hours

Interrupts

Interrupt structure of 8085 microprocessor, processing of vectored and non-vectored interrupts, latency time and response time; Handling multiple interrupts.

UNIT - 4	07 Hours

Interfacing

Memory Interfacing, Interfacing with 8255 Programmable Peripheral Interface, 8254 Programmable Interval Timer, 8279 Display controller, Interrupt controller 8259.

UNIT - 5	07 Hours

Introduction of 8086 Microprocessor

Detail Architecture of 8086, Addressing Modes, Assembler directives, Co-Processor

TEXT/REFERENCE BOOKS

1. Microprocessor and interfacing 8085, Douglas V Hall, Tata Mc Gram Hill.
2. Microprocessor-Architecture, programming and application with 8085, gaonkar, penram international.
3. Short K. L., "Microprocessors and Programmed Logic", 2nd Ed.,Pearson Education, 2008..
4. D V kodavade, S. Narvadkar, 8085-86 microprocessors Architecture progg and interfaces, wiley.
5. Rout 8085 microcontroller-architecture, programming and application, 2nd edi, penram international.

BTEXC404	Signals and Systems	3 Credits

Course Objectives:

1. To understand the mathematical description of continuous and discrete time signals and systems.
2. To classify signals into different categories.
3. To analyze Linear Time Invariant (LTI) systems in time and transform domains.
4. To build basics for understanding of courses such as signal processing, control system and communication.
5. To develop basis of probability and random variables.

Course Outcomes:

On completion of the course, students will be able to:

1. Understand mathematical description and representation of continuous and discrete time signals and systems.
2. Develop input output relationship for linear shift invariant system and understand the convolution operator for continuous and discrete time system.

3. Understand and resolve the signals in frequency domain using Fourier series and Fourier transforms.
4. Understand the limitations of Fourier transform and need for Laplace transform and develop the ability to analyze the system in s- domain.
5. Understand the basic concept of probability, random variables & random signals and develop the ability to find correlation, CDF, PDF and probability of a given event.

UNIT - 1	06 Hours

Introduction to Signals and Systems

Introduction and Classification of signals: Definition of signal and systems, 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 (Accumulator for DT), time scaling, time shifting and time folding, Sampling Theorem and reconstruction of sampled signal, Concept of aliasing, examples on under sampled and over sampled signals.

Systems: Definition, Classification: linear and non-linear, time variant and invariant, causal and non-causal, static and dynamic, stable and unstable, invertible.

UNIT - 2	06 Hours

Time domain representation of LTI System

System modeling: Input-output relation, definition of impulse response, convolution sum, convolution integral, computation of convolution integral using graphical method, Computation of convolution sum. Properties of convolution, properties of the system based on impulse response, step response in terms of impulse response.

UNIT - 3	06 Hours

Fourier Series

Fourier series (FS) representation of periodic Continuous Time (CT) signals, Dirichlet condition for existence of Fourier series, FS representation of CT signals using exponential Fourier series, Fourier spectrum representation, properties of Fourier series, Gibbs phenomenon, Discrete Time Fourier Series and its properties.

UNIT - 4	06 Hours

Fourier transform

Fourier Transform (FT) representation of aperiodic CT signals, Dirichlet condition for existence of Fourier transform, evaluation of magnitude and phase response, FT of standard CT signals, FT of standard periodic CT signals, Introduction to Fourier Transform of DT signals, Properties of CTFT and DTFT, Fourier Transform of periodic signals. Concept of sampling and reconstruction in frequency domain, sampling of bandpass signals.

UNIT - 5	06 Hours

Laplace and Z-transform

Definition of Laplace Transform (LT), Limitations of Fourier transform and need of Laplace transform, ROC and its properties, properties of Laplace transform, Laplace transform evaluation using properties, Inverse Laplace transform based on partial fraction expansion, Application of Laplace transforms to the LTI system analysis.

Introduction to Z-transform, and its properties, Inverse Z-transform, different methods of inverse Z-transform, Z-transform for discrete time system LTI analysis.

UNIT - 6	06 Hours

Probability and Random Signals

Probability: Experiment, sample space, event, probability, conditional probability and statistical independence, Bayes theorem, Random variables: Continuous and Discrete random variables, cumulative distributive function, Probability density function, properties of CDF and PDF. Definitions: Statistical averages, mean, moments and expectations, standard deviation and variance, Introduction to Correlation: Autocorrelation, Cross correlation, and their properties.

TEXT/REFERENCE BOOKS

1. Alan V. *Oppenheim*. Alan S. Willsky and S. Hamid Nawab, “Signals and Systems”, PHI
2. Dr. S. L. Nalbalwar, A.M. Kulkarni and S.P. Sheth, “Signals and Systems”, 2nd Edition, Synergy Knowledgeware, 2017
3. Simon Haykins and Barry Van Veen, “Signals and Systems”, 2nd Edition, Wiley India.
4. Shaila Apte, “Signals and Systems-principles and applications”, Cambridge University press, 2016.

5. Mrinal Mandal and Amir Asif, Continuous and Discrete Time Signals and Systems, Cambridge University Press, 2007.
6. Peyton Peebles, "Probability, Random Variable, Random Processes", 4th Edition, Tata McGraw Hill.
7. A. Nagoor Kanni "Signals and Systems", 2nd edition, McGraw Hill.
8. NPTEL video lectures on Signals and Systems.

BTID405	**Product Design Engineering**	**2 Credits**

Teaching Scheme:	**Examination Scheme:**
Lecture-cum-demonstration: 1 hr/week Design Studio: 2 hr/week	Continuous Assessment 1: 30 Marks Continuous Assessment 2: 30 Marks Final Assessment: 40 Marks

- Pre-requisites: Knowledge of Basic Sciences, Mathematics and Engineering Drawing
- Design Studio : 2 hr/week to develop design sketching and practical skills, learning digital tools
- Continuous Assessment: Progress through a product design and documentation of steps in the selected product design
- Final Assessment: Product Design in Studio with final product specifications

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

1. Create simple mechanical or other designs
2. Create design documents for knowledge sharing
3. Manage own work to meet design requirements
4. Work effectively with colleagues.

UNIT - 1	04 Hours

Introduction to Engineering Product Design:

Trigger for Product/ Process/ System, Problem solving approach for Product Design, Disassembling existing Product(s) and understanding relationship of components with each other, Sketching of components, identifying materials and their processing for final product, fitting of components, understanding manufacturing as scale of the components, Reverse engineering concept, case studies of products in markets, (or in each discipline), underlying principles, Case studies of product failures, revival of failed products, Public/Society's perception of products, and its input into product design.

UNIT - 2	04 Hours

Ideation:

Generation of ideas, Funnelling of ideas, Short-listing of ideas for product(s) as an individual or group of individuals, Sketching of products, Market research for need, competitions, scale and cost, Initial specifications of products.

UNIT - 3	04 Hours

Conceptualisation:

Computer operation principles and image editing through a graphical Composition; Computer aided 2D drafting and 3D Modeling through simple exercises.

Designing of components, Drawings of parts and synthesis of a product from its component parts, Rendering the designs for 3-D visualization and to create a photo realistic image, Parametric modelling of product, 3-D Visualization of mechanical products, Detail Engineering drawings of components.

UNIT - 4	04 Hours

Detailing:

Managing assembling, Product specifications- data Sheet, Simple mechanical designs, Workshop safety and health issues, Create documents for knowledge sharing.

Hands-on Activity Charts for Use of Digital Tools

Activity 1	Learn the basic vector sketching tools.	2
Activity 2	General understanding of shading for adding depth to objects. Understanding of editing vectors	2
Activity 3	Begin developing a thought process for using digital sketching.	3
Activity 4	Create a basic shape objects sphere, box cylinders	3
Activity 5	Create Automotive wheel concepts	3
Activity 6	Understanding Navigation and Data Panel Interface	2
Activity 7	Solid and Surface modelling, Rendering 3-D models	4
Activity 8	Product market and Product Specification Sheet	3
Activity 9	Documentation for the product	2

TEXT/REFERENCE BOOKS

1. Model Curriculum for “Product Design Engineer – Mechanical”, NASSCOM (Ref. ID: SSC/Q4201, Version 1.0, NSQF Level: 7)
2. Eppinger, S., & Ulrich, K.(2015). Product design and development. McGraw - Hill Higher Education.
3. Green, W., & Jordan, P. W. (Eds.). (1999).Human factors in product design: current practice and future trends. CRC Press.
4. Sanders, M. S., & McCormick, E. J. (1993). Human factors in engineering and design McGRAW- HILL book company.

5. Roozenburg, N. F., &Eekels, J. (1995). Product design: fundamentals and methods (Vol. 2). John Wiley & Sons Inc.
6. Lidwell, W., Holden, K., & Butler, J.(2010). Universal principles of designs, revised and updated: 125 ways to enhance usability, influence perception, increase appeal, make better design decisions, and teach through design. Rockport Pub.

BTBSC406	Numerical Methods and Computer Programming	3 Credits

Course Objectives:

1. To prepare students for successful career in industries, for Post Graduate programmes 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.
5. To understand various difference operators and interpolation techniques.
6. To understand object-oriented programming fundamentals and features.
7. To mold students professionally by course contents and sufficient problem solving and programming exercises and to acquaint them with different types of numerical techniques and programming concepts.

Course Outcomes:

On completion of the course, students will be able to:

1. Able to solve algebraic and transcendental equations by using numerical techniques and will be able to compare different numerical techniques used for this purpose and also will be able to choose a proper one as per the requirement of the problem.
2. Able to solve a system of linear equations with any number of variables using different direct and iterative numerical techniques.
3. Understand the concept of interpolation, finite difference operators and their relations, and can apply different interpolation techniques on equi-spaced or non equi-spaced data values.
4. Prepare them to write computer programs for the numerical computational techniques.

5. Understand application of the NMCP course in many engineering core subjects like signal processing, digital communication, numerical techniques in electromagnetics etc.
6. Understand procedure-oriented and object oriented programming concepts.
7. Capable of writing C and C++ programs efficiently.

UNIT - 1	06 Hours

Introduction to Computational Methods and Errors

Computational Methods: General principles of computational techniques, Introduction, common ideas and concepts of computational methods, various computational techniques. Errors: Types and sources of errors, Concept in error estimation, Error propagation, Error due to floating point, Representation of errors, Elementary uses of series in calculation of errors.

UNIT - 2	06 Hours

Solution of Transcendental / Polynomial Equations and System of Linear Equation

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, Matrix triangularisation (LU decomposition), Cholesky, Gauss Seidel and Jacobi methods.

UNIT - 3	06 Hours

Interpolation and Polynomial Approximation

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.

UNIT - 4	06 Hours

Numerical Integration and Differentiation

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

UNIT - 5	06 Hours

Object Oriented Programming

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.

UNIT - 6	06 Hours

Operator Overloading and Type Conversions

Defining operator overloading, Overloading unary operators, Overloading binary operators, Manipulation of strings operators, Rules for overloading operators. Inheritance: Extending Classes: Defining derived classes, Single inheritance, multilevel inheritance, multiple inheritance, Hierarchical inheritance, Hybrid inheritance, Virtual base classes, Abstract classes, Member classes: Nesting of classes Pointers Virtual Functions and Polymorphism: Pointers to objects, Pointers to derived classes, Virtual functions, pure virtual functions Managing Console I/O Operations C++ Streams, C++ Stream Classes, Unformatted I/O Operations, Managing output with manipulators.

TEXT/REFERENCE BOOKS

1. S. S. Sastry, "Introductory Methods of Numerical Analysis", PHI, 1990, 3rd edition.
2. V. Rajaraman, "Computer Oriented Numerical Methods, PHI, New Delhi", 2000, 3rd Edition.
3. E. V. Krishnamurthy, and Sen S. K., "Numerical Algorithm: Computations in Science and Engg", Affiliated East West, New Delhi, 1996.
4. D. Ravichandran, "Programming with C++", TMH
5. E. Balagurusamy, "Object-Oriented Programming with C++", TMH, New Delhi, 2001,2ndEdition

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR
B.E. (Electrical Engineering)
SCHEME OF EXAMINATION

SEVENTH SEMESTER

S.N.	Sub Code	Subject	Board	Teaching Scheme				Credits	Examination Scheme			Min. Passing Marks	Paper Duration
				L	T	P	Total		College Assessment	Univ. Assessment	Total Marks		
1	BEELE701T	CONTROL SYSTEM-II	EE	4	1	0	5	5	20	80	100	40	3 Hours
2	BEELE702T	ELECTRICAL POWER SYSTEM –II	EE	4	1	0	5	5	20	80	100	40	3 Hours
3	BEELE703T	ELECTIVE –I	EE	3	1	0	4	4	20	80	100	40	3 Hours
4	BEELE704T	HIGH VOLTAGE ENGINEERING	EE	4	1	0	5	5	20	80	100	40	3 Hours
5	BEELE704P	HIGH VOLTAGE ENGINEERING	EE	0	0	2	2	1	25	25	50	25	
6	BEELE705T	ELECTRICAL INSTALLATION DESIGN	EE	4	1	0	5	5	20	80	100	40	3 Hours
7	BEELE705P	ELECTRICAL INSTALLATION DESIGN	EE	0	0	2	2	2	25	25	50	25	
8	BEELE706P	PROJECT SEMINAR	EE	0	0	3	3	3	50	0	50	25	
		Total		19	5	7	31	30			650		

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR
B.E. (Electrical Engineering)
SCHEME OF EXAMINATION

EIGHTH SEMESTER

S.N.	Sub Code	Subject	Board	Teaching Scheme				Credits	Examination Scheme			Min. Passing Marks	Paper Duration
				L	T	P	Total		College Assessment	Univ. Assessment	Total Marks		
1	BEELE801T	ELECTIVE- II	EE	3	1	0	4	4	20	80	100	40	3 Hours
2	BEELE802T	ELECTIVE- III	EE	3	1	0	4	4	20	80	100	40	3 Hours
3	BEELE803T	SWITCHGEAR & PROTECTION	EE	4	1	0	5	5	20	80	100	40	3 Hours
	BEELE803P	SWITCHGEAR & PROTECTION	EE	0	0	2	2	1	25	25	50	25	
4	BEELE804T	COMPUTER APPLICATIONS IN POWER SYSTEM	EE	4	1	0	5	5	20	80	100	40	3 Hours
	BEELE804P	COMPUTER APPLICATIONS IN POWER SYSTEM	EE	0	0	2	2	1	25	25	50	25	
5	BEELE805P	PROJECT	EE	0	0	6	6	6	75	75	150	75	
		Total		14	4	10	28	26			650		

S. No.	Elective-I	Elective-II	Elective - III
1	IT and Its Applications in Power System Control	Entrepreneurship Development	Bio-medical Engineering
2	Fuzzy Logic and Neural Networks	Digital Signal Processing	Advanced Microprocessor Peripherals
3	Flexible AC Transmission Systems	Power Quality	Power Semiconductor Based Electric Drives
4	Energy Management and Audit	EHV AC and HVDC Transmission	Electrical Distribution System

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur

Absorption Scheme for the students of B. E. Electrical Engg. (Electronics & Power)

from OLD semester pattern to NEW semester pattern

VII Semester B. E. Electrical Engineering

Subject Code	Name of subject in Old semester pattern	Subject Code	Name of subject in New semester pattern
7S-EE-01	CONTROL SYSTEM-II (Th.)	BEELE701T	CONTROL SYSTEM-II
7S-EE-02	ELECTRICAL POWER –II (Th.)	BEELE702T	ELECTRICAL POWER SYST –II
7S-EE-03	ELECTIVE –I i) IT and Its Applications in Power System Control ii) Fuzzy Logic and Neural Networks iii) Flex A.C. Transmission Systems iv) Non conventional energy sources	BEELE703T	ELECTIVE –I i) IT and Its Applications in Power System Control ii) Fuzzy Logic and Neural Networks iii) Flex A.C. Transmission Systems iv) Energy Management and Audit
7S-EE-04	HIGH VOLTAGE ENGG. (Th.)	BEELE704T	HIGH VOLTAGE ENGG.
7S-EE-04	HIGH VOLTAGE ENGG (Pract.)	BEELE704P	HIGH VOLTAGE ENGG.
7S-EE-05	POWER ELECTRONICS (Th.)		----
	Power Electronics (Pract.)		----
7S-EE-06	PROJECT SEMINAR	BEELE706P	PROJECT SEMINAR
7S-EE-03	Electrical Installation Design (Elective-I) (Th.)	BEELE705T	ELECTRICAL INSTALLATION DESIGN*
		BEELE705P	ELECTRICAL INSTALLATION DESIGN *

***** The students who fail to clear any subject(s) of the VII semester (old pattern) by the last chance prescribed, shall be required to clear the respective equivalent subject of VII semester (new pattern) along with an additional subject marked with (*****).

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur

Absorption Scheme for the students of B. E. Electrical Engg. (Electronics & Power)

from OLD semester pattern to NEW semester pattern

VIII Semester B. E. Electrical Engineering

Subject Code	Name of subject in Old semester pattern	Subject Code	Name of subject in New semester pattern
8S-EE-01	POWER SEMICONDUCTOR BASED DRIVES	BEELE802T	ELECTIVE- III i) Bio-medical Engineering ii) Advanced Microprocessor Peripherals iii) Power Semiconductor based Drives iv) Electrical Distribution System
8S-EE-02	ELECTIVE- II (Th.) i) EHV AC and HVDC Transmission ii) Entrepreneurship Development iii) Advanced Microprocessor Peripherals iv) Bio-medical Engineering v) Digital Signal Processing vi) Optimization Technique	BEELE801T	ELECTIVE – II i) Entrepreneurship Development ii) Digital Signal Processing iii) Power Quality iv) EHV AC and HVDC Transmission
8S-EE-03	SWITCHGEAR & PROTECTION (Th.)	BEELE803T	SWITCHGEAR & PROTECTION
8S-EE-03	SWITCHGEAR & PROTECTION (Pract.)	BEELE803P	SWITCHGEAR & PROTECTION
8S-EE-04	COMP.APPL.IN ELECTRICAL ENGG. (Th.)	BEELE804T	COMP.APPL.IN POWER SYSTEM
8S-EE-04	COMP.APPL.IN ELECTRICAL ENGG. (Pract.)	BEELE804P	COMP.APPL.IN POWER SYSTEM
8S-EE-05	PROJECT	BEELE805P	PROJECT

The students who fail to clear any subject(s) of the VIII semester (old pattern) by the last chance prescribed, shall be required to clear the respective equivalent subject of VIII semester (new pattern).

VII – SEM. ELECTRICAL ENGG.

BEELE701T - CONTROL SYSTEMS -II

Learning Objectives	Learning Outcomes
To impart knowledge of classical controller/compensator design for linear systems. To understand the theory and analyze non-linear system. To have idea about optimal and discrete time control system.	Students will be able to • Analyze the practical system for the desired specifications through classical and state variable approach. • Design the optimal control with and without constraints • Analyze non-linear and work with digital system and their further research.

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. (Design of Compensator is not required).

UNIT-II

Solution of state equation: Review of state variable representations , diagonalization of state model ,eigen values and eigen vectors , generalized eigen vector, properties of state transition matrix (STM) , Computation of STM by Laplace transform, Cayley Hamilton theorem and Canonical transformation method. Solution of state equation.

UNIT-III

Design by state variable feedback: Controllability & observability. Kalman's test and Gilbert's test, duality, Design of State variable feedback. Effect of state feedback on controllability and observability.

UNIT-IV

Optimal Control System: Performance Index. Desirability of single P.I. Integral Square Error (ISE), Parseval's Theorem, parameter Optimization with & without constraints. Optimal control problem with T.F. approach for continuous time system only.

UNIT - V

Non Linear Control Systems: Types of non - linearities. jump resonance. Describing function analysis and its assumptions. Describing function of some common non- linearities. Singular points. Stability from nature of singular points. Limit cycles. Isocline method, Delta method.
(Construction of phase trajectories is not expected)

UN1T-VI

Sampled Data Control Systems: Representation SDCS. Sampler & Hold circuit. Shanon's Sampling theorem, Z-Transform. Inverse Z- Transform & solution of Differencial Equations. 'Z' & 'S' domain relationship. Stability by Bi-linear transformation & Jury's test. Controllability &. observability of Discrete time systems.

BOOKS :

Text Books		
Title of Book	**Name of Author/s**	**Edition & Publisher**
Control System Analysis	Nagrath & Gopal	New Age International
Linear Control System Analysis and Design	Constantine H. Houpis, Stuart N. Sheldon, John J. D'Azzo, Constantine H. Houpis, Stuart N. Sheldon	CRC Press
Digital Control and state variable methods	M. Gopal	The McGraw-Hill
Reference Books		
Modern Control Engineering	k. Ogata	Prentice Hall
Modern control system	M.Gopal	New Age International
Modern Control Engineering	D.Roy Choudhury	PHI Learning Private Limited, New Delhi

BEELE702T - ELECTRICAL POWER SYSTEM - II

Learning Objectives	Learning Outcomes
Students will understand the various aspects of electrical power systems such as stability, analysis of symmetrical components, various faults, economic scheduling and different methods of earthling.	A student will be able to • Understand the basics of power system. • Analyze and solve problems on symmetrical & unsymmetrical fault, stability. • Understand economy of operation and get familiar with types of grounding.

Unit 1: Symmetrical Component transformation: Three phase power in unbalanced circuit in terms of symmetrical component. Sequence impedances of Generator. Transformer Transmission line & Passive loads. Phase shift in Y/ delta three phase transformer (Yd1, Yd11 connection.).

Unit 2: **Symmetrical fault analysis:** Without & with pre fault load current . Selection of Circuit Breakers ratings, current limiting reactors.

Unit 3: **Unsymmetrical fault Analysis:** L-G, L-L-G, L-L, open conductors faults analysis using symmetrical components.

Unit 4: Stability of Power System- Steady state, Dynamic and Transient stability definition. Dynamics of synchronous machine, swmg equation, swing equation for machines swinging coherently and Non Coherently. Power angle equation. Steady state stability studies.

Transient stability studies: **-**

Swing curve. Equal Area criterion for transient stability. Application of equal area criterion for different disturbances. Solution of swing equation by point by point method. Methods of improving transient stability..

Unit 5: 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 coefficient. Derivation of loss formula co-efficient, simulation of co-ordination equation on digital computer.

Unit 6: i) Grounding of Neutral in power system.

ii) Shunt & series compensation-

Generalized equation, shunt reactor compensation of very long line with intermediate switching station, series capacitor compensation at line centre, shunt reactors at both ends and series capacitor in middle of line. Elementary idea of sub synchronous resonance problem arid counter measures.

Text Books		
Title of Book	**Name of Author/s**	**Edition & Publisher**
Elements of P.S. Analysis	William D. Stevenson	The McGraw-Hill Company
Modem power System analysis	Nagrath & Kothari	The McGraw-Hill Company
Power System Analysis	Wadhwa C.L	Tata McGraw-Hill Education
Reference Books		
Extra High Voltage AC. - Transmission Engineering	R D. Begamudre	New Age International

Note: **-** Unit 6 (ii) **-** Scope will be limited to the treatment given in recommended Book (4).

Elective- I BEELE703T (1)- I.T. & ITS APPLICATIONS IN POWER SYSTEM CONTROL

Learning Objectives	Learning Outcomes
Students will understand the various aspects of real time issues and communication required for automation. Student will also learn energy management and auditing.	A student will be able to • Understand the communication used for automation. • Understand the various aspects of energy auditing in industry • Do the networking of communication in industry with instrumentation and microprocessors.

UNIT# 1

Real-time issues on signal transmission and control; Communication systems for industrial automation; Data acquisition and Supervisory" control; Control of discrete manufacturing processes, Intelligent systems for monitoring, supervision and control; Case studies of industrial control systems.

UNIT # 2

Energy Auditing-Introduction, importance of Energy Audit basic terms of energy audit, Procedure for carrying energy audit, instruments used for energy audit such as power analyzer multipoint heat flow meter, lux meter, portable infrared radiation thermometer, thermocouple based temperature indicator.

Energy Conservation & Management-Need & importance of Energy Conservation & Management, payback period, return on investment (ROI),life cycle costs ,specific energy consumption. Calculation of Energy costs of specified products & simple systems. Analysis of selected energy intensive units like iron-steel, cement, petroleum refining etc.

UNIT # 3

Principles of multi-objective Energy management - with emphasis on conservation, User friendly software development on Windows 9x. UNIX Platforms for Energy Conservation &. Management Studies.

UNTT # 4

Serial data communication using RS232 and RS485 based system, distributed measurement system. IEEE488 protocol.

UNIT # 5

Local area networks - Common topologies. Medium access control-round-robin, reservation and contention based strategies. ALOHA protocol and its variants. CSMA and CSMA/CD protocols. Token-ring protocol. IEEE 802 standards for local area networks. High speed LANs - Fast and Gigabit Ethernet, FDDI. Wireless LANs. Internet Working- Repeaters, bridge routers and gateway S. TCP/IP protocol suite. TCP/IP sockets, client server computing. Name Service. Application protocols over TCP/IP. Network-Security.

UNIT # 6

Design of microprocessor based Instrumentation systems, design. interfacing circuits and data acquisition systems.

Text Books		
Title of Book	**Name of Author/s**	**Edition & Publisher**
Microprocessor & Interfacing	D.V Hall	Tata McGraw-Hill Education
LAN	Keiser	McGraw Hill
Reference Books		
Energy management	William T. Synder & Fredric W. symonds	
Energy management Handbook	W C Turker	

Elective- I BEELE703T (2)- FUZZY LOGIC & NEURAL NETWORK

Learning Objectives	**Learning Outcomes**
Students will understand the various aspects of fuzzy logic and neural network.	A student will be able to • Understand the fundamentals of fuzzy logic and ANN. • Learn different neural networks • Learn concepts of Associative memories and self organizing network.

UNIT –I: Introduction:
1. Fuzzy sets, Approximate reasoning Representing set of rules.
2. Fuzzy knowledge based.(FKBC)parameters. Introduction rule and data base inference engine, choice of fuzzyfication and & defuzzyfication processes.

UNIT -II: Nonlinear Fuzzy Control
Introduction, Control problem, FKBC as nonlinear transfer element, types of' FKBC.

UNIT - Ill: Adaptive Fuzzy control
Introduction, design, and performance evaluation, main approach to design.

UNIT-IV:

I. Fundamental concept of ANN.

2. Model of artificial neural network (ANN), Learning & adaptation learning rules.
Feed forward network:
Classification Model, feature & decision regions; Minimum distance, Classification, perceptron, delta learning rules for multi-perceptron layer, Generalized learning rules, back propagation Algorithm, back propagation training, learning factors.

UNIT - V: Recurrent Networks
Mathematical foundation of discrete time & gradient type hope field networks, transient response & relaxation modeling.

UNIT-VI: Associative memories &, self organizing networks.
Basic concept & performance analysis of recurrent associative memory',' 'Bidirectional associative memory, Hamming net & MAXNET Unsupervised larning of clusters, counter propagation network, feature mapping self organizing feature maps, cluster discovery network (ART 1)

Text Books		
Title of Book	**Name of Author/s**	**Edition & Publisher**
Introduction of Artificial Neural Networks	Jacek M. Zurada	PWS Publishing Company
Neural Network & Fuzzy system	Bart Kosko	Prentice Hall,India
Neural Networks: Comprehensive Foundation	Simon Hayking	Macmillan , Canada Inc
Reference Books		
An Introduction to Fuzzy Control	Dimiter Driankov, Hans Hellendoorn, Michael Reinfrank	Springer,
Fuzzy sets: ncertainty & information	Klir & Folger	Prentice Hall,India
Digital Image Processing	Gonzalez	AWFC

Elective- I BEELE703T (3) FLEXIBLE AC TRANSMISSION SYSTEMS

Learning Objectives	Learning Outcomes
To understand the problems and constraints related with stability of large interconnected systems and to study their solutions using different FACTS controllers, shunt (SVC, STATCOM), series (TCSC, GCSC, SSSC), series-shunt (UPFC), series-series (IPFC) .	A student who successfully completes the course will be able to demonstrate the • Ability to understand and identify the problems and constraints with stability of large interconnected system. • Ability to understand different types of converters, regulators and compensators

Unit-I: FACTS CONCEPT AND GENERAL SYSTEM CONSIDERATION:
Transmission Interconnection, Flow of Power in an AC System, factors affecting the Loading Capability, Power Flow and Dynamic Stability Consideration of Transmission interconnection, relative importance of controllable. Parameters, FACTS Controller.

Unit-II: VOLTAGE-SOURCED AND CURRENT. SOURCED CONVERTERS:
Single phase three phase full wave bridge converters transformer connections for 12 pulse 24 and 48 pulse operation. Three level voltage source converter, Generalized Technique of Harmonic Elimination and Voltage Control, Basic pulse width modulation converter, basic concept of current source Converters, and comparison of current source converters with voltage Source converters.

Unit-3: **STATIC SHUNTS COMPENSATORS: SVC AND STATCOM:**
Objectives 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-4: STATIC SERIES COMPENSATORS: GCS, TSSC, TCSC AND SSSC:
Objectives 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. Applications of SSSC in load flow and transient stability studies.

Unit-5: STATIC VOLTAGE AND PHASE ANGLE REGULATORS; TCVR AND TCPAR:
Objectives 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-6: COMBINED COMPENSATORS (UPFC, IPFC) AND SPECIAL PURPOSE FACTS CONTROLLERS:
The Unified Power Flow Controller (UPFC}, operating principal v-I Characteristics UPFC_–_Principal of Operation-modes of operation-application**.** Interline Power Flow Controllers Generalized and Multifunctional FACTS Controllers, Sub synchronous Resonance, NGH-SSR Damping Scheme, Thyristor-Controlled Braking Resistor (TCBR).

BOOKS :

Text Books		
Title of Book	**Name of Author/s**	**Edition & Publisher**
Understanding FACTS	Narayan G. Hingorani and Laszlo Gyigyi	Standard Publishers
FACTS : Controllers in Power Transmission & Distribution	K. R. Padiyar	1st , New Age International
Flexible AC Transmission System (FACTS)	Edited by Yang Hua Song and Johns	IEEE Publishers
Reference Books		
HVDC and FACTS controllers – Applications of Static Converters in Power System	V.K.Sood	New Age International(P) Limited, Publishers, New Delhi,
Thyristor Based FACTS Controllers for Electrical Transmission System	R. Mohan Mathur, Rajiv K Verma	Wiley

Elective- I BEELE703T (4) ENERGY MANAGEMENT AND AUDIT

Learning Objectives	Learning Outcomes
To understand the need of energy audit and the mechanism through which it should be carry out and also to manage the electric and thermal energy.	A student will able to • Know Present energy scenario with need of energy audit and energy conservation. • Understand various aspects of energy audit such as planning, monitoring and implementation • Manage electric and thermal energy in the industry.

Unit 1: Basics of Energy Management and Conservation (10 Hrs)
Global and Indian energy scenario. Global environmental concerns, Climate Change, Concept of energy management, energy demand and supply, economic analysis; Carbon Trading & Carbon foot prints.
Energy Conservation: Basic concepts, Energy conservation in household, transportation, agricultural, service and industrial sectors; Lighting & HVAC systems in buildings.

Unit 2: Energy Audit (8 Hrs)
Definition, need, and types of energy audit; Energy management (audit) approach: Understanding energy costs, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements; Fuel & energy substitution; Energy audit instruments; Energy Conservation Act; Duties and responsibilities of energy managers and auditors.

Unit 3: Material & Energy balance and Waste Heat Recovery (8 Hrs)
Facility as an energy system; Methods for preparing process flow; material and energy balance diagrams.
Cogeneration and waste heat recovery;

Unit 4: Energy Action Planning, Monitoring and Targeting: (8 Hrs)
Energy Action Planning : Key elements; Force field analysis; Energy policy purpose, perspective, contents, formulation, ratification; Organizing the management: location of energy management, top management support, managerial function, roles and responsibilities of energy manager, accountability; Motivation of employees: Information system-designing barriers, strategies; Marketing and communicating: Training and planning.
Monitoring and Targeting : Defining monitoring & targeting; Elements of monitoring & targeting; Data and information analysis; Techniques: energy consumption, production, cumulative sum of differences (CUSUM); Energy Service Companies; Energy management information systems; SCADA systems.

Unit 5: Electrical Energy Management: (8 Hrs)
Supply side: Methods to minimize supply-demand gap, renovation and modernization of power plants, reactive power management, Demand side management: conservation in motors, pumps and fan systems; energy efficient motors.

Unit 6: Thermal energy Management: (8 Hrs)
Energy conservation in boilers, steam turbines and Furnaces; Application of FBC, Heat exchangers and heat pumps.

Text Books		
Title of Book	**Name of Author/s**	**Edition & Publisher**
Handbook on Energy Audits and Management	Amit Kumar Tyagi	TERI
Energy Management Handbook	Wayne C. Turner	Wiley Inter Science Publication
Reference Books		
Principles of Energy Conservation	Archie, W Culp	McGraw Hill, 1991
Energy Management	P. O'Callaghan	McGraw - Hill Book Company, 1993
Handbook of Energy Engineering	Thuman A and Mehta D Paul	The Fairmount Press
Bureau of Energy Efficiency Study material for Energy Managers and Auditors Examination: Paper I to IV.		
Handbook of Energy Audit and Environment Management	Y.P. Abbi, Shashank Jain	TERI

BEELE 704 T- HIGH VOLTAGE ENGINEERING

Learning Objectives	Learning Outcomes
Student will learn the various concepts of high voltage engineering such as breakdown mechanism, lightning and switching overvoltage, travelling waves etc. Student will also learn measurement and calculation of high voltage and current using different tests.	Students has understood breakdown mechanism in solid liquid and gaseous medium lightening and switching over-voltages and insulation coordination different methods of generation and measurement of high voltage and currents in laboratory different methods of non destructive and High Voltage testing of apparatus.

Unit 1 : Breakdown mechanism in Di-electric : Ionization process*;* Townsend's criterion for B.D. Break down in electro-negative gases, Time-lag for B.D.; Streamer theory for B.D in gases, Paschen's law; B.D in non-uniform field. Corona discharges and introduction of corona post B.D. phenomenon and applications, Practical considerations in using gases for insulation purpose; vacuum insulation, Liquid as insulators, conduction and B.D. in pure and commercial liquids. Intrinsic, electromechanical &.thermal B.D., B.D. of solid di-electrics in practice; B.D. in composite dielectrics.

Unit 2: Lighting and switching over voltages; Mechanism of lightening, types of strokes, parameter and characteristics of lightening strokes, characteristics of switching surges; power frequency over voltages. control of O.V. due to switching. Protection of lines by ground wires, protection by lightning Arrester, gap type and sapless L.A.., selection of L.A. ratings, surge-absorbers.

Unit 3: Traveling waves and Insulation coordination; Traveling waves' on transmission lines, Classification of lines attenuation and distortion of traveling waves, reflection and transmission of waves, behavior of rectangular waves at transition points. Introduction to insulation coordination, associated terms, impulse waveform. Introduction to BIL Reduced BIL and SIL.

Unit 4: Generation of high voltage and. Currents: Generation of High D.C voltages by rectifiers, voltage doubler and multiplier, circuits (Derivations and expression 'not required), electrostatic machines, Generation of high AC voltages by Cascade transformers, Resonant transformers, generation high frequency AC high voltage. Generation of impulse voltages: Standard impulse wave shapes, analyses of model and commercial impulse generation circuits, wave shape contro1 Marx circuit, tripping and control of impulse generation, generation of switching surges generation of impulse current.

Unit 5: -Measurement of high voltage and current: Measurement of high AC and DC voltage by micro ammeter, generating voltmeter resistance and capacitance potential divider, series impedance voltmeter CVT, Magnetic type potential transformers, electrostatic voltmeter. Peak reading AC voltmeter. Sphere gap arrangement. Measurement of impulse voltage by' potential dividers and peak reading voltmeters. Measurement of High AC DC current; measurement of high frequency and impulse current by resistive shunt (Bifilar strip shunt only,)

Unit 6: Non destructive and high voltage testing of electrical apparatus; Non destructive testing Measurement of DC Resistivity, measurement of Dielectric constant and loss-factor *(low* and power frequency only), Schering bridge for high charging circuits, for high dissipation factor for three terminal measurement, transformer ratio arm bridges, partial discharge measurements by straight detectors & by balance detectors , calibration of detectors, discharge detection *in* power cables. High voltage testing. Testing of insulators, bushings, Isolators, circuit. breakers, cables, transformer, lightning arresters and power capacitors.

Text Books		
Title of Book	**Name of Author/s**	**Edition & Publisher**
High Voltage Engineering	M.S. Naidu and V Kamaraju	TMG
High Voltage Engineering	C.L.Wadhwa	New Age International
EHV AC Transmission	Begamudre	New Age international Publisher
Reference Books		
Advances In high Voltage Engineering	A.Haddat and D. Warne	IET

BEELE 705 T - ELECTRICAL INSTALLATION DESIGN

Learning Objectives	Learning Outcomes
The course will prepare students 1. The course will prepare students to understand methodology of load forecasting and assessment of electrical loads, types of electric loads and selection of apparatus for controlling electrical power. 2. The course will prepare students to design the distribution system for residential, commercial, industrial applications and utility distribution networks and illumination design 3. The course will prepare students to understand methods of installation, testing and commissioning of electrical apparatus and conductors. 4. The course will prepare the students to understand statutory requirements related to electrical design, safety and protection.	Upon the completion of this course, a. The students will understand concept of load forecasting, solve problems based on regression analysis. b. The students will be able to draw single line diagrams with specifications for electrical distribution networks for residential and commercial installations. c. The students will be able to draw single line diagrams with specifications for distribution networks, motor and power control centers for industrial installations and design reactive power compensation. d. The students will be able to understand construction, types and selection of PVC/ XLPE cables and overhead conductors e. Students shall be able to design 11kV and 33 kV substations for utility and industrial installations and specify the ratings and specifications of apparatus used f. Students shall be able to understand procedure for receipt, storage, testing and commissioning of transformers along with its accessories viz OTI, WTI, Silica Gel Breather, MOG, Buchholz relay etc g. Students will be able to determine fault level at various locations in radial networks and be able to find rating and location of series reactors h. Students will understand the relevant provisions of IE rules for low medium and high voltage installations i. Students will be able to understand provisions for system and equipment earthings as per IS 3043

Unit 1:

Electrical load assessment: **(4H)**

Concept of electrical load, categories of load, types of loads, connected load, demand factor, Maximum demand, diversity factor, load factor, power factor, TOD Tariff, Industrial Electric Bills.

Cables, conductors & bus-bars: (4H)

Construction, selection, installation, testing of LT/ HT cables, overload & short circuit ratings, rating factors; Overhead line conductors, copper and aluminium busbars.

Unit 2:

Switching & protection devices: (5H)

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. Various types of protective releases for above circuit breakers.

Symmetrical Short Circuit Calculations: (4H)

Determining symmetrical short circuit currents at various locations for selecting proper circuit breaker rating & determining value of series reactors for limiting short circuit current. Overcurrent protection with two phase fault & one ground fault relays.

Unit 3:

Electric supply to Induction Motors in industries: (5H)

Types of motors, SLD and working of DOL/ Star-Delta/ Autotransformer starters; types, specifications, selection of power contactors, Overload relays, short circuit protective devices.

Reactive power management in industries: (4H)

Reactive power compensation in industries using static capacitors, use of Power Triangle, Calculating payback period for capacitor investment due to reduced system currents.

Unit 4:

Transformers: **(4H)**
Specifications, ratings, selection, installation, testing & commissioning.
Substations: **(4H)**
11kV & 33 kV, indoor/ outdoor substations, plan/ elevations, Earthing Arrangement

Unit 5:
Design of Industrial Electrical Installations: **(8H)**
Preparing load list, assessing various factors associated with loads, selection of transformer, design of PCC & MCC, selection of all the associated electrical apparatus, busbars, cables, switchgear, protective devices, earthing system, testing, commissioning.
Unit 6:
Earthing (IS 3043): **(4H)**
Necessity of earthing, concept of system & equipment earthing, definitions of various terms, types of earthing, earth tester and measurement of earth resistance.
IE Rules: **(4H)**
Important IE Rules applicable to residential, commercial & industrial installations.

Text Books		
Title of Book	**Name of Author/s**	**Edition & Publisher**
Electric Power Distribution system	A.S.Pabla,	Tata McGraw-Hill
Course in Electrical Power	P. V. Gupta, M. L. Soni, U. S. Bhatnagar	Dhampat Rai and Sons., 1987
Electrical Substation Engineering & Practice	S. Rao	Kanna Tech. Publ., 1992
Reference Books		
Design of Electrical Installations	V. K. Jain, Er. V.K. Jain & Er. Amitabh Bajaj	Laxmi Publications Pvt Limited, 01-Jan-1993
Electrical Engineering Handbook	C. L. Wadhwa	
Indian Electricity Regulation 1956		

BEECE 705 P – ELECTRICAL INSTALLATION DESIGN (PRACTICAL)

A. Visit for Comprehensive study of existing electrical installation:
Student should visit a residential/ commercial or industrial facility, preferably with its own transformer substation and:

1. Understand the processes in which the electricity is used and characterize the processes viz lighting, heating, cooling, air-conditioning, ventilation, pumping and other industry specific applications like mixing, pulverizing, machining, welding etc.
2. Prepare a list of all the loads demanding electric supply and assess “connected load”
3. Get the copies of at least six previous electric bills and determine the “demand factor”, “load factor”“power factor” etc.
4. Study the tariff structure and note various costs, taxes and duties. Understand TOD tariff. Note the sanctioned load, contract demand etc.
5. Note how the establishment receives electric supply (overhead/ underground), its voltage level (HT/LT, single phase two wire/ three phase three wire, three-phase four wire etc. Note the specifications of incoming conductor/ cable.
6. Note the type of energy meter used by electricity board (analogue/ digital, single/ three phase, directly connected/ CT operated, HT metering cubical)
7. Draw the power flow diagram of the electrical installation including transformers, stand- by DG supply
8. Convert the power flow diagram into single line diagram (SLD). Identify different components of Power Control Center (PCC) and Motor Control Center (MCC). Specify the current rating and specifications of various HT/LT switchgear and control- gear.

9. Identify various protections against earth leakage, overloads and short circuits.
10. Note in details the Earthing System, types, material used and quantity of earth electrodes etc.
11. Note reactive power management system, types and rating of capacitors, manual/ automatic control of PF improvement capacitors, Location of capacitors in system.
12. Submit the report for assessment.

B) Understanding the operating principle, construction and internal parts of electrical apparatus/ equipments:

Power and Control contactors: power contacts, control contacts, fixed/ moving contacts, magnetic circuit, copper shading band in AC contactors, operating coil, arc chutes; dismantling & assembly of contactors.Capacitor Duty Contactors.Rating & Specifications.

Switchgear: Re-wirable/ HRC main switches (Switch fuse, fuse switch units), MCB/ MCCB (Thermal/ magnetic release), Overload relays. Identifying difference between switch and circuit breakers. Single vs double break arrangement of contacts.

Transformer accessories: Buchholz Relay, Oil temperature Indicator (OTI), Winding Temperature Indicator (WTI), magnetic Oil Level Gauge, Silica Gel Breather.

C) Performing Routine Tests:

1. OC/ SC test on 5 kVA, Three –phase, delta- star transformer.Megger Test.
2. Turns ratio, magnetic Balance Test; Megger Test on three phase transformer.
3. Megger and Continuity test for HT/ LT cables.

C) Assembling and testing of DOL and Automatic Star Delta Starters.

D) Simulation for 3-phase short circuit current in distribution system using software like e-tap.

E) Common HT equipments: construction, operation, specifications, ratings of 11 kV AB Switch, Drop Out/ Horn Gap fuse, Distribution/ station class lightening arrestors.

F) Earthing system: Study of various types of Earth electrodes (rod/pipe/plate), maintenance free earth electrodes, Measurement of Earth electrode resistance and measurement of soil resistivity.

G) Some practicals based on illumination.

H)Preparing a list of reputed national/ global manufacturers in Electrical systems, their product range.

VIII – SEM. ELECTRICAL ENGG.

Elective II BEELE 801 T (1) - ENTREPRENEURSHIP DEVELOPMENT

Learning Objectives	Learning Outcomes
Student will learn how to become an entrepreneur. Various role an entrepreneur has to play such as market surveyour, project manager, planner, Operational incharge etc.	Students has understood • How to carry out market survey, demand forecasting etc. • How to calculate economic feasibility, preparation of project report, project planning, implementation schedule etc. • How to do performance analysis, environmental and societal impact.

UNIT - I
Need analysis, market survey, characteristics of market, sample survey, demand forecasting secondary data, accuracy, and confidence level, uncertainty.

UNIT- II
Technical feasibility: Process selection, level of automation, plant capacity, acquiring technology, appropriate technology plant location, Equipment selection & procurement, Govt. policies.

UNIT - III
Economic feasibility: Cost of project working capital analysis, fixed cost, means of finance, estimation of sales and production price analysis, breakeven point, projected cash flow statements, projected balance sheet, projected profit and loss statement, projected cash projected cash flow, rate of return, discounted payback period, cost benefit analysis , return after taxes.

UNIT - IV
Project Planning & Control: CPM, PERT. Optimum project duration, resource allocation, updating.

UNIT V:
Project report: Preparation of project report, risk analysis, sensitivity analysis, methods of raising capital.

UNIT VI:
Project review:
Initial review, performance analysis, ratio analysis, sickness, project revival, environmental & social aspects.

Text Books		
Title of Book	**Name of Author/s**	**Edition & Publisher**
Engineering Economy	H.G. Thuesen. W.J. Fabricky, G.J. Thuersen	Prentice Hall of India Pvt. Ltd
CPM & PERT	Shrinath	East West publisher
Reference Books		
Projects	P.K Joy	Mc Millan
Projects	Prasanna Chandra	Tata Mc Graw Hill Publishing Company Ltd

ELECTIVE-II BEELE 801 T (2) -DIGITAL SIGNAL PROCESSING

Learning Objectives	Learning Outcomes
Student will learn discrete time signals and systems with representation in different ways. They will also learn how to do the analysis using Fourier and Z-transform.	Students has understood • Discrete time signals and system. • Use of Fourier and z-transform in analysis of discrete signals. • Various filter design techniques use for discrete variables and discrete Fourier transform

UNIT–1: Discrete time signals & systems; Discrete time signals, Discrete time systems, Classification of discrete time systems: Linearity, causality, stability, static dynamic, Time Invariance Time variance. Linear convolution, circular convolution, cross correlation, Autocorrelation. Sampling theorem & sampling process, Reconstruction of sampled data.

UNIT- II: Frequency domain representation of discrete time signals and systems, Fourier transform (DTFT) of discrete time signals, properties of discrete time Fourier transform,

UNIT - III: The Z - transform: Definition. Properties of the region of convergence for the Z- transformer, Z - transform properties, Inverse Z - transform using contour integration, partial fraction expansion, power series methods, Parseval's theorem, unilateral Z – transform.

UNIT – IV: Transform analysis of LTI system & structures for discrete - time system: Frequency response of LTI system, relationship between magnitude & phase, all pass system, minimum phase system, linear system with generalized linear phase.

Block diagram representation & signal flow graph representation of linear constant Coefficient difference equations, basic structures for IIR systems, transposed forms, basic network structures for FIR systems, lattice structures.
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UNIT - V: Filter design techniques: Design of discrete time IIR filters from continuous time filters.
Frequency transformations of low pass IIR filters, Design of FIR filters by windowing, FIR filter design by Kaiser Window method. Frequency sampling method.

UNIT-VI: Discrete Fourier Transform: Discrete Fourier series, properties of discrete Fourier series, discrete Fourier transform, properties of DFT, circular convolution using discrete Fourier transform. Decimation in time FFT algorithm, decimation in frequency FFT, FFT of long sequences using overlap add & overlap save method.

Text Books		
Title of Book	**Name of Author/s**	**Edition & Publisher**
Discrete time signal processing	Alan V. Oppenheim, Ronald W. Schafer & Buch	2^{nd}, Pearson
Digital Signal Processing - A Computer based approach	Sanjit K. Mitra	McGraw-Hill Education, 2011
Reference Books		
Digital signal processing Theory & application	Prows end Manolakis	3^{rd}, PHI Ltd.
Digital signal processing, principles, algorithm and applications	John G. Prokis	PHI Ltd.

Elective- II BEELE 801T (3) POWER QUALITY

Learning Objectives	Learning Outcomes
Students will know the various power quality issues such as voltage sag, swell, flickers etc. with a waveform distortion. They will also learn how to monitor, assess and mitigate these issues.	Students will be able to understand • Power quality standards for voltage sag, swell, distortions, flickers etc. • Approach for power quality monitoring, assessment and mitigation. • State variable model and harmonic estimation.

Unit I: Introduction: Importance of power quality, terms and definitions of power quality as per IEEE std. 1159. such as transients, short and long duration voltage variations, interruptions, short and long voltage fluctuations, imbalance, flickers and transients. Symptoms of poor power quality. Definitions and terminology of grounding. Purpose of groundings. Good grounding practices and problems due to poor grounding. **(8 Hrs)**

Unit II: Flickers & transient voltages: RMS voltage variations in power system and voltage regulation per unit system, complex power. Principles of voltage regulation. Basic power flow and voltage drop. Various devices used for voltage regulation and impact of reactive power management. 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. **(10 Hrs)**

Unit III: Voltage sag, swells and interruptions: Definitions of voltage sag and interruptions. Voltage sags versus interruptions. Economic impact of voltage sag. Major causes and consequences of voltage sags. Voltage sag characteristics. Voltage sag assessment. Influence of fault location and fault level on voltage sag. Areas of vulnerability. Assessment of equipment sensitivity to voltage sags. Voltage sag *limits for computer equipment, CBEMA, ITIC, SEMI F 42 curves. Representation of the results of voltage sags analysis. Voltage sag indices. Mitigation measures for voltage sags, such as UPS, DVR, SMEs, CVT etc., utility solutions and end user solutions. **(8Hrs)**

Unit IV: Waveform Distortion: Definition of harmonics, inter-harmonics, sub-harmonics. Causes and effect of harmonics. Voltage versus current distortion. Overview of Fourier analysis. Harmonic indices. A.C. quantities under non-sinusoidal conditions. Triplen harmonics, characteristics and non characteristics harmonics. Harmonics series and parallel resonances. Consequences of harmonic resonance. Principles for controlling harmonics. Reducing harmonic currents in loads. K-rated transformer. Harmonic study procedure. Computer tools for harmonic analysis. Locating sources of harmonics. Harmonic filtering, passive and active filters. Modifying the system frequency response. IEEE Harmonic standard519-1992. **(10Hrs)**

Unit V: Power quality monitoring 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. **(6Hrs)**

UNIT VI: Power Quality Assessment & Mitigation Power Quality assessment, Power quality indices and standards for assessment disturbances, waveform distortion, voltage and current unbalances. Power assessment under waveform distortion conditions. Power quality state estimation, State variable model, observability analysis, capabilities of harmonic state estimation. Test systems. Mitigation techniques at different environments. (**8 Hrs**)

Text Books		
Title of Book	**Name of Author/s**	**Edition & Publisher**
Understanding power quality problems, voltage sag and interruptions	M. H. J. Bollen	IEEE press, 2000, series on power engineering
Electrical power system quality	R.C. Dugan, M.F. McGranghan, S. Santoso, H. Wayne Beaty	2nd, McGraw Hill Pub.
Reference Books		
Power system quality assessment	J. Arrillaga, M.R. Watson, S. Chan	John Wiley and sons
Electric power quality	G. J. Heydt	
Power system harmonics: Computer modeling and analysis	Enriques Acha, Manuel Madrigal	John wiley and sons ltd
Power System Harmonics	J. Arrillaga & N. Watson	
IEEE std 519-1992/ IEEE std 1159 IEEE recommended practices and requirements for harmonics control in electrical power system		

ELECTIVE-II BEELE 801T (4) - EHV AC & HVDC TRANSMISSION

Learning Objectives	**Learning Outcomes**
Students will understand various aspects of Transmission systems, power flow controls for EHVAC and HVDC transmission lines,design parameters of filters and Layout of HVDC power plant	On Successful Completion of the course the Student will be able to demonstrate the knowledge of : • Power handling capacity of different Transmission systems • Electrostatic and electromagnetic fields and corona in EHVAC lines • Voltage control and current control systems for power flow controls in HVDC system. • The knowledge of design parameters of AC filters as well as DC filters and Reactive power compensation • Overall knowledge about the HVDC system such as MTDC, protection and substation layout of HVDC power plant.

Unit 1: (i) Power Handling capacities of EHV AC transmission lines. (ii) Voltage, gradients; Electric field of point charge sphere gap, line-charge, single and three phase line bundled conductors. Maxwell's potential coefficients, Mangoldt formula.
Unit 2: (i) Electrostatic and electromagnetic fields of EHV line electric shock and Threshold current capacitance of long object; calculation of electrostatic field of AC. Lines (3-phase single and double circuit lines only) Effect of high electrostatic field, measurement *of* electrostatic field, induced voltages in insulated ground wires, electromagnetic interference (ii) Corona types, critical disruptive voltages; factor affecting corona, methods for reducing corona power loss, corona current wave form charge voltage diagram audible noise and radio interference.
Unit 3: (i) Comparison of EHVAC and HVDC systems. (ii) Conversion from AC to DC. Rectifiers, converter conversion from DC to AC, Invertors. (iii) Kinds of DC link. (iv) Earth electrode and earth returns; Introduction & objectives, location and configuration, resistance of electrodes, means of reducing earth electrode resistance, trouble caused by earth current and remedies. (v) Multi terminal HVDC system: Introduction, 2 pole transmission, MTDC system with series and paral1el connected converters, advantages OF parallel connected converters, and applications, configurations and types.
Unit 4:- (1) Power flow control in HVDC system: Constant current. Constant voltage, constant ignition and excitation angle control, control characteristics. (ii) Parallel operation of AC and DC links (Synchronous and Asynchronous links)
Unit 5:-(i) Harmonic Filters: Introduction, Filters, Surge capacitor and damping circuit, shunt filters, senes filters, AC filters, design of AC. filters and turned filters, double frequency and damped filters cost consideration. Rating AND harmonics on D.C. Side of converter, D.C. Harmonic filters. (ii) Reactive power compensation: Reactive power requirements of HVDC convertors, substations, effect of Delay angle and extinction angle on reactive power.
Unit 6: (1) HVDC circuit breakers Introduction, construction, principle, switching energy interruption of DC current application of MRTB. Types of HVDC C.B. capability and characteristics of HVDC circuit breakers (ii) HVDC substation protection against short circuit: Introduction, fault Clearing, protective zones, protection symbols, HVDC line pole protections (fault clearing and re-energizing), (iii) HVDC sub-station protection against over voltage, difference between Insulation coordination of AC and DC systems, fundamentals of switching over voltages, Over Voltages on A.C sides, and on D.C side surge- Arrestors protection scheme. Insulation coordination and protection margin.

Text Books		
Title of Book	**Name of Author/s**	**Edition & Publisher**
EHV AC and HVDC Transmission Engineering and practice	Sunil S. Rao	Khanna, publications
Electrical Power Systems	C.L. Wadhwa	2nd Edition New Age International
Reference Books		
EHV AC Transmission	Rakosh Das Begamudre	New Age International

ELECTIVE-III BEELE 802 T (1) - BIOMEDICAL ENGINEERING

Learning Objectives	Learning Outcomes
Students will understand the human body physiology with subsystem. Different methods of monitoring system of human body parameters and different control methods used.	On Successful Completion of the course the Student will be able to understand : • Physiology of human body with subsystem. • Different parameter measurement and monitoring using different devices • Control of body functioning using electronic devices.

UNIT - 1: Introduction: Human body physiology and subsystems, Biochemistry, Measurement of Electrical activities of human body.

UNIT - 2: Electrocardiography, Electro-encephalography, electromyography, Electroretinography, Principles specifications and interpretation of records.

UNIT -3: Measurement of no electrical quantity in human body, Measurement of blood flow respiration rate and depth heart rate.

UNIT- 4: ESR blood pressure, temperature PH impedance of various parts GSR mobility of internal organs.

UN1T-5: Control of body functioning: Stimulator for muscle and nervous system cardiac pacemaker.

UNIT- 6: Blood pump respiration controller myo electric control of paralyzed muscles.

Text Books		
Title of Book	**Name of Author/s**	**Edition & Publisher**
Biomedical Instrument	Cromwell.	Prentice Hall of India, New Delhi
Biomedical Engineering System		McGraw Hill
Biomedical Instrumentation & Measurement	Carr & Brown	Pearson
Medical Instrumentation	John. G. Webster	John Wiley
Reference Books		
Bioelectric Phenomena	Robert Blensev	McGraw Hill
Introduction to Biomedical electronics	Edwand J. Bukstein	Sane and Co. Inc

ELECTIVE-III
BEELE 802 T (2) - ADVANCED MICROPROCESSORS AND PERIPHERALS

Learning Objectives	Learning Outcomes
Students will understand various aspects of microprocessor and its peripherals	On Successful Completion of the course the Student will be able to understand : • Microprocessor and microcontrollers with its architecture. • Interfacing of microprocessor and microcontroller with its peripherals • Concept of virtual memory and DoS structure

Unit 1: Introduction to 16 bit microprocessors. 8086/8088 CPU architecture, Memory organization and interfacing.

Addressing modes, Instruction Set, examples Pseudo op-codes with ASM.86. ..

Unit 2: Interfacing of peripherals 8255 and 8253 with 8086. Architecture, operation and interfacing of 8251, 8257 with 8085 and. 8086/8088.

Unit 3: Architecture, operation and interfacing of 8259; with 8279 with 8085 and 8086/8088.

Unit 4: Multiprocessor system bus, 8087 coprocessor with architecture and instruction set, organization of PCXT / AT mother board.

Unit 5: Introduction to 80286, 386, 486 architecture. Concepts of Cache, associated/virtual memory. DOS structure.

Unit 6: Architecture of 8097 microcontrol1er, its important features, interface with parallel and serial I/O (Instruction set not included.)

Text Books		
Title of Book	**Name of Author/s**	**Edition & Publisher**
Programming and interfacing of 8086/808,8	D. V.Ha11	McGraw Hill
Programming and Interfacing 8086	Leu and Gibson	PHI
Reference Books		
Intel Reference Manuals for i) Microprocessor and ii) microcontrollers		
80286/80386 Assembly Language	Murary	Tata McGraw Hill
80386 Assembly Language	Femamdez	T.M.H.

ELECTIVE-III

BEELE 802 T (3) -POWER SEMICONDUCTOR BASED DRIVES

Learning Objectives	Learning Outcomes
• To study the converter and Chopper control of DC drives. • To study the semiconductor based control of Induction and Synchronous motors. • To learn the basics of Switched reluctance motor and Brushless DC motor. • To Study the non conventional and renewable energy based drives.	The student will be able to :- • work with confidence on the various drives used in the Industry. • The students can carry research on the newer Switched Reluctance motor and Brushless DC motor. • Understands the traction drives with ac and dc motors.

Unit 1: Dynamics of electric drives and control of electric drives,

Unit 2: 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.

Unit 3: Induction motor drives: Stator voltage control, variable frequency control using voltage 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 motor drives.(Numericals excluded)

Unit 4: Synchronous Motor Drive ; Starting Braking of synchronous motor, variable frequency control self controlled synchronous motor drive employing load commutated thyristor inverter or cycloconverter, starting of large synchronous motors.

Unit 5: Brushless de motor, stepper motor, switched reluctance motor drives and eddy current drives. introduction to solar and battery powered drives. Energy conservation in electric drives.

Unit 6: 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.

BOOKS:

Text Books		
Title of Book	**Name of Author/s**	**Edition & Publisher**
Fundamentals of Electric drives	G. K. Dubey	CRC Press
Modern Electric Traction	H. Partab	Pritam Surat, 1973
Power Electronics and drives	B. K. Bose	Pearson
Reference Books		
Electric drives concepts and applications	Vedam Subrahmanyam	McGraw-Hill, 1996

ELECTIVE-III BEELE 802 T (4) ELECTRICAL DISTRIBUTION SYSTEM

Learning Objectives	Learning Outcomes
Student will able to learn various aspects of distribution system including distribution automation.	The student will be able to :- • Calculate different distribution factors, • Understand classification of load, types of load curves. • Control of voltage and reactive power in distribution system • Understand distribution automation • Understand distribution substation layout with associated equipments.

UNIT-1: 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.

UNIT-2: Feeders: Radial and loop types, engineering considerations for voltage levels and loading, causes of unbalance and unequal drops.

UNIT-3 : System analysis : Voltage drop and power loss calculations, manual methods of solution of radial networks, three-phase & non-three-phase primary lines load flow and symmetrical component applications.

UNIT-4: 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.

UNIT-5 : Introduction to Distribution Automation, Data acquisition system and decentralized control, data acquisition and protection considerations of control panel(Specific reference to MCCB, HRC), earthing.

UNIT-6: Substation :- Equipment, layouts, theoretical consideration for fault calculations.

Text Books		
Title of Book	**Name of Author/s**	**Edition & Publisher**
Electrical Power Distribution System	Kamaraju	Tata-McGraw Hill Publications
Electric Power Distribution	A. S. Pabla	Tata Mc Graw-Hill Publishing Company
Reference Books		
Electric Power Distribution Automation	M. K. Khedkar & G. M. Dhole	University Science Press

BEELE 803 T -SWITCH GEAR AND PROTECTION

Learning Objectives	Learning Outcomes
Students will understand • The theory and applications of the main components used in power system protection. • The protection systems used for electric machines, transformers, bus bars, transmission lines. • The theory, construction, and applications of main types of circuit breakers. • to design the feasible protection systems needed for each main part of a power system	Students has understood • Theory & application of main components used in power system protection. • Protection systems used for electric machines, transformers, bus bars, transmission lines. • Theory, construction, and applications of main types of circuit breakers. • Design the protection systems needed for each main part of a power system.

Unit 1:- General philosophy of Protective Relaying: Protective zones, primary protection, Back up protection Remote and Local Back up selectivity.

Unit 2:- Medium voltage Line Protection: Over current relaying, directional- over current relay.

Unit 3: High Voltage Line Protection: Distance relays, carrier distance Schemes. Unit carrier schemes.

Unit 4: Equipment Protection: Principles of differential relaying, protection of generator, transformers and bus Bars by differential relaying and other relays. Protection of Induction Motors against overloads, short circuits. thermal relays, miniature circuit breakers.

Unit 5: - Introduction static relays *:* Comparison of static and electro mechanical relays, two input amplitude and phase comparator and their duality. Generation of various distance relay characteristics using above comparators.

Unit 6: Switchgear: Circuit breakers. Arc interruption theory, recovery and Restricting voltages, RRRV, breaking of inductive and capacitive currents, C.B, ratings, different media of arc interruption, overview of oll circuit breakers, construction and operation of Air blast, SF6 and vacuum breakers.

Books:

Text Books		
Title of Book	**Name of Author/s**	**Edition & Publisher**
Switchgear and Protection	Sunil S Rao	Khanna Publishers, 1992
Power System *Protection* and *Switchgear*	B. Ravindranath, M. Chander	New Age International
Power System Protection and switchgear	B.Ram	Tata McGraw Hill
Reference Books		
The art and science of protective relaying	C. Russell Mason	Wiley, 1956
Protective Relaying, Vol. I & II	Warrington	Springer

BEELE 804 T - COMPUTER APPLICATIONS IN POWER SYSTEM.

<table>
<tr><th>Learning Objectives</th><th>Learning Outcomes</th></tr>
<tr><td>This subject exposes students to the mathematical foundational concepts that are necessary in the field of electrical engineering such as
a) Load flow.
b) Short Circuit studies.
c) Transient Stability Studies.</td><td>On successful completion of this course, students will be able to
• Determine Bus Impedance & Admittance matrix (required for Load flow & Short circuit Studies) by graphically, Inspection & building algorithm.
• Load flow study of a power system by Newton-Raphson & Gauss-Seidal Iterative Method.
• Short circuit studies.
• Transient stability by using Eulers, Modified Eulers & RK-4^{th} order differential method.</td></tr>
</table>

Unit 1: Incidence & Network Matrices: Graph incidence Matrices, Primitive network, formation of network matrices by Singular transformations.

Unit 2: Algorithm for formation of Bus Impedance and Bus Admittance matrix' for system without mutual coupling.

Unit 3: Three phase Networks: Three phase balance network elements with balanced and unbalanced excitation, incidence and network matrices *for* three phase element. Algorithm for formation of three phase bus impedance matrices without mutual coupling. .

Unit 4: Load Flow Studies: Power system load flow equations, solution Technique; Gauss Seidel Newton Raphson and fast decoupled technique with and without voltage control buses. Representation of tap changing and phase shifting transformers, Elementary load flow programs.

Unit 5: Short circuit studies: Three phase network short circuit calculations using bus impendence matrix for balance and unbalanced faults. Computer programme for short circuit studies on simple system.

Unit 6: Transient Stability studies: Modelling of synchronous machine. power system network for transient stability studies, Numerical, solution of swing equation by modified Euler and Runge Kutta 4th order method. Elementary computer programme for the transient stability study.

BOOKS:

Text Books		
Title of Book	**Name of Author/s**	**Edition & Publisher**
Computer method in power system analysis	Stagg and E1e Abid	McGraw Hill
Elements of power system analysis	William D. Stevenson	Mcgraw-Hill Book Comp., 1982
Computer Analysis of Power system	R N Dhar	
Reference Books		
Electric Energy System Theory and introduction	Ole Elegard	Tata McGraw-Hill, 1983

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Detailed Syllabus
for
Third Year B. Tech. Program in Computer Engineering

With effective from July 2019-20

Semester I

Group A

Course Code	**Course Title**	**Weekly Teaching hrs**			**Evaluation Scheme**			**Credit**
		L	T	P	MSE	CA	ESE	
Mandatory	**Induction Program**	**3 Weeks duration in the beginning of the semester.**						
BTBS101	Engineering Mathematics - I	3	1	-	20	20	60	4
BTBS102	Engineering Physics	3	1	-	20	20	60	4
BTES103	Engineering Graphics	2	-	-	20	20	60	2
BTHM104	Communication Skills	2	-	-	20	20	60	2
BTES105	Energy and Environment Engineering	2	-	-	20	20	60	2
BTES106	Basic Civil and Mechanical Engineering	2	-	-	-	50	-	Audit
BTBS107L	Engineering Physics Lab	-	-	2	-	60	40	1
BTBS108L	Engineering Graphics Lab	-	-	4	-	60	40	2
BTHM109L	Communication Skill Lab	-	-	2	-	60	40	1
	TOTAL	**14**	**2**	**8**	**100**	**330**	**420**	**18**

Semester II

Group B

Course Code	Course Title	Weekly Teaching hrs			Evaluation Scheme			Credit
		L	T	P	MSE	CA	ESE	
BTBS201	Engineering Mathematics - II	3	1	-	20	20	60	4
BTBS202	Engineering Chemistry	3	1	-	20	20	60	4
BTES203	Engineering Mechanics	2	1	-	20	20	60	3
BTES204	Computer Programming in C	2	-	-	20	20	60	2
BTES205	Workshop Practices	-	-	4	-	60	40	2
BTES206	Basic Electrical & Electronics Engineering	2	-	-	-	50	-	Audit
BTBS207L	Computer Programming Lab	-	-	2	-	60	40	1
BTBS208L	Engineering Chemistry Lab	-	-	2	-	60	40	1
BTES209L	Engineering Mechanics Lab	-	-	2	-	60	40	1
BTES210P	Mini Project	-	-	2	-	60	40	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).	-	-	-	-	-	-	Credit to be evaluated in III Sem.
	TOTAL	**12**	**3**	**12**	**80**	**430**	**440**	**19**

Semester III

Sr. No.	Course Code	Course Title	Weekly Teaching hrs			Evaluation Scheme			Credit
			L	T	P	MSE	CA	ESE	
1	BTBSC301	Engineering Mathematics – III	3	1	-	20	20	60	4
2	BTCOC302	Discrete Mathematics	2	1	-	20	20	60	3
3	BTCOC303	Data Structures	2	1	-	20	20	60	3
4	BTCOC304	Computer Architecture & Organization	2	1	-	20	20	60	3
5	BTCOC305	Digital Electronics & Microprocessors	2	1	-	20	20	60	3
6	BTHM3401	Basic Human Rights	2	-	-	-	50	-	Audit
7	BTCOL306	Python Programming	1	-	2	-	60	40	2
8	BTCOL307	HTML and JavaScript	1	-	2	-	60	40	2
9	BTCOL308	Data Structures Lab	-	-	2	-	60	40	1
10	BTCOL309	Digital Electronics & Microprocessor Lab	-	-	2	-	60	40	1
11	BTES211P	Field Training / Internship / Industrial Training Evaluation	-	-	-	-	-	50	1
		TOTAL	**15**	**5**	**8**	**100**	**390**	**510**	**23**

Semester IV

Sr. No.	Course Code	Course Title	Weekly Teaching hrs			Evaluation Scheme			Credit
			L	T	P	MSE	CA	ESE	
1	BTCOC401	Design & Analysis of Algorithms	2	1	-	20	20	60	3
2	BTCOC402	Probability & Statistics	2	1	-	20	20	60	3
3	BTCOC403	Operating Systems	2	1	-	20	20	60	3
4	**Elective-I**								
	BTCOE404A	Object Oriented Programming in Java	2	1	-	20	20	60	3
	BTCOE404B	Object Oriented Programming in C++							
5	BTID405	Product Design Engineering	1	-	2	-	60	40	2
6	**Elective-II**								
	BTBS405A	Physics of Engineering Materials	2	1	-	20	20	60	3
	BTCOE406B	Numerical Methods							
	BTHM3402	Soft Skills and Personality Development							
7	BTCOL407	Design & Analysis of Algorithms Lab	-	-	2	-	60	40	1
8	BTCOL408	Introduction to Data Science with R	1	-	2	-	60	40	2
9	BTCOL409	Object Oriented Programming Lab	-	-	2	-	60	40	1
10	BTCOL410	Operating System Lab	-	-	2	-	60	40	1
11	BTCOF411	Field Training/Internship/Industrial Training Evaluation (Credit to be evaluated in V Sem.)	-	-	-	-	-	-	*
		TOTAL	**12**	**5**	**10**	**100**	**400**	**500**	**22**

Sr. No.	Course Code	Course Title	Weekly Teaching hrs			Evaluation Scheme			Credit
Semester V									
			L	T	P	MSE	CA	ESE	
1	BTCOC501	Database Systems	3	1	-	20	20	60	4
2	BTCOC502	Theory of Computations	3	1	-	20	20	60	4
3	BTCOC503	Machine Learning	3	1	-	20	20	60	4
4	BTCOE504	**Elective-III** (A) Introduction to Research (B) Cyber Laws **(C) Open Elective offered by other departments**	2	-	-	20	20	60	2
5	BTCOE505	**Elective-IV** (A) Economics & Management (B) Business Communication	2	-	-	20	20	60	2
6	BTCOC506	Competitive Programming-I	1	-	2	-	60	40	2
7	BTCOL507	Database System Laboratory	-	-	2	-	60	40	1
8	BTCOL508	Machine Learning Laboratory	-	-	2	-	60	40	1
9	BTCOS509	Seminar	-	-	2	-	60	40	1
10	BTCOF411	Internship/Industrial Training	-	-	-	-	60	40	1
		TOTAL	**14**	**3**	**8**	**100**	**400**	**500**	**22**

Sr. No.	Course Code	Course Title	Weekly Teaching hrs			Evaluation Scheme			Credit
Semester VI									
			L	T	P	MSE	CA	ESE	
1	BTCOC601	Compiler Design	3	1	-	20	20	60	4
2	BTCOC602	Computer Networks	3	1	-	20	20	60	4
3	BTCOE603	**Elective-V** (A) Human Computer Interaction (B) Artificial Intelligence (C) Object-Oriented Analysis Design	2	1	-	20	20	60	3
4	BTCOE604	**Elective-VI** (A) Geographic Information System (B) Biology (C) Internet of Things	2	-	-	20	20	60	2
5	BTCOE605	**Open Elective-VII** (A) Development Engineering (B) National Social Service (C) Consumer Behaviour	2	-	-	20	20	60	2
6	BTCOC606	Competitive Programming-II	1	-	2	-	60	40	2
7	BTCOL607	(A) Mobile Application Development (B) Internet of Things Laboratory	1	-	2	-	60	40	2
8	BTCOL608	Computer Networks Laboratory	-	-	2	-	60	40	1
9	BTCOF609	Filed Training / Internship / Industrial Training (Credit to be evaluated in VII Sem.)	-	-	-	-	-	-	*
		TOTAL	**14**	**3**	**6**	**100**	**280**	**420**	**20**

Sr. No.	**Course Code**	**Course Title**	**Weekly Teaching hrs**			**Evaluation Scheme**			**Credit**
Semester VII									
			L	T	P	MSE	CA	ESE	
1	BTCOC701	Software Engineering	2	-	-	20	20	60	2
2	BTCOE702	**Elective-VIII** (A) Bioinformatics (B) Distributed System (C) Cloud Computing	2	1	-	20	20	60	3
3	BTCOE703	**Elective-IX** (A) Advanced Operating System (B) Computer Graphics (C) Bio-Metrics (D) Digital Image Processing	2	1	-	20	20	60	3
4	BTCOE704	**Open Elective-X** (A) Information Security (B) Business Intelligence (C) Blockchain	2	1	-	20	20	60	3
5	BTCOL705	Full Stack Development (LAMP/MEAN)	1	-	2	-	60	40	2
6	BTCOL706	System Administration	1	-	2	-	60	40	2
7	BTCOP707	Project-I	-	-	6	-	60	40	6
8	BTCOF609	Internship/Industrial Training	-	-	-	-	60	40	1
		TOTAL	**10**	**3**	**10**	**80**	**320**	**400**	**22**

Sr. No.	Course Code	Course Title	Weekly Teaching hrs			Evaluation Scheme			Credit
Semester VIII (Scheme A)									
			L	T	P	MSE	CA	ESE	
1	BTCOE801	**Elective-XI** (A) Software Product Design (B) Quantum Computing (C) Software Testing (D) Big Data Analytics	2	1	-	20	20	60	3
2	BTCOE802	**Open Elective-XII** (A) 3D Printing And Design (B) Robotics (C) Advanced Database Techniques	2	1	-	20	20	60	3
3	BTCOE803	**Open Elective-XIII** (A) Virtual Reality (B) Deep Learning (C) Elective offered by other dept.	2	1	-	20	20	60	3
4	BTCOP804	Project-II	-	-	8	-	60	40	8
		TOTAL	**6**	**3**	**8**	**60**	**120**	**220**	**17**
Semester VIII (Scheme B)									
1	BTCOF805	Industrial In-plant Training	-	-	18	-	120	180	9
2	BTCOP804	Project-II	-	-	8	-	60	40	8
		TOTAL	**-**	**-**	**26**	**-**	**180**	**220**	**17**

NPTEL Mapping of Courses (Semester V to VIII)

No.	DBATU Course	NPTEL Course
Semester V		
1	Database Systems	Fundamental of Database System Prof. Arnab Bhattacharya, IIT Kanpur
2	Theory of Computations	Formal Languages and Automata Theory Prof. Diganta Goswami, IIT Guwhati
3	Machine Learning	Introduction to Machine Learning Prof. Sudeshana Sarkar, IIT Kharagpur
4	Introduction to Research	Introduction to Research Prof. Pratap Haridoss
5	Economics and Management	Economics, Management & Entrepreneurship Prof. P. K. Mahapotra, IIT Kharagpur
6	Business Communication	International Business Communication Prof: Aradhana Malik, IIT Kharagpur
Semester VI		
1	Compiler Design	Compiler Design By Prof. Santanu Chattopadhyay, IIT Kharagpur
2	Computer Network	Computer Network Prof. Soumya Kanti Ghosh, IIT Kharagpur
3	Human Computer Interaction	Human Computer Interaction Prof. K. Ponnurangam, IIT Delhi
4	Artificial Intelligence	Artificial Intelligence Prof. P. Dasgupta, IIT Kharagpur
5	Geographic Information System	Geographic Information System Prof. A K. Saraf, IIT Roorkee
6	Biology	Basic Biology Prof. Vishal Trivedi, IIT Guwahati
7	Internet of Things	Design for Internet of Things Prof. T. V. Prabhakar, IISC Bangalore
8	Consumer Behaviour	Introduction to Consumer Behavior Prof. Shrabanti Mukharjee, IIT Kharagpur
Semester VII		
1	Distributed System	Distributed System Prof. Rajiv Misra, IIT Patna
2	Cloud Computing	Cloud Computing Prof. Soumya Kanti Ghosh, IIT Kharagpur

3	Computer Graphics	Computer Graphics Prof. Sukhedu Das, IIT Madras
4	Blockchain	Blockchain Architecture Design and Use Cases Prof Sandip Chakraborty, IIT Kharagpur
	Semester VIII	
1	Software Testing	Software Testing Prof. Rajib Mall, IIT Kharagpur
2	Robotics	Robotics Prof. Dilip Kumar Pratihar, IIT Kharagpur
3	Virtual Reality	Virtual Reality Prof. Steve Lavalle, University of Illinois
4	Deep Learning	Deep Learning Prof. Mitesh Khapra, IIT Madras

BTCOC501 Database Systems

[Unit 1] 6 Hrs

Database system architecture: Data Abstraction, Data Independence, Data Definition Language (DDL), Data Manipulation Language (DML).

Data models: Entity-relationship model, Relational integrity constraints, data manipulation operations.

[Unit 2] 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 3] 6 Hrs

Relational database design: Domain and data dependency, Armstrong's axioms, Normal forms, Dependency preservation, Lossless design.

[Unit 4] 6 Hrs

Query processing: Evaluation of relational algebra expressions, Query equivalence, Join strategies.

[Unit 5] 6 Hrs

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

[Unit 6] 6 Hrs

Transaction processing: Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp based schedulers, Multi-version and optimistic Concurrency Control schemes, Database recovery.

Text Books:

1. Henry Korth, Abraham Silberschatz & S. Sudarshan, *Database System Concepts*, McGraw-Hill Publication, 6th Edition, 2011.
2. Raghu Ramakrishnan, 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. Mark L. Gillenson, *Fundamentals of Database Management System*, Wiley Publication, 2nd Edition, 2011.
5. J. D. Ullman, “Principles of Database and Knowledge – Base Systems”, Vol 1, Computer Science Press.
6. Serge Abiteboul, Richard Hull, Victor Vianu, “Foundations of Databases”, Reprint by Addison-Wesley.

BTCOC502 Theory of Computations

[Unit 1] 6 Hrs
Finite Automata and Regular Expressions: Definition of deterministic finite automata, Non-deterministic finite automata, Moore and Mealy machines and their conversions, Regular expressions, Recursive definition, NFA with e-moves, Inter-conversion between NFA and DFA, Regular expression and FA, Pumping lemma.

[Unit 2] 6 Hrs
Context Free Grammars: Definition, Production rules, Ambiguous grammar, Removal of ambiguity, Chomsky hierarchy, Context Free Grammar (CFG) – definition, Simplification of CFG.

[Unit 3] 6 Hrs
Context Free Languages: Definition of context free languages, Regular grammar definition, Left linear, Right linear grammar, Inter-conversion between left linear and right linear regular grammar, Regular grammar and finite automata, CNF, GNF, Derivation graphs, Type 0 and Type 1 grammars.

[Unit 4] 6 Hrs
Pushdown Automata: Formal definition, Pushdown automata (PDA), Deterministic Pushdown automata (DPDA) – definition, Non-deterministic Pushdown automata (NPDA) - definition, relative powers of DPDA and NPDA.

[Unit 5] 6 Hrs
Turing Machines and Undecidability: Definition, Computing with Turing machine, Extensions of Turing machines, Random access Turing machines, Non-deterministic Turing machines, Grammars, The Church's Turing hypothesis, Universal Turing machines, The Halting problem, Unsolvable problems about Turing machines.

Reference Books:

1. John C. Martin, *Introduction to Languages and Theory of Computation*, McGraw-Hill Publication, 4th Edition, 2010.
2. Krithivasan Kamala, *Introduction to Formal Languages, Automata Theory and Computation*, Pearson Education, 1st Edition, 2009.
3. Papadimitriou, Lewis, *Elements of the Theory of Computations*, PHI Publication, 2nd Edition, 1997.
4. E. V. Krishnmurthy, *Introductory Theory of Computer Science*, Springer-Velang New York Inc., 1st Edition, 1985.

Text Books:

1. Hopcroft, Ullman, Motwani, *Introduction to Automata Theory, Languages, and Computation,* Addison Wesley Publication, 2nd Edition, 2001.
2. Daniel I. A. Cohen, *Introduction to Computer Theory*, Wiley Publication, 1st Edition, 1986.

BTCOC503 Machine Learning

[Unit 1] **6 hrs**

Introduction: Basic definitions, types of learning, hypothesis space and inductive bias, evaluation, cross-validation, Linear regression, Decision trees, overfitting.

[Unit 2] **6 hrs**

Instance based learning, Feature reduction, Collaborative filtering based recommendation, Probability and Bayes learning.

[Unit 3] **6 hrs**

Logistic Regression, Support Vector Machine, Kernel function and Kernel SVM.

[Unit 4] **6 hrs**

Neural network: Perceptron, multilayer network, backpropagation, introduction to deep neural network.

[Unit 5] **6 hrs**

Computational learning theory, PAC learning model, Sample complexity, VC Dimension, Ensemble learning.

[Unit 6] **6 hrs**

Clustering: k-means, adaptive hierarchical clustering, Gaussian mixture model.

Reference Books:

1. Machine Learning, Tom Mitchell, First Edition, McGraw Hill, 1997.
2. Introduction to Machine Learning, 2nd Edition, by Ethem Alpaydin.

BTCOE504(A) Introduction to Research

[Unit 1]
What is research; Overview of research.

[Unit 2]
Literature survey, Conducting Systematic Research Survey.

[Unit 3]
Experimental skills; Data analysis; modelling skills.

[Unit 4]
Technical writing, Technical Presentations, Creativity in Research.

[Unit 5]
Technical writing, Technical Presentations, Creativity in Research, Research plagiarism.

[Unit 6]
Conducting a sample Research Survey on a given topic

Reference Books:

1. Research Methodology, Methods and Techniques by C.R Kothari, 2nd Edition.

BTCOE504(B) Cyber Laws

[Unit 1]
Internet, E-Commerce And E-Governance With Reference To Free Market Economy Understanding Computers, Internet and Cyber Laws, Conceptual Framework of E-commerce: E-governance, The Role of Electronic Signatures in E-commerce with Reference to Free Market Economy in India.

[Unit 2]
Law Relating To Electronic Records And Intellectual Property Rights In India Legal Aspects of Electronic Records/Digital Signatures, The Rules and Regulations of Certifying Authorities in India, Protection of Intellectual Property Rights in Cyberspace in India.

[Unit 3]
International Efforts Relating To Cyberspace Laws And Cyber Crimes International Efforts Related to Cyberspace Laws, Council of Europe (COE) Convention on Cyber Crimes.

[Unit 4]
Penalties, Compensation And Offences Under The Cyberspace And Internet In India Penalties, Compensation and Adjudication of Violations of Provisions of IT Act and Judicial Review Some Important Offences under the Cyberspace Law and the Internet in India, Other Offences under the Information Technology Act in India.

[Unit 5]
Miscellaneous Provisions Of It Act And Conclusions The Role of Electronic Evidence and the Miscellaneous Provisions of the IT Act, Information Technology Act as Amended up to 2008, The Information Technology (Certifying Authorities) Rules, 2000, The Information Technology (Certifying Authorities) Rules, 2000, Ministerial Order on Blocking of Websites.

Reference Books:

1. Harish Chander, Cyber Laws and It Protection, PHI Publication.
2. Faiyaz Ahamad, KLSI, Cyber Law and Information Security, Dreamtech Press.
3. Murray, Information Technology Law: Law and Society, 3rd Edition, Oxford University Press Oxford 2016.
4. Sunit Belapure Nina Godbole, Cyber Security, Wiley India Pvt. Ltd.
5. Vivek Sood, Cyber Law Simplified, McGraw-Hill Publication.

BTCOE505(A) Economics and Management

[Unit 1]

Introduction, Market Equilibrium: Demand and Supply, Elasticity of Demand Demand Forecasting, Production, Exercises on Economics, Cost-Volume-Profit Relationships, Cost Management Systems and Activity Costing System

[Unit 2]

Relevant Information and Decision Making, Cost Allocation, Exercises on Economics, Double-Entry Bookkeeping, Job Casting, Process Costing, The Master Budget, Flexible Budgets and Variance Analysis.

[Unit 3]

Financial Statements, Analysis of Financial Statements, Time Value of Money, Comparison of Alternatives.

[Unit 4]

Depreciation Accounting, Evolution of Management Thoughts, Functions of Management Directing.

[Unit 5]

Product Development, Forecasting Revisited, Capacity Planning, Product / Services Strategies and Plant Layout, Production Planning and Control.

[Unit 6]

Inventory Management, Supply Chain Management, Marketing Management, Forms of Ownership, Starting a New Company and Small-Scale Industrial Understandings, Capital Financing, Entrepreneurship.

BTCOE505(B) Business Communication

[Unit 1]
Introduction, Definitions & Concepts, Communicative Competence.

[Unit 2]
Intercultural Communication, Nonverbal Communication, Thought and Speech, Translation as Problematic Discourse.

[Unit 3]
Barriers to Communication, Listening, Communication Rules, Communication Style.

[Unit 4]
Interpersonal Communication, Relational Communication, Organizational Communication.

[Unit 5]
Collaboration, Communication in Groups and Teams, Persuasive Communication.

[Unit 6]
Negotiation and Conflict Management, Leadership, Written Communication in International Business, Role of Technology in international Business Communication, Moving to Another Culture, Crisis Communication, Ethics in Business Communication.

BTCOC506 Competitive Programming-I

[Unit 1]

Introduction

Online Judge The Programming Challenges Robot Judge, Understanding Feedback From the Judge, Choosing Programming Languages, Reading Our Programs, Standard Input/Output, Programming Hints, Elementary Data Types.

Challenging Problems

(1) The 3n + 1 Problem (2) Minesweeper (3) The Trip, (4) LCD Display (5) Graphical Editor (6) Interpreter (7) Check the Check (8) Australian Voting.

[Unit 2]

Elementary Data Structures

Data Structures: Elementary Data Structures, Stacks, Dictionaries, Priority Queues Sets, Object Libraries, The C++ Standard Template Library, The Java java.util Package, Program Design Example: Going to War, Hitting the Dec, String Input/Output, Winning the War, Testing and Debugging.

Challenging Problems

(1) Jolly (2) Poker Hands (3) Hartals (4) Crypt Kicker (5) Stack ’em Up (6) Erd¨os Numbers (7) Contest Scoreboard (8) Yahtzee.

[Unit 3]

Strings

Character Codes, Representing Strings, Program Design Example: Corporate Renamings, Searching for Patterns, Manipulating Strings, Completing the Merger, String Library Functions.

Challenging Problems

(1) WERTYU (2) Where’s Waldorf? (3)Common Permutation (4) Crypt Kicker II (5) Automated Judge Script (6) File Fragmentation (7) Doublets (8) Fmt

[Unit 4]

Sorting

Sorting, Sorting Applications Sorting Algorithms, Program Design Example: Rating the Field, Sorting Library Functions, Rating the Field.

Challenging Problems

(1) Vito’s Family (2) Stacks of Flapjacks (3) Bridge (4) Longest Nap (5) Shoemaker’s Problem (6) CDVII (7) ShellSort (8) Football.

[Unit 5]

Arithmetic and Algebra
Machine Arithmetic, Integer Libraries, High-Precision Integers, High-Precision Arithmetic, Numerical Bases and Conversion, Real Numbers, Dealing With Real Numbers, Fractions, Decimals, Algebra, Manipulating Polynomials, Root Finding, Logarithms, Real Mathematical Libraries.

Challenging Problems
(1) Primary Arithmetic (2) Reverse and Add (3) The Archeologist's Dilemma (4) Ones
(5) A Multiplication Game (6) Polynomial Coefficients (7) The Stern-Brocot Number System
(8) Pairsumonious Numbers.

[Unit 6]

Combinatorics
Basic Counting Techniques, Recurrence Relations, Binomial Coefficients, Other Counting Sequences, Recursion and Induction Problems.

Challenging Problems
(1) How Many Fibs? (2) How Many Pieces of Land? (3) Counting (4) Expressions (5) Complete Tree Labeling (6) The Priest Mathematician (7) Self-describing Sequence (8) Steps

List of Practical:

At least twenty five problems solving on competitive programming platforms such as, https://uva.onlinejudge.org, http://hackerrank.com/, http://codechef.com/

Reference Books:

1. Steven S. Skiena Miguel A. Revilla, PROGRAMMING CHALLENGES The Programming Contest Training Manual, Springer.
2. Antti Laaksonen, Competitive Programmer's Handbook.
3. Steven Halim, Competitive Programming 3: The Lower Bounds of Progamming Contests.
4. Gayle Lakaman Cracking the Coding Interview.
5. The Hitchhiker's Guide to the Programming Contests.

BTCOL507 Database System Laboratory

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.

BTCOL508 Machine Learning Laboratory

As a part of lab exercises for Machine Learning Laboratory, it is suggested that the student should get hands-on experience by solving data analysis problems available on Machine Learning competition platforms such as HackerEarth and Kaggle. Some of the suggestive list of problem solving is given below. The link address is as retrieved from www.hackerearth.com on 17 June 2019. Knowledge of R programming or Python is required to solve these problems, students get this prerequisite in Second Year.

1	Regression Analysis and Plot interpretation
2	Logistic Regression Analysis in R
3	Random Forest and Parameter Tuning in R
4	Clustering Algorithms and Evaluation in R
5	Machine Learning Project in Python on Hourse Prices Data

BTCOC601 Compiler Design

[Unit 1] **6 Hrs**
Introduction to Compiling
Definition, analysis of the source program, the phases of a compiler, the grouping of phases, Compiler Construction tools, A simple one-pass compiler,

[Unit 2] **6 Hrs**
Lexical Analysis
The role of the Lexical analyzer, Input buffering, Specification of Tokens, A Language for Specifying Lexical Analyzers, Design of a Lexical Analyzer generator.

[Unit 3] **6 Hrs**
Syntax Analysis
The role of the Parser, Context-free grammars, Writing a Grammar, Top-Down Parsing, Bottom-Up Parsing, Operator-precedence Parsing, LR Parsers, Using Ambiguous Grammars, Parser Generators.

[Unit 4] **6 Hrs**
Syntax-Directed Translation
Definitions, Construction of Syntax Trees, Bottom-Up Evaluation of S- Attributed definitions, Top-Down Translation, Bottom-Up Evaluation of Inherited attributes.

Unit 5] **6 Hrs**
Intermediate Code Generation
Intermediate Languages, Declarations, Assignment Statements, Boolean Expressions, Case Statements, Back patching, Procedure Calls.

[Unit 6] **6 Hrs**
Code Generation
Issues in the Design of a Code Generator, The target Machine, Run-Time Storage Management, Basic Blocks and Flow Graphs, Next-Use Information, Simple Code Generator, Register allocation and Assignment, The DAG Representation of Basic Blocks, Generating Code from DAGs, Dynamic Programming, Code-Generation Algorithm, Code-Generators.

Text Books:

1. Aho, Sethi, Ullman, *Compilers Principles, Techniques and Tools*, Addison Wesley, 1st Edition, 1987.
2. Hopcroft, Motwani and Ullman, *Introduction to Automata Theory*, *Languages and Computation*, Pearson Publication, 2nd Edition, 2001.
3. Dick Grune, Kees van Reeuwijk, Henri E. Bal, Ceriel J. H. Jacobs and Koen Langendoen, *Modern Compiler Design*, Springer, 2nd Edition, 2012.

BTCOC602 Computer Networks

[Unit 1] 6 Hrs

Introduction: Applications of computer networks, Network hardware, Network software: Protocol Hierarchy, Design Issue, connection oriented vs. connectionless, Service Primitives, Reference models: OSI and TCP/IP, Example networks: Internet, Network standardization, Performance: Bandwidth and Latency, Delay and bandwidth product, High-Speed Network, Application Performance Needs.

[Unit 2] 6 Hrs

LAN Technologies: X.25, Frame relay, ATM, Ethernet (802.3), FDDI, Token Rings, Resilient Packet Rings, Wireless LANs: Wi-Fi (802.11), Cell Phone Technologies, Broadband Wireless: Wi-MAX (802.16), Bluetooth (802.15.1), RFID.

[Unit 3] 6 Hrs

Data Link Layer: Data Link Layer Design Issues: Service provided to network layer Framing, Error Control, Flow Control, Error Detection and Correction: error correcting codes, error detecting codes.

[Unit 4] 6 Hrs

Network Layer and Congestion Control: IPv4/IPv 6, Routers and Routing Algorithms distance vector link state. TCP UDP and sockets.

Congestion Control and QOS: General principles, Congestion prevention policies, Load shading, Jitter control, Quality of service: Packet scheduling, Traffic shaping, integrated Services.

[Unit 5] 6 Hrs

Application Layer Protocols: DNS, SMTP, POP, FTP, HTTP.

[Unit 6] 6 Hrs

Network Security: Authentication, Basics of public key and private key cryptography, digital signatures and certificates, firewalls.

Reference Books:

1. S. Keshav, *An Engineering Approach to Computer Networking*, Addison-Wesley Professional, 1st Edition, 1997.
2. D. Comer, *Computer Networks and Internet*, Pearson Education, 6th Edition, 2014.
3. M. Gallo, W. Hancock, *Computer Communications and Networking Technologies*, Brooks/Cole Publisher, 2001.
4. Natalia Olifer, Victor Olifer, *Computer Networks: Principles, Technologies and Protocols for Network Design*, Wiley Publication, 2005.

Text Books:

1. Tanenbaum, *Computer Networks*, PHI Publication, 5th Edition, 2011.
2. B. Forouzan, *Data Communications and Networking*, McGraw Hill Publication, 5th Edition, 2013.
3. Larry Peterson and Bruce Davie, *Computer Networks: A Systems Approach*, Morgan Kufman Publication, 5th Edition, 2012.

BTCOE603(A) Human Computer Interaction

[Unit 1] 6 Hrs

Introduction: Course objective and overview, Historical evolution of the field, The Human, The Computer, The Interaction.

[Unit 2] 6 Hrs

Design processes: Interaction Design basics, Concept of usability – definition and elaboration, HCI in the Software Process, Design Rules.

[Unit 3] 6 Hrs

Implementation and Evaluation: Implementation Support, Evaluation Techniques, Universal Design, Use Support.

[Unit 4] 6 Hrs

Models: Cognitive Models, Socio – Organizational Issues and Stakeholders Requirements, Communication and Collaboration models.

Theories: Task Analysis Dialog notations and Design Models of the system Modeling Rich Interactions.

[Unit 5] 6 Hrs

Modern Systems: Group ware, Ubiquitous Computing and Augmented Realities, Hypertext, Multimedia and World Wide Web.

Reference Books:

1. Jenny Preece, Helen Sharp, Yvonne Rogers, *Interaction Design: Beyond Human-Computer Interaction*, Wiley Publication, 4th Edition, 2015.
2. Gerard Jounghyun Kim, *Human–Computer Interaction: Fundamentals and Practice*, CRC Press, 2015.
3. Jenifer Tidwell, *Designing Interfaces, Patterns for Effective Interaction Design*, O'Reilly Media, 2nd Edition, 2010.

Text Books:

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, *Human Computer Interaction*, Pearson Education, 3rd Edition, 2003.
2. B. Shneiderman, *Designing the User Interface*, Addison-Wesley Publishing Company.

BTCOE603(B) Artificial Intelligence

[Unit 1]

Introduction

Introduction, What Is AI?, The Foundations of Artificial Intelligence, The History of Artificial Intelligence, The State of the Art.

Intelligent Agents

Agents and Environments Good Behavior: The Concept of Rationality, The Nature of Environments, The Structure of Agents.

[Unit 2]

Problem-solving

Solving Problems by Searching, Problem-Solving Agents, Example Problems, Searching for Solutions, Uninformed Search Strategies, Informed (Heuristic) Search Strategies, Heuristic Functions.

[Unit 3]

Constraint Satisfaction Problems

Defining Constraint Satisfaction Problems, Constraint Propagation: Inference in CSPs, Backtracking Search for CSPs, Local Search for CSPs, The Structure of Problems.

[Unit 4]

Game Playing

Adversarial Search, Games, Optimal Decisions in Games, Alpha–Beta Pruning.

[Unit 5]

Logical Agents

Knowledge-Based Agents, The Wumpus World, Logic, Propositional Logic: A Very Simple Logic, Propositional Theorem Proving, Effective Propositional Model Checking, Agents Based on Propositional Logic

First-Order Logic

Representation Revisited Syntax and Semantics of First-Order Logic, Using First-Order Logic, Knowledge Engineering in First-Order Logic, Inference in First-Order Logic, Propositional vs. First-Order Inference, Unification and Lifting, Forward Chaining, Backward Chaining, Resolution.

[Unit 6]

Uncertainty

Quantifying Uncertainty, Acting under Uncertainty, Basic Probability Notation, Inference Using Full Joint Distributions, Independence, Bayes' Rule and Its Use, The Wumpus World Revisited, Probabilistic Reasoning, Representing Knowledge in an Uncertain Domain, The Semantics of Bayesian Networks, Efficient Representation of Conditional Distributions Exact Inference in Bayesian Networks, Approximate Inference in Bayesian Networks, Relational and First-Order Probability Models, and Other Approaches to Uncertain Reasoning.

Reference Books:

1. Peter Norvig, Artificial Intelligence: A Modern Approach, Third Edition.

BTCOE603(C) Object Oriented Analysis Design

[Unit 1]
Introduction Overview of object oriented system, Object orientation, Objects, attributes, object behavior, Object respond to messages, encapsulation, Inheritance, Polymorphism, object relationships and association, aggregation, Object identity static and dynamic binding, Object persistence, meta classes. Object oriented system development life cycle.

[Unit 2]
Object oriented modeling Modeling, UML Modeling, class diagram, activity diagram, Sequence diagram, collaboration diagram state chart diagram, interaction diagram, Implementation diagram, use case diagram.

[Unit 3]
Object oriented analysis Use case analysis, CRC card analysis.

[Unit 4]
Object Oriented Design, Design Patterns.

[Unit 5]
Implementation from Design to Implementation, Programming Style, Object-Oriented languages, Non-Object-Oriented languages, Object Oriented Databases, Computer animation, Electrical Distribution design System, Future of Object-Oriented Technology.

Text Books:

1. Grady, Booch, Object Oriented analysis and design with applications, 2nd Edition, PHI.
2. James Rumbaugh, Object-Oriented Modeling And Design, 1st Edition, PHI Publication.
3. Ali Bahrami, Object Oriented Systems Development, 1st Edition, McGraw-Hill Publication.
4. Robert Lafore, Object Oriented Programming, Galgotia Publication.
5. Dan Pilone, Neil Pitman, UML 2.0 in a Nutshell: A Desktop Quick Reference, O'Reilly Media.
6. E. Balagurusamy, Object Oriented Programming, McGraw-Hill Publication.
7. S. Koshafian, Object Orientation, Wiley Publication.
8. Mike O'Docherty, Object-Oriented Analysis Design: Understanding System Development with UML 2.0, Wiley Publication.

BTCOE604(A) Geographic Information System

[Unit 1]
What is Geographic Information Systems?, Different components of GIS, Different types of vector data, Raster data models and their types TIN data model.

[Unit 2]
Advantages and disadvantages associated with vector, raster and TIN Non-spatial data attributes and their type Raster data compression techniques Different raster data file formats Spatial database systems and their types.

[Unit 3]
Pre-processing of spatial datasets Different map projections, Spatial interpolation techniques Different types of resolutions Digital Elevation Model (DEM).

[Unit 4]
Quality assessment of freely available DEMS GIS analysis-1 GIS analysis-2 and applications Errors in GIS Key elements of maps

Reference Books:
1. An Introduction to Geographical Information Systems (4th Edition) by Ian Heywood, Sarah Cornelius and Steve Carver, 2012.
2. Introduction to Geographic Information Systems by Chang Kang-tsung (Karl), 2006
3. Geographic Information Systems: An Introduction.

BTCOE604(B) Biology

[Unit 1]

Introduction

Introduction, Different Fields of Biology.

[Unit 2]

Origin of Life and Evolution

Different theories of origin of life, Experimental evidences supporting different theories. Lamarck, Darwanism and other theories of evolution, Documentary evidences supporting different evolution theories.

[Unit 3]

Ecology

Ecosystem, Food Chain, Pollution

[Unit 4]

Physiology

Process of Food intake and Digestion, Nerves conduction and electrophysiology, Muscle contraction and locomotion, Different Methods of Reproduction in prokaryotic and eukaryotic system

[Unit 5]

Cell Biology and Sub-Cellular Structures

Structure and function of eukaryotic and prokaryotic cells

[Unit 6]

Biological System

Structure-function of biological macromolecules, Central Dogma of Life, Replication, Transcription, Translation,

Reference Books:

1. J. L. Tymoczko, J. M. Berg and L. Stryer, Biochemistry, 5th Ed, W. H. Freeman & Co.
2. D. L. Nelson and M. M. Cox, Lehninger Principles of Biochemistry, Macmillan Worth, 2000.
3. N. Hopkins, J. W. Roberts, J. A. Steitz, J. Watson and A. M. Weiner, Molecular Biology of the Gene, 4th Ed, Benjamin Cummings, 1987.
4. C. R. Cantor and P. R. Schimmel, Biophysical Chemistry (Parts I, II and III), W.H. Freeman & Co., 1980.

BTCOE604(C) Internet of Things

[Unit 1] 8 Hrs

Introduction to IoT

Architectural Overview, Design principles and needed capabilities, IoT Applications, Sensing, Actuation, Basics of Networking, M2M and IoT Technology Fundamentals Devices and gateways, Data management, Business processes in IoT, Everything as a Service(XaaS), Role of Cloud in IoT, Security aspects in IoT.

[Unit 2] 9 Hrs

Elements of IoT

Hardware Components Computing (Arduino, Raspberry Pi), Communication, Sensing, Actuation, I/O interfaces, Software Components Programming API's (using Python / Node.js / Arduino) for Communication Protocols-MQTT, ZigBee, Bluetooth, CoAP, UDP, TCP.

[Unit 3] 18 Hrs

IoT Application Development

Solution framework for IoT applications- Implementation of Device integration, Data acquisition and integration, Device data storage- Unstructured data storage on cloud/local server, Authentication, authorization of devices.

[Unit 4] 10 Hrs

IoT Case Studies

IoT case studies and mini projects based on Industrial automation, Transportation, Agriculture, Healthcare, Home Automation

Reference Books:

1. Vijay Madisetti, Arshdeep Bahga, Ïnternet of Things, "A Hands on Approach", University Press
2. Dr. SRN Reddy, Rachit Thukral 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
4. Jeeva Jose, "Internet of Things", Khanna Publishing House, Delhi
5. Adrian McEwen, "Designing the Internet of Things", Wiley
6. Raj Kamal, "Internet of Things: Architecture and Design", McGraw Hill
7. Cuno Pfister, "Getting Started with the Internet of Things", O Reilly Media.

BTCOE605(A) Development Engineering

[Unit 1]
Introduction, Various Definitions of Development Engineering.

[Unit 2]
World Poverty and Development, Poverty in the India, Sustainable Development, Culture and Global Competence, The Engineer's Role.

[Unit 3]
Social Justice, Social Justice and Engineering, Religious Perspectives, Secular Perspectives.

[Unit 4]
Development Strategies: Society, Technological Change, and Development, Development Economists' Perspectives, Global Health Perspective, International Education Perspective, Social Business Perspectives.

[Unit 5]
Engineering for Sustainable Community Development: The Engineer as a Helper Participatory Community Development, Teamwork and Project Management, Community Assessment: Learning About a Community, Project Selection, Humanitarian Technology, Participatory Technology Development, Humanitarian STEM Education.

[Unit 6]
ICT for Development, AI for Humanitarian purposes, Blockchain and Social Development.

Reference Books:

1. Kevin M. Passino, Humanitarian Engineering: Advancing Technology for Sustainable Development.

BTCOE605(B) National Social Service

[Unit 1] 6 Hrs

Introduction and Basic Concepts of NSS: History, Philosophy, Aims & objectives of NSS Organizational structure, Concept of regular activities, Special camping, Day Camps, Basis of adoption village/slums, Methodology of conducting Survey.

[Unit 2] 6 Hrs

Youth and community mobilization: Definition, Profile of youth, Categories of youth, Issues, Challenges and opportunities for youth, Youth as an agent of social change, Youth-adult partnership, Mapping of community stakeholders, Identifying methods of mobilization, Needs & importance of volunteerism.

[Unit 3] 6 Hrs

Importance and Role of Youth Leadership: Meaning and types of leadership, Qualities of good leaders; Traits of leadership, Importance and role of youth leadership.

[Unit 4] 6 Hrs

Life Competencies and skill: Definition and importance of life competencies, Communication, Inter Personal, Problem solving and decision making, Positive thinking, Self-confidence and self-esteem, Life goals, Stress and time management.

[Unit 5] 6 Hrs

Social Harmony and National Integration: Indian history and culture, Role of youth in peace-building and conflict resolution, Role of youth in Nation building.

[Unit 6] 6 Hrs

Youth Development Programmes in India: National Youth Policy, Youth development programmes at the National Level, State Level and voluntary sector, Youth-focused and Youth-led organizations.

Reference Books:

1. *National Service Scheme Manual (Revised),* Government of India, Ministry of Youth Affairs and Sports, New Delhi, 2006.
2. University of Mumbai National Service Scheme Manual, 2009.
3. Avhan Chancellor’s Brigade – NSS Wing, *Training camp on Disaster Preparedness Guidelines*, March 2012.
4. *Rashtriya Seva Yojana Sankalpana* – Prof. Dr. Sankay Chakane, Dr. Pramod Pabrekar, Diamond Publication, Pune.
5. *National Service Scheme Manual for NSS District Coordinators*, National Service Scheme Cell, Dept. of Higher and Technical Education, Mantralaya.
6. *Annual report of National Service Scheme (NSS)* published by DTE, Mantralaya.
7. *NSS Cell*, Dept. of Higher and Technical Education, Mantralaya, UTKARSHA- Socio and cultural guidelines.
8. *Case material as a Training Aid for Field Workers*, Gurmeet Hans.
9. *Social service opportunities in hospitals*, Kapil K. Krishnan, TISS.
10. *New Trends in NSS*, Research papers published by University of Pune.
11. *ANOOGUNJ Research Journal*, published by NSS Unit C. K. Thakur College.

BTCOE605(C) Consumer Behavior

[Unit 1]

Introduction to the Study of Consumer Behavior

Defining Consumer Behavior, Scope and Application of Consumer Behavior, Why Study Consumer Behavior, Evolution of Consumer Behavior as a Field Of Study and its relationship with Marketing: Behavioral Dimension, The Interdisciplinary Nature of Consumer Behavior.

Market Research and Consumer Behavior

Relevance of Market Research with Consumer Behavior, Approaches to Consumer Behavior Research, Quantitative Research, Qualitative Research.

[Unit 2]

Market Segmentation and Positioning, Market Segmentation, Basis for Segmentation, Alternatives available for Segmentation, Positioning.

[Unit 3]

The Consumer Decision Making Process

Buying Motives, Buying Roles, Consumer Decision Making Process, Levels of Consumer Decision Making, Perspectives to Consumer Decision Making, Consumer Decision Making Process.

[Unit 4]

Models of Consumer Behavior

The Economic model, Learning model, Psychoanalytic model, The sociological model.
The Howard Sheth model of Buying Behaviour, The Nicosia model, The Engel - Kollat - Blackwell Model, Engel, Blackwell and Miniard (EBM) model.

Psychological Influences on Consumer Decision Making

Consumers Needs & Motivation, Emotions and Mood, Consumer Involvement, Consumer Learning, Personality, Self-concept and Self-image, Consumer Perception, Risk and Imagery. Consumer Attitude: Belief, Affect, Attitude and Intention, Attitude Formation and Attitude Change, Consumer Communication.

[Unit 5]

Sociological Influences on Consumer Decision Making

Consumer groups, Consumer reference groups, Family and Life cycle, Social class and mobility, lifestyle analysis, Culture; Sub-Culture, Cross Culture, Interpersonal Communication and influence, Opinion Leadership.

Diffusion of innovation Diffusion Process, Adoption Process, Consumer Innovators, Multiplicative innovation adoption (MIA) model.

[Unit 6]

Organizational Buying

Differences between Industrial Markets and Consumer Markets, Differences between Organizational and Consumer Buying, Buying Decisions in Organizational Buying Process, Types of Decision Making, Organization Buyer's Decision Making Process, and Factors influencing Organizational Buying Behaviour, Decision Makers in Organizational Buying, Webster and Wind model of Organizational buying behaviour, The Sheth model of Industrial buying, The Sheth model of Industrial buying.

Consumer Behavior Analysis and Marketing Strategy

Consumer Behavior and Product Strategy, Consumer Behavior and Pricing Strategy, Consumer Behavior and Distribution Channel Strategy, Consumer Behavior and Promotion Strategy.

Reference Books

1. Consumer Behavior, Schiffman, L.G. and Kanuk L.L., Prentice Hall, India.

2. Consumer Behavior, Concepts and Applications, Loudon, D.L. and Bitta, A.J.D, Tata McGraw Hill.

3. Consumer Behavior and Marketing Startegy, Peter, J.P. and Olson, J.C., Schiffman, L.G. and Kanuk L.L., Prentice Hall, India.

BTCOC606 Competitive Programming-II

[Unit 1]
Number Theory
Prime Numbers, Finding Primes, Counting Primes, Divisibility Greatest Common Divisor, Least Common Multiple, Modular Arithmetic, Congruence’s Operations on Congruence’s, Solving Linear Congruence’s, Diophantine Equations, Number Theoretic Libraries.

Challenging Problems
(1) Light, More Light (2) Carmichael Numbers (3) Euclid Problem, (4) Factovisors, (5) Summation of Four Primes (6) Smith Numbers (7) Marbles (8) Repackaging.

[Unit 2]
Backtracking
Backtracking, Constructing All Subsets, Constructing All Permutations, Program Design Example: The Eight-Queens Problem, Pruning Search.

Challenging Problems
(1) Little Bishops (2) 15-Puzzle Problem (3) Queue (4) Servicing Stations (5) Tug of War (6) Garden of Eden (7) Color Hash (8) Bigger Square Please

[Unit 3]
Graph Traversal
Flavors of Graphs, Data Structures for Graphs, Graph Traversal: Breadth-First, Breadth-First Search, Exploiting Traversal, And Finding Paths Graph Traversal: Depth-First Finding Cycles Connected Components Topological Sorting.

Challenging Problems
(1) Bicoloring (2) Playing With Wheels (3) The Tourist Guide (4) Slash Maze (5) Edit Step Ladders (6) Tower of Cubes (7) From Dusk Till Dawn (8) Hanoi Tower Troubles Again!

[Unit 4]
Graph Algorithm
Graph Theory, Degree Properties, and Connectivity, Cycles in Graphs, Planar Graphs, Minimum Spanning Trees, Shortest Paths, Dijkstra’s Algorithm, All-Pairs Shortest Path, Network Flows and Bipartite Matching

Challenging Problems (1) Freckles The Necklace (2) Fire Station (3) Railroads (4) War (5) Tourist Guide (6) The Grand Dinner (7) The Problem With the Problem Setter

[Unit 5]
Dynamic Programming
Don’t Be Greedy, Edit Distance, Reconstructing the Path, Varieties of Edit Distance, Program Design Example: Elevator Optimization

Challenging Problems
(1) Is Bigger Smarter? (2)Distinct Subsequences (3) Weights and Measures (4) Unidirectional TSP (5) Cutting Sticks (6) Ferry Loading (7) Chopsticks (8) Adventures in Moving: Part IV.

[Unit 6]
Grids
Rectilinear Grids, Traversal, Dual Graphs and Representations, Triangular and Hexagonal Grids, Triangular Lattices, Hexagonal Lattices, Program Design Example: Plate Weight, Circle Packings, Longitude and Latitude.

List of Practical:
At least twenty five problems solving on competitive programming platforms such as, https://uva.onlinejudge.org, http://hackerrank.com/, http://codechef.com/

Reference Books:

1. Steven S. Skiena Miguel A. Revilla, Programming Challenges The Programming Contest Training Manual, Springer.

2. Antti Laaksonen, Competitive Programmer's Handbook.

3. Steven Halim, Competitive Programming 3: The Lower Bounds of Programming Contests.

4. Gayle Lakaman Cracking the Coding Interview.

5. The Hitchhiker's Guide to the Programming Contests.

BTCOL607 Mobile Application Development for iOS / Android

Note: The course on mobile application development can be taught for two different mobile OS platforms either iOS or Android.

The students can opt any one either iOS or Android for studying mobile application development. Either Part (A) or Part (B) of the following syllabus needs to be completed. It is not required to complete both parts i.e. Part(A) and Part(B)

Part (A) Mobile Application Development with SWIFT for iOS

Build a foundation in Swift, UI Kit and networking through hands-on labs and guided projects. Students can build an app of their own design by the end of the course.

1. Get Started with App Development. Learn about the basics of data, operators, and control flow in Swift, as well as documentation, debugging, Xcode, building and running an app, and Interface Builder. They then apply this knowledge to the guided project, Light, to create a simple flashlight app.

2. Introduction to UI Kit. Explore Swift strings, functions, structures, collections, and loops. Learn about UIKit—the system views and controls that make up a user interface—and how to display data using Auto Layout and stack views. Put this knowledge to practice in the guided project, Apple Pie, to build a word-guessing game app.

3. Navigation and Workflows. Discover how to build simple workflows and navigation hierarchies using navigation controllers, tab bar controllers, and segues. Also examine two powerful tools in Swift, optionals and enumerations. Put this knowledge into practice with the guided project, Personality Quiz, a personalized survey that reveals a fun response to the user.

4. Tables and Persistence. Learn about scroll views, table views, and building complex input screens. Explore how to save data, share data to other apps, and work with images in the user's photo library. Use new skills in the guided project, List, a task-tracking app that allows the user to add, edit, and delete items in a familiar table- based interface. Students can customize the app to keep track of any type of information, such as a collection, tasks, or playlists.

5. Working with the Web Learn about animations, concurrency, and working with the web. Apply learning in the guided project, Restaurant, a customizable menu app that displays the available dishes from a restaurant and allows the user to submit an order. This app uses a web service that allows students to set up the menu with their own menu items and photos.

6. Prototyping and Project Planning. Design, prototype, and architect a project of your own design.

List of Experiments: (Guided Projects)

1. Create a simple Flashlight app
2. Apple Pie Game - Word-guessing game app

3. Personality Quiz - a personalized survey that reveals a fun response to the user.
4. List – a task tracking app that allows the user to add, edit and delete items in a familiar table-based interface. Customize the app to keep track of any type of information, such as a collection, tasks or playlists.
5. Restaurant Menu - a customizable menu app that displays the available dishes from a restaurant and allows the user to submit an order.

Reference Books:

1. Matt Neuburg, *iOS 12 Programming Fundamentals with Swift*, O'Reilly Media, Fifth Edition, 2018.
2. Craig Clayton, *iOS 12 Programming for Beginners*, 3rd Edition, 2018.
3. App Development with Swift - #iBooks https://books.apple.com/in/book/app-development-with-swift/id1465002990
4. Intro to App Development with Swift - #iBooks https://books.apple.com/in/book/intro-to-app-development-with-swift/id1118575552

Part (B) Mobile Application Development for Android

1. Introduction to mobile computing, installing of required software and preparing the working environment, creating your first Android Application.

2. Layouts, Views, Resources, Activities, Intents, Background tasks, Connecting to the Internet, Fragments, Preferences.

3. User Interaction – input, menu items, custom views.

4. User Experience – themes and styles, material design, adaptive layouts, accessibility, localization, debugging the UI.

5. Storing Data, SQLite database, Sharing Data, content resolver and providers, loaders to load data Services, background work, alarms, broadcast receivers.

6. Notification, widgets, transferring data efficiently, publishing app, Multiple form factors, sensors, Google cloud messaging, monetizing your app.

List of Experiments:

1. Install the Android SDK and developer tools and build a test project to confirm that those tools are properly installed and configured.
2. Write a program using a Table Layout for our restaurant data entry form; add a set of radio buttons to represent the type of restaurant.
3. Write a program using activity class to show different events.
4. Write a program to send user from one application to another. (For example redirection to map).
5. Write a program to play audio files.
6. Write a program to play video files.
7. Write a program to capture image using built in camera.
8. Write a program to send SMS.

9. Write a program to convert text to speech.
10. Write a program to call a number.

Reference Books:

1. Brian Fling, *Mobile Design & Development*, O'Reilly Media, 1st Edition, 2009.
2. Meier, *Professional Android 4 Application Development*, Wrox Publication, 2012.
3. Lee, *Beginning Android™ 4 Application Development*, Wrox Publication, 2011.
4. J. F. DiMarzio, *Android A Programmers Guide*, McGraw-Hill Publication, 1st Edition, 2008.
5. Ian F. Darwin, *Android Cookbook*, O'Reilly Media, 2nd Edition, 2016.
6. Dawn Griffiths, David Griffiths, *Head First Android Development*, O'Reilly Media, 2nd Edition, 2015.

BTCOL607(B) Internet of Things Laboratory

1. Study of Raspberry-Pi, Beagle board, Arduino and other micro controller.
2. Study of different operating systems for Raspberry-Pi. Understanding the process of OS installation on Raspberry-Pi.
3. Study of Connectivity and configuration of Raspberry-Pi circuit with basic peripherals, LEDS. Understanding GPIO and its use in program.
4. Understanding the connectivity of Raspberry-Pi 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 circuit with IR sensor. Write an application to detect obstacle and notify user using LEDs.
6. Understanding and connectivity of Raspberry-Pi with camera. Write an application to capture and store the image.
7. Study of different CPU frequency governors. Write an application to change CPU frequency of Raspberry-Pi.
8. Write an application using Raspberry-Pi to control the operation of a hardware simulated traffic signal.
9. Write an application using Raspberry-Pi to control the operation of a hardware simulated lift elevator.
10. Write a server application to be deployed on Raspberry-Pi. Write client applications to get services from the server application.
11. Create a small dashboard application to be deployed on cloud. Different publisher devices can publish their information and interested application can subscribe.
12. Develop a Real time application like smart home with following requirements: When user enters into house the required appliances like fan, light should be switched ON. Appliances should also get controlled remotely by a suitable web interface. The objective of this application is student should construct complete Smart application in group.

BTCOL608 Computer Networks Laboratory

1. Simulate and Understand IP forwarding within a LAN and across a router.
2. Study the working of spanning tree algorithm by varying the priority among the switches.
3. Understand the working of "Connection Establishment" in TCP using a network simulator.
4. Study how the Data Rate of a Wireless LAN (IEEE 802.11b) network varies as the distance between the Access Point and the wireless nodes is varied.
5. Study the working and routing table formation of Interior routing protocols, i.e. Routing Information Protocol (RIP) and Open Shortest Path First (OSPF).
6. Plot the characteristic curve throughput versus offered traffic for a Slotted ALOHA system.
7. Understand the impact of bit error rate on packet error and investigate the impact of error of a simple hub based CSMA / CD network.
8. Study the performance of networks based on Star, Bus and Ring topologies
9. TCP/IP Sockets: Using TCP/IP sockets, write a client – server program to make the client send the file name and to make the server send back the contents of the requested file if present.
10. Write a program for calculating the shortest oath using Link State Routing Algorithms

Experiments can be done using NS2, NETSIM, NCTU etc.

Syllabus
for
M. Tech. (Computer Engineering)
M. Tech. (Computer Science)
M. Tech. (Computer Science & IT)
M. Tech. (Computer Science & Engg)
w.e.f. July 2017

Department of Computer Engineering

Master of Technology (Computer Engineering)

Sr No	Code	Course Name	Teaching Scheme				Examination Scheme				
			L	P	T	CR	IA	MSE	ESE	OR	Total
Semester I											
1	MTCE1101	Computer Algorithms	3		1	4	20	20	60		100
2	MTCE1102	Machine Learning	3		1	4	20	20	60		100
3	MTCE1103	Advanced Computer Networks	3		1	4	20	20	60		100
4	MTCE1104	Elective I	3			3	20	20	60		100
5	MTCE1105	Elective II	3			3	20	20	60		100
6	MTCE1106	Communication Skill	2			2	25			25	50
7	MTCE1107	Software Lab I		4		2	25			25	50
		Total	17	4	3	22	150	100	300	50	600
Semester II											
1	MTCE1201	Data Science	3		1	4	20	20	60		100
2	MTCE1202	Software Architecture	3		1	4	20	20	60		100
3	MTCE1203	Elective III	3			3	20	20	60		100
4	MTCE1204	Elective IV	3			3	20	20	60		100
5	MTCE1205	Elective V	3			3	20	20	60		100
7	MTCE1207	Software Lab II		4		2	50			50	100
8	MT CE1208	Seminar I		4		2	50			50	100
		Total	15	8	2	21	200	100	300	100	700
Semester III											
1	MTCE2101	Project Management and Intellectual Property Rights (Self Study)				2	50			50	100
3	MTCE2103	Project- I				10	50			50	100
		Total				12	100			100	200
Semester IV											
1	MTCE2201	Project-II				20	100			100	200
		Total				20	100			100	200

List of Electives

Elective 1

1. Cloud Computing
2. Game Theory
3. Natural Language Processing
4. Social Network Analysis

Elective 2

1. Intrusion Detection System
2. Model Checking
3. Artificial Intelligence and Knowledge Reasoning
4. High Performance Computing

Elective 3

1. Software Testing
2. Algorithms for Big Data
3. Software Language Engineering
4. Cryptography and Network Security

Elective 4

1. Introduction to Cognitive Sciences
2. Virtual Reality
3. Mobile Computing
4. Storage Systems

Elective 5:

1. Functional Programming
2. Object Oriented Systems
3. Reinforcement Learning
4. Pattern Recognition

MTCE1101: Computer Algorithms

L:3 T:1 P:0 MSE:20 CA:20 ESE:60

Prerequisites: Data-structures.

Unit I

Advanced Data Structures: Red-Black Trees, B-Trees, Binomial Heap, Fibonacci Heap Data Structures for Disjoint Sets.

Unit II

Graph algorithm: Search algorithms, computation of strongly connected components, shortest distance algorithms, minimum spanning tree algorithms.

Network-flow algorithm: Ford-Fulkerson method; preflow-push algorithm

Unit III

Geometric algorithm: convex-hull computation, line-segment intersection computation, closest-pair computation.

Unit IV

String matching: Rabin Karp algorithm, Knuth-Morris-Pratt algorithm, Boyer-Moore algorithm

Unit V

Matrix algorithms: Strassen’s multiplication algorithm, LU decomposition, inverse computation

Unit VI

Polynomial computation algorithms: multiplication using DFT, division

Number theoretic algorithms: division, solution of modular linear equation, primality testing.

REFERENCES:

1. Cormen, Leiserson, Rivest, "Introduction to Algorithms", McGraw Hill.
2. Aho, Hopcroft, Ullman, " The Design and Analysis of Computer Algorithms", Addison Wesley.

NPTEL Course

1. Computer Algorithms – 2 by Prof. Shashank K. Mehta, IIT Kanpur.

MTCE1102: Introduction to Machine Learning

L:3 T:1 P:0 MSE:20 IA:20 ESE:60

Prerequisites: Basic programming skills (in Python), algorithm design, basics of probability & statistics

Unit I

Introduction: Basic definitions, types of learning, hypothesis space and inductive bias, evaluation, cross-validation.

Unit II

Linear regression, Decision trees, overfitting.

Instance based learning, Feature reduction, Feature Selection, Collaborative filtering based recommendation.

Unit III

Probability and Bayes learning, Evaluation Measures, Hypothesis Testing.

Unit IV

Logistic Regression, Linear Classification, Support Vector Machine, Kernel function and Kernel SVM.

Unit V

Neural network: Perceptron, multilayer network, backpropagation, introduction to deep neural network.

Unit VI

Computational learning theory, PAC learning model, Sample complexity, VC Dimension, Ensemble learning ad methods.

Clustering: k-means, adaptive hierarchical clustering, Gaussian mixture model.

Expectation Maximization, Introduction to Reinforcement Learning.

REFERENCES:

1. T. Hastie, R. Tibshirani, J. Friedman. The Elements of Statistical Learning, 2e, 2008.
2. Christopher Bishop. Pattern Recognition and Machine Learning. 2e.
3. Machine Learning. Tom Mitchell. First Edition, McGraw- Hill, 1997.
4. Introduction to Machine Learning Edition 2, by Ethem Alpaydin.

5. Darren Cook Practical Machine Learning with H2O Oreilly 2017

NPTEL Courses:

1. Introduction to Machine Learning by Dr. Balaraman Ravindran, IIT Madras.
2. Introduction to Machine Learning by Prof. S. Sarkar, IIT Kharagpur.

MTCE1103: Advanced Computer Network

L:3 T:1 P:0 MSE:20 IA:20 ESE:60

Prerequisites: Computer Network.

Unit I

Review to Fundamentals of Computer N/Ws, TCP/IP reference model, Interior and Exterior Gateways routing application layered protocols such as DHCP, BOOTP OSI, TCP/IP, ATMX.25, frame relay, switching techniques in communication system.

Unit II

Fundamentals of Optical Networks, SONET/SDH Introduction, TDM Networks elements, Generation of optical N/W's.

Unit III

Introduction to key optical node Organization and key other terms, Cross connect Terminology, brief introduction to TDM and WDM, Evolution of optical system, Key Attributes of optical fiber, Digital

Unit IV

Multiplexing Hierarchy, Characterization of optical fiber, timing and Synchronization.

Unit V

Fiber Optic Technologies History, Basic fundamentals Operation, Physical properties, networking elements. Wavelength Division Multiplexing Principle of Operation, CDM/DWDM, and WDM networks elements, Impairments and Compensation in WDM.

Unit VI

SONET/ SDH Multiservice platform. Protection / Restoration and diversity in optical N/W's, MPLS/GMPLS introduction.

REFERENCES:

1. Optical Networks Control, Bala Rajagopalan, Gerg Bernstein, Debanjan saha.
2. Optical Networks and WDM, Walter J. Goralski, McGraw-Hill 2001.
3. Computer Networks: A System Approach, Larry L. Peterson, Bruce S. Davie, Morgan Kaufmann.
4. WDM Optical Networks: Concepts, Design and Algorithms, C. Siva Ram Murthy, Prentice Hall

MTCE1104: Cloud Computing (Elective I)

L:3 T:1 P:0 MSE:20 IA:20 ESE:60

Prerequisites: Distributed Systems, Computer Networks

Unit1: Introduction to distributed and cluster computing, Basics of the emerging cloud computing paradigm, Cloud Benefits (10)
Unit 2: Virtualization concepts and types, KVM, VM Scheduling (8)
Unit 3: Disaster Recovery, Scaling (6)
Unit 4: Cloud security, Regulatory and compliance issues, VM Security Issues (6)
Unit 5: Latest Research Paper Topics (10)

Text Books:

1. Cloud Computing, Michael Miller, Pearson, 2012
2. Cloud Computing: Implementation, Management, and Security, , John Ritting house and James F.Ransome, CRC Press Taylor and Francis Group, 2009
3. Dan Kusnetzky , “Virtualization: A Manager’s Guide”, 1st Edition ,O’Reilly,2011
4. Tim Mather Cloud Security and Privacy, Oreilly 2015

References:

1. Barrie Sosinsky, “Cloud Computing Bible”, 1 st Edition ,Wiley India Pvt Ltd,2011.
2. Robert Elsenpeter, Toby J. Velte, Anthony T. Velte, “Cloud Computing : A Practical Approach”, 1st Edition, Tata Mcgraw Hill Education, 2011.
4. Handbook of Cloud Computing , Borko Furht, Armando Escalante , Springer, 2010

NPTEL/Open Course Course

1. **Yogesh Simmhan, Introduction to Cloud Computing, www.serc.iisc.ac.i/~simmhan**

MTCE1104: Game Theory: (Elective-1)

L:3 T:1 P:0 MSE:20 IA:20 ESE:60

Prerequisites:

Unit I

1 Introduction and Outline of the Course, Definitions, Utilities, Rationality, Intelligence, Common Knowledge, Classification of Games

Unit II

I. **NON-COOPERATIVE GAME THEORY** Extensive Form Game Strategic Form Games with Illustrative Examples Dominant Strategy Equilibria Pure Strategy Nash Equilibrium with Illustrative Examples and Key Results Mixed Strategy Nash Equilibrium with Illustrative Examples and Key Results such as the Nash Theorem

Unit III

Computation of Nash Equilibria and introduction to algorithmic theory Matrix Games: Saddle Points, Minimax Theorem Bayesian Games, Bayesian Nash Equilibrium Evolutionary Game Theory (ESS Strategies) Repeated Game

Unit IV

II. **MECHANISM DESIGN** The Mechanism Design Environment Social Choice Functions with Illustrative Examples Implementation of Social Choice Functions Incentive Compatibility and Revelation Theorem.

Unit V

Gibbard-Satterthwaite and Arrow Impossibility Theorem Vickrey-Clarke-Groves (VCG) Mechanisms Bayesian Mechanisms (dAGVA) Revenue Equivalence Theorem Myerson Optimal Auction Further Topics in Mechanism Design

Unit VI

PART III: COOPERATIVE GAME THEORY Correlated Strategies and Correlated Equilibrium The Nash Bargaining Problem Coalitional Games (Transferable Utility Games) The Core The Shapley Value Other Solution Concepts: Kernel, Nucleolus To Probe Further and Conclusion

Reference Books

1. Martin J. Osborne. An Introduction to Game Theory. Oxford University Press. Indian Edition, 2003.
2. Roger B. Myerson. Game Theory: Analysis of Conflict. Harvard University Press, 1991.
3. Y. Narahari, Dinesh Garg, Ramasuri Narayanam, Hastagiri Prakash.
4. Game Theoretic Problems in Network Economics and Mechanism Design Solutions. Springer, London, 2009.

NPTEL/Open Course

1. http://lcm.csa.iisc.ernet.in/gametheory/index.html

Natural Language Processing

L:3 T:1 P:0 MSE:20 IA:20 ESE:60

Prerequisites: A previous course on Artificial Intelligence will help. Courses of Data Structures and Algorithms should have been done. Exposure to Linguistics is useful, though not mandatory.

Unit I

Introduction, Machine Learning and NLP, ArgMax Computation WSD: WordNet, Wordnet;

Unit II

Application in Query Expansion, Wiktionary; semantic relatedness, Measures of WordNet Similarity, Similarity Measures, Resnick's work on WordNet Similarity, Parsing Algorithms, Evidence for Deeper Structure;

Unit III

Top Down Parsing Algorithms, Noun Structure; Top Down Parsing Algorithms, Non-noun Structure and Parsing Algorithms, Probabilistic parsing; sequence labeling, PCFG, Training issues;

Unit IV

Arguments and Adjuncts, Probabilistic parsing; inside-outside probabilities, Speech : Phonetics, HMM, Morphology, Graphical Models for Sequence Labelling in NLP, Phonetics, Consonants (place and manner of articulation) and Vowels, Forward Backward probability;

Unit V

Viterbi Algorithm, Phonology, Sentiment Analysis and Opinions on the Web, Machine Translation and MT Tools - GIZA++ and Moses, Text Entailment, POS Tagging, Phonology;

ASR, Speech Synthesis, HMM and Viterbi, Precision, Recall, F-score, Map, Semantic Relations; UNL;

Unit VI

Towards Dependency Parsing, Universal Networking Language, Semantic Role Extraction, Baum Welch Algorithm; HMM training.

REFERENCES:

1. Allen, James, Natural Language Understanding, Second Edition, Benjamin/Cumming, 1995.
2. Charniack, Eugene, Statistical Language Learning, MIT Press, 1993.
3. Jurafsky, Dan and Martin, James, Speech and Language Processing, Second Edition, Prentice Hall, 2008.
4. Manning, Christopher and Heinrich, Schutze, Foundations of Statistical Natural Language Processing, MIT Press, 1999.

NPTEL Course:

1. Natural Language Processing by Prof. Pushpak Bhattacharyya, IIT Bombay.

MTCE1104: Social Network Analysis (Elective I)

L:3 T:1 P:0 MSE:20 IA:20 ESE:60

Course Contents

Unit I & II Introduction, Network Analysis.

Unit III Properties of Social Networks.

Unit IV Community Analysis.

Unit V & VI Case Study: Citation Networks.

REFERENCE:

1. Networks: An Introduction, Oxford University Press, Oxford, 2010.
2. Evolution of Networks, Oxford University Press, Oxford, 2003.
3. The structure and function of complex networks, SIAM Review 45, 167-256, 2003.
4. Statistical mechanics of complex networks, Rev. Mod. Phys., 74(1), 2002.
5. Social Network Analysis for Startup Tsvetovat, 2015 Oreilly.

NPTEL Course:

1. Complex Network : Theory and Application by Prof. Animesh Mukherjee, IIT Kharagpur.

MTCE1105: Intrusion Detection System (Elective 2)

L:3 T:0 P:0 MSE:20 IA:20 ESE:60

Prerequisites:

Unit I

Intruder types, intrusion methods, processes and detection, message integrity and authentication, honey pots.

Unit II

General IDS model, data mining based IDS, Denning model, data mining framework for constructing features and models for intrusion detection systems

Unit III

Unsupervised anomaly detection, CV5 clustering, SVM, probabilistic and statistical modeling, general IDS model and taxonomy, evaluation of IDS, cost sensitive IDS.

NBAD, specification based and rate based DDOS, scans/probes, predicting attacks, network based anomaly detection, stealthy surveillance detection; Defending against DOS attacks in scout: signature-based solutions, snort rules.

Unit IV

Host-based anomaly detection, taxonomy of security flaws in software, self-modeling system calls for intrusion detection with dynamic window size.

Unit V & VI

Secure intrusion detection systems, network security, secure intrusion detection environment, secure policy manager, secure IDS sensor, alarm management, intrusion detection system signatures, sensor configuration, signature and intrusion detection configuration, IP blocking configuration, intrusion detection system architecture

Reference Books

1. Endorf, C., Schultz E. and Mellander J., "Intrusion Detection and Prevention," McGraw-Hill. 2003
2. Bhatnagar, K., "Cisco Security", Course Technology. 2002
3. Marchette, D. J., "Computer Intrusion Detection and Network Monitoring: A Statistical Viewpoint", Springer. 2001
4. Rash, M., Orebaugh, A. and Clark, G., "Intrusion Prevention and Active Response: Deploying Network and Host IPS", Syngress. 2005
5. Cooper, M., Northcutt, S., Fearnow, M. and Frederick, K., "Intrusion Signatures and Analysis", Sams. 2001

MTCE1105: Model Checking (Elective 2)

L:3 T:0 P:0 MSE:20 IA:20 ESE:60

Prerequisites: Familiarity with basic algorithms and finite-state machines preferable

Course Contents

Unit I Modeling systems as Finite-state machines, Using the model-checker NuSMV,.

Unit II Linear-time properties for verification, Regular properties – automata over finite words, Omega-regular properties – automata over infinite words, Model checking omega-regular properties,

Unit III Linear Temporal Logic (LTL), Algorithms for LTL,

Unit IV Computation Tree Logic (CTL), Algorithms for LTL, Models with timing constraints – timed automata,

Unit V More on timed automata,

Unit VI Probabilistic models I, Probabilistic models II, Probabilistic models III.

REFERENCES:

1. Principles of Model-checking, Christel Baier and Joost-Pieter Katoen, MIT Press (2008).

NPTEL Course:

1. Model Checking by Prof. B. Srivathsan, CMI.

MTCE1105 Artificial Intelligence: Knowledge Representation and Reasoning

L:3 T:0 P:0 MSE:20 IA:20 ESE:60

Prerequisites: Some exposure to formal languages, logic and programming**.**

Unit I

Introduction: Introduction to Knowledge Representation and Reasoning and Formal Logics.
Propositional Logic: Language, Semantics and Reasoning, Syntax and Truth Values, Valid Arguments and Proof Systems, Rules of Inference and Natural Deduction, Axiomatic Systems and Hilbert Style Proofs, The Tableau Method, The Resolution Refutation Method.

Unit II

First Order Logic(FOL): Syntax, Semantics, Entailment and Models, Proof Systems, Forward Chaining, Unification, Forward Chaining Rule Based Systems, The Rete Algorithm, Programming in a Rule Based Language, The OPS5 Expert System Shell.
Representation in FOL: Skolemization, Knowledge Representation, Properties and Categories, Reification and Abstract Entities, Resource Description Framework(RDF), Event Calculus: Reasoning About Change.
Mapping Natural Language to FOL: Understanding=Fulfilling Expectations, Conceptual Dependency (CD) Theory, Understanding Language, Conceptual Analysis: Mapping English to CD Theory.

Unit III

Programming in Logic: Deductive Retrieval in Backward Chaining, Logic Programming, Prolog, Depth First Search and Efficiency Issues, Controlling Search, The Cut Operator in Prolog.
Theorem Proving in FOL: Incompleteness of Forward and Backward Chaining, The Resolution Refutation Method for FOL, Clause Form and The Resolution Rule, FOL with Equality, Complexity.

Unit IV

Knowledge Structures: Semantic Nets using Frames, Scripts, Script Applier Mechanism(SAM), Goals, Plans and Actions, Plan Applier Mechanism(PAM): Expectations and Recognition, PAM: Top Down and Bottom Up Reasoning.

Unit V

Ontology and Description Logics: A Description Logic, Normalisation, Structure Matching, Classification, A-box Reasoning, Extensions, ALC, Further Extensions.
Inheritance: Taxonomies and Inheritance, Beliefs, Credulous and Skeptical Reasoning.

Unit VI

Default Reasoning: Introduction to Default Reasoning, Circumscription, Minimal Models, The Event Calculus Revisited, Default Logic, Autoepistemc Logic.
Reasoning in Multi-agent Systems: Epistemic Logic: Kripke Semantics in a Multi Agent Scenario, The Muddy Children Puzzle.

REFERENCES:

1. Ronald J. Brachman, Hector J. Levesque: Knowledge Representation and Reasoning, Morgan Kaufmann, 2004.
2. Deepak Khemani. A First Course in Artificial Intelligence, McGraw Hill Education (India), 2013.

NPTEL Course

MTCE1105: High Performance Computing (Elective 2)

L:3 T:0 P:0 MSE:20 IA:20 ESE:60

Prerequisites: Computer programming, Data structures.

Unit I

Program Execution: Program, Compilation, Object files, Function call and return, Address space, Data and its representation.

Unit II

Computer Organization: Memory, Registers, Instruction set architecture, Instruction processing.

Unit III

Pipelined Processors: Pipelining, Structural, data and control hazards, Impact on programming.

Unit IV

Virtual Memory: Use of memory by programs, Address translation, Paging.

Unit V

Cache Memory: Organization, impact on programming, virtual caches.

Operating Systems: Processes and system calls, Process management.

Program Profiling

Unit VI

File Systems: Disk management, Name management, Protection.

Parallel Architecture: Inter-process communication, Synchronization, Mutual exclusion, Basics of parallel architecture, Parallel programming with message passing using MPI.

REFERENCE:

1. J. L. Hennessy and D. A. Patterson, Computer Architecture: A Quantitative Approach, Morgan Kaufmann.
2. A. Silberschatz, P. B. Galvin, G. Gagne, Operating System Concepts, John Wiley.
3. R. E. Bryant and D. R. O'Hallaron, Computer Systems: A Programmer's Perspective, Prentice Hall.

NPTEL Course:

1. High Performance Computing by Prof. Mathew Jacob, IISc Bangalore.

Semester II

MTCE1201: Data Science

L:3 T:1 P:0 MSE:20 IA:20 ESE:60

Prerequisites:

Course Contents

Unit I Data Mining Patterns: Cluster Analysis, Anomaly Detection, Association Rules, Data Mining Sequences:

Unit II Text Mining: Text mining Text Clusters

Unit III Data Analysis: Simple regression, Multiple Regression, Multivariate Regression Analysis, Robust Regression, Correlation, Clustering.

Unit IV Data Viualization: R graphics, Plotting, Scatter Plots Bar Charts and Plots 3D graphics

Unit V Machine Learning: Data Partitioning Predicting events with machine learning, Supervised and Unsupervised learning.

Reference Books

1. Dan Toomey, R for Data Science, Packit First Edition Publishing 2014 NPTEL/Open Course
2. Hadley Wickham et al R for Data Science Oreilly 2016
3. Richard Cotton Learning R Oreilly 2013

MTCE1202: Software Architecture

L:3 T:1 P:0 MSE:20 IA:20 ESE:60

Prerequisites:

Course Contents

Unit I Review of Software Engineering,

Unit II Various Definitions of Software Architecture,

Unit III Architecture Documentation: SEI Framework, Module View, Component and Connector View, Deployment View,

Unit V Pattern-Oriented Software Architecture: Layer, MVC, Pipe-Filter, Publish/Scriber, Presentation Abstraction and Control Patterns,

Unit VI Software Architecture quality Attributes, Evaluating Software Architecture, Architecture Decisions, Architecture Knowledge Management, Technology Architectures.

Reference Books

1. Paul Clements, Documenting Software Architecture, Addison Wesley
2. Fran Buschman Pattern Oriented Software Architecture Vol I

MTCE1203 Software Testing (Elective 3)

L:3 T:1 P:0 MSE:20 IA:20 ESE:60

Course Contents

Unit I Introduction: Principles of testing, Software development life cycle models.

Unit II Types of testing: White box testing - Static testing, Structural testing, Black box testing– Requirement based testing, positive and negative testing, boundary value analysis, decision tables, equivalence partitioning, state based or graph based testing, compatibility testing, user documentation testing, domain testing.

Integration testing: top down integration, bottom up integration, bi-directional integration, system integration System and Acceptance testing–functional testing–design/architecture verification, business vertical testing, deployment testing, beta testing, certification standards and testing for compliance;

Unit III Non-functional testing: setting up the configuration, coming up with entry/exit criteria, balancing key resources, scalability testing, reliability testing, stress testing, interoperability testing;

Acceptance testing: acceptance criteria, selecting test cases for acceptance testing, executing acceptance tests.

Unit IV Performance testing: collecting requirement, writing test cases, automating performance test cases, analyzing the performance test results, performance benchmarking, capacity planning.

Unit V & VI Regression testing: erforming an initial smoke or sanity test, understanding criteria for selecting the test cases, classifying test cases, methodology for selecting test cases, resetting the test cases for regression testing Test planning, management, execution and reporting.

Test metrics and measurements.

REFERENCE:

1. Srinivasan Desikan, Gopalaswamy Ramesh, “Software Tesing Principles and Practices”,

Pearson Education.

2. William Perry, "Effective Methods for Software Testing", John Wiley & Sons, New York, 1995.

MTCE1203 Algorithm for Big Data (Elective3)

L:3 T:1 P:0 MSE:20 IA:20 ESE:60

Prerequisites: Algorithms, probability theory.

Course Contents

Unit I Intro to Probability Theory, Tail bounds with Applications, Markov Chains and Random Walks.

Unit II Randomized Algorithms against an Oblivious Adversary, Pairwise Independence and Universal Hashing, The Streaming Model, Approximate Counting, Approximate Median.

Unit III Flajolet Martin-Distinct Sampling, Alon-Mattias-Szegedy Sketch, Bloom Filters, Count-min Sketch, Property Testing Model, Local search and testing connectivity.

Unit IV Enforce and Test Techique: Biclique and Bipartiteness Testing.

Unit V& VI Random Walks and Testing Bipartiteness & Expansion, Regularity Lemma and Testing, Triangle Freeness, Boolean Functions, BLR test for Linearity.

REFERENCE:

1. Probability and Computing: Randomized Algorithms and Probabilistic Analysis, by Mitzenmacher and Upfal.
2. Algorithmic and Analysis Techniques in Property Testing, by Dana Ron.
3. Synopses for Massive Data: Samples, Histograms, Wavelets, Sketches, by Graham Cormode, Minos Garofalakis, Peter J. Haas and Chris Jermaine.

NPTEL Course:

1. Algorithms for Big Data by Prof. John Augustine, IIT Madras.

MTCE1203 Real-Time System (Elective 3)

L:3 T:1 P:0 MSE:20 IA:20 ESE:60

Prerequisites: Programming and Data Structures, Operating Systems, Computer Architecture and Organization, Computer Communication, and Database Systems.

Course Contents

Unit I Introduction: What is Real Time System?, Application of Real Time System, A Basic Model of Real Time System, Characteristics of Real Time System, Safety and Relibility, Types of Real-Time Tasks, Timing Constraints, Modelling Timing Constraints.

Unit II Real-Time Task Scheduling: Concept, Types of real time task and their characteristics, Task scheduling, Clock-Driven Scheduling, Hybrid Schedulers, Event-driven scheduling, EDF scheduling, Rate monotonic System, Issue associate with RMA, Issue in using RMA in practical situations.

Unit III Handling Resource Sharing and Dependencies Among Real-Time Tasks: Resource Sharing Among Real-time Tasks, Priority Inversion, Priority Inheritance Protocol (PIP), Higher Locker Protocol (HLP), Priority Ceiling Protocol (PCP), Difference types of Priority Inversion under PCP, Important features of PCP, Some issues in Using A Resource Sharing Protocol.

Unit IV Scheduling Real-Time Tasks in Multiprocessor and Distributed Systems: Multiprocessor task Allocation, Dynamic Allocation of Tasks, Fault Tolerant Scheduling of Tasks, Clocks in Distributed Real Time Systems, Centralized Clock Synchronization, Distributed Clock Synchronization.

Unit V Commercial Real-Time Operating Systems: Time Services, Features of Real Time Operating System, Unix as a Real Time Operating System, UNIX-based Real-Time Operating System, Wndows as a Real-Time Operating System, POSIX, A Survey of contemporary Real-Time Operating System, Benchmarking Real-Time System.

Unit VI Real-Time Communication: Examples of Real-Time Communication in Applications, Basic Concepts, Real-Time Communication in LAN, Soft Real-Time Communication in LAN, Hard Real-Time Communication in LAN, Bounded Access Protocol, Performance Comparison, Real-Time Communication over Internet, Routing, Multicast Routing, Resource Reservation, Traffic Shaping and Policing, Scheduling Mechanism, QoS Models.

Real-Time Databases: Examples applications of Real-Time Databases, Review of Basic Database Concepts, Real-Time Databases, Real-Time Databases Application Design Issues, Characteristics of Temporal Data, Concurrency Control in Real-Time Databases, Commercial Real-Time Databases.

REFERENCE:

1. Rajib Mall, "Real-Time Systems: Theory and Practice," Pearson, 2008.
2. Jane W. Liu, "Real-Time Systems" Pearson Education, 2001.
3. Krishna and Shin, "Real-TIme Systems," Tata McGraw Hill. 1999.

NPTEL Course:

1. Real Time Systems by Prof. Rajib Mall, IIT Kharagpur.

MTCE1203 Cryptography and Network Security (Elective 3)

L:3 T:1 P:0 MSE:20 IA:20 ESE:60

Prerequisites:

Course Contents

Unit I Introduction: Basic objectives of cryptography, secret-key and public-key cryptography, one-way and trapdoor one-way functions, cryptanalysis, attack models, classical cryptography.

Unit II Block ciphers: Modes of operation, DES and its variants, RCS, IDEA, SAFER, FEAL, BlowFish, AES, linear and differential cryptanalysis. Stream ciphers: Stream ciphers based on linear feedback shift registers, SEAL, unconditional security.

Unit III Message digest: Properties of hash functions, MD2, MD5 and SHA-1, keyed hash functions, attacks on hash functions. Public-key parameters: Modular arithmetic, gcd, primality testing, Chinese remainder theorem, modular square roots, finite fields.

Unit IV Intractable problems: Integer factorization problem, RSA problem, modular square root problem, discrete logarithm problem, Diffie-Hellman problem, known algorithms for solving the intractable problems.

Unit V Public-key encryption: RSA, Rabin and EIGamal schemes, side channel attacks. Key exchange: Diffie-Hellman and MQV algorithms. Digital signatures: RSA, DAS and NR signature schemes, blind and undeniable signatures.

Unit VI Entity authentication: Passwords, challenge-response algorithms, zero-knowledge protocols. Standards: IEEE, RSA and ISO standards. Network issues: Certification, public-key infrastructure (PKI), secured socket layer (SSL), Kerberos. Advanced topics: Elliptic and hyper-elliptic curve cryptography, number field sieve, lattices and their applications in cryptography, hidden monomial cryptosystems, cryptographically secure random number generators.

Text Books:

1. Cryptography and Network Security, William Stallings, Prentice Hall of India

2. Cryptography and Network Security, Forouzan, Tata McGraw-Hill

3. Network Security: Private Communication in a Public World, Charlie Kaufman, Prentice Hall Series

NPTEL course

Prof. D. Mukhopadhyay, Cryptography and Network Security.

MTCE1204 Introduction to Cognitive Science (Elective 4)

L:3 T:0 P:0 MSE:20 IA:20 ESE:60

Prerequisites: Introduction to Computing**.**

Course Contents

Unit I Philosophical Issues (fundamental assumptions underlying differing theories),

Unit II Cognitive Psychology (experiments revealing computational processes underlying cognition),

Unit III Neuroscience (understanding at the micro-level; wetware),

Unit IV Computational intelligence (simulation and testing of cognitive models),

Unit V Linguistics (a prime window into cognition is through language).

Unit VI Perception: Embodiment; From qualia to representation.

Space, Time and Language: Spatial and Temporal categories.

Categorization and Concepts: Prototype Theory, Objects and Events.

Language: Lexical structure, compositionality, and semantics.

Learning: Developmental models.

Evolution of social convention: Multi-Agent Games, Speech Acts, Diachronic Processes.

REFERENCE:

1. Wilson, Robert A., & Keil, Frank C. (eds.), The MIT Encyclopedia of the Cognitive Sciences (MITECS), MIT Press, 2001 [Primary text; available on Cognet].
2. Bowerman, Melissa and Stephen C. Levinson, Language Acquisition and Conceptual Development, Cambridge University Press 2001.
3. Sternberg, Robert J., Cognitive Psychology, 4th ed., Cengage Learning India, 2008.
4. Gardenfors, Peter, Conceptual Spaces: The Geometry of Thought, MIT Press, 2000, 317 pages.

MTCE1204 Virtual Reality (Elective 4)

L:3 T:0 P:0 MSE:20 IA:20 ESE:60

Prerequisites: Basic maths and exposure to engineering.

Unit I

Introduction: Course mechanics, Goals and VR definitions, Historical perspective, Birds-eye view(general), Birds-eye view(hardware), Birds-eye view(software), Birds-eye view(sensation and perception).

Unit II

Geometry of Virtual Worlds: Geometric modeling, Transforming models, Matrix algebra and 2D rotations, 3D rotations and yaw, pitch, and roll, Axis-angle representations, Quaternions, Converting and multiplying rotations, Homogeneous transforms, The chain of viewing transforms, Eye transforms, Canonical view transform, Viewport transform.

Unit III

Light and Optics: Three interpretations of light, Refraction, Simple lenses, Diopters, Imaging, properties of lenses, Lens aberrations, Optical system of eyes.

Visual Physiology: Photoreceptors, Sufficient resolution for VR, Light intensity, Eye movements, Eye movement issues for VR, Neuroscience of vision.

Unit IV

Visual Perception: Depth perception, Motion perception, Frame rates and displays.

Tracking Systems: Overview, Orientation tracking, Tilt drift correction, Yaw drift correction, Tracking with a camera, Perspective n-point problem, Filtering, Lighthouse approach.

Unit V

Visual Rendering: Visual Rendering-Overview, Shading models, Rasterization, Pixel shading, VR-specific problems, Distortion shading, Post-rendering image warp.

Unit VI

Audio: Physics and physiology, Auditory perception, Auditory localization, Rendering, Spatialization and display, Combining other senses.

Interfaces: Interfaces overview, Locomotion, Manipulation, System control, Social interaction, Evaluation of VR Systems.

REFERENCE:

1. http://msl.cs.uiuc.edu/vr/
2. George Mather, Foundations of Sensation and Perception: Psychology Press; 2nd edition, 2009.
3. Peter Shirley, Michael Ashikhmin, and Steve Marschner, Fundamentals of Computer Graphics, A K Peters/CRC Press; 3 edition, 2009.

NPTEL Course:

1. Virtual Reality by Prof. Steven LaValle, IIT Madras.

MTCE104 Mobile Computing (Elective 4)

L:3 T:0 P:0 MSE:20 IA:20 ESE:60

Prerequisites: Java Programming, Operating Systems, Basic knowledge on socket connection.

Course Contents

Unit I Introduction to mobile computing, installing of required software and preparing the working environment, creatingyour first Android Application.

Unit II Layouts, Views, Resources.

Activities, Intents.

Background tasks, Connecting to the Internet.

Fragments, Preferences.

Unit III User Interaction – input, menu items, custom views.

User Experience – themes and styles, material design, adaptive layouts, accessibility, localization, debuggingthe UI.

Unit IV Storing Data, SQLite database.

Sharing Data, content resolvers and providers, loaders to load data.

Unit V Services, background work, alarms, broadcast receivers.

Notification, widgets, transferring data efficiently, publishing app.

Unit VI Multiple form factors, sensors, Google cloud messaging, monetizing your app.

REFERENCE:

1. Android Programming (Big Nerd Ranch Guide), by Phillips, Stewart, Hardy and Marsicano.
2. Android Programming – Pushing the limits by Hellman.

NPTEL Course:

1. Mobile Computing by Prof. Pushpendra Singh, IIITD.

MTCE104 Storage System (Elective 4)

L:3 T:0 P:0 MSE:20 IA:20 ESE:60

Prerequisites: Operating System.

Unit I

Introduction: History: computing, networking, storage, Need for storage networking, SAN, NAS, SAN/NAS Convergence, Distributed Storage Systems, Mainframe/proprietary vs. open storage, Storage Industry Organizations and Major Vendors Market, Storage networking strategy (SAN/NAS or Distr storage), Impact of Regulations: existing and new.

Technology: Storage components, Data organization: File vs. Block, Object; Data store; Searchable models, Storage Devices (including fixed content storage devices), File Systems, Volume Managers, RAID systems, Caches, Prefetching.

Unit II

Network Components: Connectivity: switches, directors, highly available systems, Fibre Channel, 1GE/10GE, Metro-ethernet, Aggregation, Infiniband.

Error Management: Disk Error Mgmt, RAID Error Mgmt, Distr Systems Error Mgmt

Unit III

Highly available and Disaster-tolerant designs: Ordered writes, Soft updates and Transactions, 2 phase, 3 phase, Paxos commit protocols, Impossibility Results from Distributed Systems, Choose 2 of 3: Availability, Consistency and Partition Tolerance.

Unit IV

Layering and Interfaces in Storage Protocols: SCSI 1/2/3SNIA model.

SAN Components: Fibre Channel, IP-based Storage (iSCSI, FCIP, etc.), Examples, NAS: NFS, CIFS, DAFS

Unit V

Large Storage Systems: Google FS/BigTable, Cloud/Web-based systems (Amazon S3), FS+DB convergence, Programming models: Hadoop

Unit VI

Archival Systems: Content addressable storage, Backup: serverless, LAN free, LAN Replication issues, Storage Security, Storage Management, Device Management, NAS Management, Virtualization : Virtualization solutions, SAN Management: Storage Provisioning, Storage Migration, SRM.

NPTEL Course:

1. Storage Systems by Dr. K. Gopinath, IISc Bangalore.

MTCE105 Functional Programming (Elective 5)

L:3 T:0 P:0 MSE:20 IA:20 ESE:60

Prerequisites:

Course Contents

I **Unit I** ntroduction to Haskell and the ghci interpreter

Unit I I Defining functions: guards, pattern matching and recursion

Lists, strings and tuples 4. Types and polymorphim

Unit III Higher order functions on lists: map, filter, list comprehension

Unit IV Computation as rewriting, lazy evaluation and infinite data structures

Unit V Conditional polymorphism and type classes

Unit VI User defined datatypes: lists, queues, trees

Input/output and the ghc compiler

Arrays

Reference Books

MTCE1205 Object-Oriented System (Elective 5)

L:3 T:0 P:0 MSE:20 IA:20 ESE:60

Prerequisites:

Course Contents

Unit I Review of programming practices and code-reuse;

Unit II Object model and object-oriented concepts; Object-oriented programming languages and implementation;

Unit III Object-oriented analyses and design using UML structural, behavioral and architectural modeling;

Unit IV Unified development process, Software reuse design patterns, components and framework;

Unit V Distributed object computing, interoperability and middle ware standards COM/DCOM and CORBA;

Unit VI Object-oriented database system data model, object definition and query language, object-relational system.

REFERENCE:

1. Object Oriented System Analysis, Sally Shlaer, Prentice Hall PTR.
2. Object Oriented System Analysis and Design using UML, Simon Bennett, McGraw-Hill.

MTCE205 Reinforcement Learning (Elective 5)

L:3 T:0 P:0 MSE:20 IA:20 ESE:60

Course Contents

Unit I Introduction, Bandit algorithms – UCB, PAC,

Unit II Bandit algorithms –Median Elimination, Policy Gradient, Full RL & MDPs, Full RL & MDPs,

Unit III Dynamic Programming & TD Methods, Eligibility Traces,

Unit IV Function Approximation, Least Squares Methods,

Unit V Fitted Q, DQN & Policy Gradient for Full RL,

Unit VI Hierarchical RL, POMDPs.

REFERENECE:

1. R. S. Sutton and A. G. Barto. Reinforcement Learning - An Introduction. MIT Press. 1998.

NPTEL Course:

1. Reinforcement Learning by Dr. B. Ravindran, IIT Madras.

MTCE1205 Pattern Recognition (Elective 5)

L:3 T:0 P:0 MSE:20 IA:20 ESE:60

Prerequisites: Vector spaces and Linear Algebra, Algorithms, Probability theory, Statistics**.**

Course Contents

Unit I Introduction and mathematical preliminaries: What is pattern recognition?, Clustering vs. Classification; Applications; Linear Algebra, vector spaces, probability theory, estimation techniques, Decision Boundaries, Decision region / Metric spaces/ distances.

Unit II Classification: Bayes decision rule, Normal Distribution, Error probability, Error rate, Minimum distance classifier, Mahalanobis distance; K-NN Classifier, Linear discriminant functions and Non-linear decision boundaries. Mahalanobis Distance, K-NN Classifier, Fisher's LDA, Single and Multilayer perceptron, training set and test sets, standardization and normalization.

Unit III Clustering: Basics of Clustering; similarity/dissimilarity measures, clustering criteria, Different distance functions and similarity measures, Minimum within cluster distance criterion, K-means clustering, single linkage and complete linkage clustering, MST, K-medoids, DBSCAN, Visualization of datasets, existence of unique clusters or no clusters.

Unit IV Feature selection: Problem statement and Uses, Probabilistic separability based criterion functions, interclass distance based criterion functions, Branch and bound algorithm, sequential forward/backward selection algorithms, (l,r) algorithm. Probabilistic separability based criterion functions, interclass distance based criterion functions.

Unit V Feature Extraction: PCA, Kernel PCA.

Unit VI Recent advances in PR: Structural PR, SVMs, FCM, Soft-computing and Neuro-fuzzy techniques, and real-life examples.

REFERENCE:

1. R.O.Duda, P.E.Hart and D.G.Stork, Pattern Classification, John Wiley, 2001.
2. Statistical pattern Recognition; K. Fukunaga; Academic Press, 2000.
3. S.Theodoridis and K.Koutroumbas, Pattern Recognition, 4th Ed., Academic Press, 2009.

NPTEL Course:

1. Pattern Recognition by Prof. Sukhendu Das and Prof. C.A. Murthy, IIT Madras.

B. Tech (Electronics Engineering)

Proposed Curriculum for Semester V [Third Year]

S. N.	Course Code	Type of Course	Course Title	Hours Per Week			Evaluation Scheme			Total Marks	Credits
				L	T	P	MSE	CA	ESE		
1	BTEXC501	Professional Core Course 1	Electromagnetic Field Theory	2	1	0	20	20	60	100	3
2	BTEXC502	Professional Core Course 2	Control System Engineering	2	1	0	20	20	60	100	3
3	BTEXC503	Professional Core Course 3	Microelectronics	3	0	0	20	20	60	100	3
4	BTEXC504	Professional Core Course 4	Digital Signal Processing	2	1	0	20	20	60	100	3
5	BTEXC505	Professional Core Course 5	Microcontroller and its Applications	3	0	0	20	20	60	100	3
6	BTEXPE506A	Program Elective Course 1	Probability Theory and Random Processes	3	0	0	20	20	60	100	3
	BTEXPE506B		NSQF (Level 7 Course)								
	BTEXPE506C		Data Structures and Algorithms Using Java Programming								
	BTEXPE506D		Introduction to MEMS								

	BTEXPE506E		Audio and Video Processing							
7	BTEXL507	Control System Engineering Lab		0	0	2	--	30	20	50	1
8	BTEXL508	Digital Signal Processing Lab		0	0	2	--	30	20	50	1
9	BTEXL509	Microcontroller and its Applications Lab		0	0	2	--	30	20	50	1
10	BTEXP510	Mini Project		0	0	2	--	30	20	50	1
11	BTEXS511	Seminar		0	0	2	--	30	20	50	1
12	BTEXF412	Field Training/ Internship/Industrial Training Evaluation		--	--	--	--	--	50	50	1
			Total	**15**	**03**	**10**	**120**	**270**	**510**	**900**	**24**

B. Tech (Electronics Engineering)

Proposed Curriculum for Semester VI [Third Year]

S.N.	Course Code	Type of Course	Course Title	Hours Per Week			Evaluation Scheme			Total Marks	Credits
				L	T	P	MSE	CA	ESE		
1	BTEXC601	Professional Core Course 1	Computer Architecture	3	0	0	20	20	60	100	3
2	BTEXC602	Professional Core Course 2	Power Electronics	3	0	0	20	20	60	100	3
3	BTEXPE603A	Program Elective Course 2	Digital Communication	3	0	0	20	20	60	100	3
	BTEXPE603B		Computer Network and Cloud Computing								
	BTEXPE603C		Nano Electronics								
	BTEXPE603D		Web Development and Design								
4	BTEXOE604A	Open Elective Course 1	Digital System Design	3	0	0	20	20	60	100	3
	BTEXOE604B		Neural Networks and Fuzzy Systems								
	BTEXOE604C		NSQF (Level 7 Course)								
	BTEXOE604D		Analog Integrated Circuit Design								
5	BTEXOE605A	Open Elective Course 2	Embedded System Design	2	0	0	20	20	60	100	2
	BTEXOE605B		Electronics System Design								

	BTEXOE605C		Project Management and Operation Research								
	BTEXOE605D		Android Programming								
6	BTHM606	Humanities & Social Science including Management Courses	Employability & Skill Development	2	0	0	--	50	0	50	2
7	BTEXL607	Power Electronics Lab		0	0	2	--	30	20	50	1
8	BTEXL608	Program Elective Course 2 Lab		0	0	2	--	30	20	50	1
9	BTEXL609	Open Elective Course 1 Lab		0	0	2	--	30	20	50	1
10	BTEXP610	Community Project		0	0	2	--	30	20	50	1
11	BTEXS611	Seminar		0	0	2	--	30	20	50	1
12	BTEXF612	Field Training/ Internship/Industrial Training (Minimum 4 weeks)		--	--	--	--	--	--	--	1*
			Total	**16**	**0**	**10**	**100**	**300**	**400**	**800**	**21**

Program Elective 2	**Open Elective 1**	**Open Elective 2**
(A) Digital Communication	(A) Digital System Design	(A) Embedded System Design
(B) Computer Network and Cloud Computing	(B) Neural Networks and Fuzzy Systems	(B) Electronics System Design
(C) Nano Electronics	(C) NSQF (Level 7 Course)	(C) Project Management and Operation Research
(D) Web Development and Design	(D) Analog Integrated Circuit Design	(D) Android Programming

* To be evaluated in VIIth Semester

6. Yeshwant Kanetkar, "Let us C++, BPB Pub.", Delhi, 2002, 4th Edition.
7. Stroupstrup Bjarne, "C++ Programming Language", Addison Wesley, 1997, 3rd Edition.
8. Horton, "Beginning C++: The Complete Language", Shroff Pub., Navi Mumbai, 1998.

BTEXC501	Electromagnetic Field Theory	3 Credits

Course Objectives:

1. Learners can be able to explore their knowledge in the area of EM Waves and its analysis.
2. To learn basic coordinate system, significance of divergence, gradient, curl and its applications to EM Waves.
3. To understand the boundary conditions for different materials /surfaces.
4. To get insight on finding solution for non-regular geometrical bodies using Finite 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.

UNIT - 1

Maxwell's Equations

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

UNIT - 2

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

UNIT - 3

Transmission Lines

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.

UNIT - 4

Plane Waves at a Media Interface

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

UNIT - 5

Wave propagation

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

UNIT - 6

Radiation

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.

BTEXC502	Control Systems Engineering	3 Credits

Course Objectives:

- To introduce the elements of control system and their modeling using various Techniques.
- To introduce methods for analyzing the time response, the frequency response and the stability of systems.
- To introduce the concept of root locus, Bode plots, Nyquist plots.
- To introduce the state variable analysis method.
- To introduce concepts of PID controllers and digital and control systems.
- To introduce concepts programmable logic controller.

Course Outcomes:

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

1. Understand the modeling of linear-time-invariant systems using transfer function and state-space representations.
2. Understand the concept of stability and its assessment for linear-time invariant systems.
3. Design simple feedback controllers.

UNIT - 1

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 diagram reduction techniques, Signal flow graph analysis.

UNIT - 2

Time Response Analysis

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

UNIT - 3

Stability Analysis

Concept of Stability, Routh-Hurwitz Criteria, Relative Stability analysis, Root-Locus technique. Construction of Root-loci, Dominant Poles, Application of Root Locus Diagram,

UNIT - 4

Frequency-response analysis

Relationship between time and frequency response, Polar plots, Bode plots. Nyquist stability criterion, Relative stability using Nyquist criterion – gain and phase margin. Closed-loop frequency response.

UNIT - 5

Introduction to Controller Design

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.

UNIT - 6

State variable Analysis

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 discrete-time systems.

TEXT/REFERENCE BOOKS

1. N. J. Nagrath and M.Gopal, "Control System Engineering", New Age International Publishers, 5th Edition, 2009.
2. Benjamin C. Kuo, "Automatic control systems", Prentice Hall of India, 7th Edition,1995.
3. M. Gopal, "Control System – Principles and Design", Tata McGraw Hill, 4th Edition, 2012.
4. Schaum's Outline Series, "Feedback and Control Systems" Tata McGraw-Hill, 2007.
5. John J. D'Azzo& Constantine H. Houpis, "Linear Control System Analysis and Design", Tata McGraw-Hill, Inc., 1995.
6. Richard C. Dorf and Robert H. Bishop, "Modern Control Systems", Addison – Wesley, 1999.

BTEXC503	Microelectronics	3 Credits

Course Objectives: As part of this course, students:

- Will understand the physical, electrical, and optical properties of semiconductor materials and their use in microelectronic.
- Relate the atomic and physical properties of semiconductor materials to device and circuit performance issues.
- Develop an understanding of the connection between device-level and circuit-level performance of microelectronic systems.

Course Outcomes: After successfully completing the course students will be able to upon successful completion of this course, students should be able to:

1. Compute carrier concentrations for semiconductor materials under a variety of doping conditions.
2. Compute conductivity and resistivity of semiconductor materials under a variety of condition.
3. Silicon wafer processing and formation of P N junction using diffusion and Ion Implantation technique
4. Wet and Dry oxidation process required for photolithography process.
5. Manufacturing process for P N junction, BJT, MOS, and IC fabrication.

UNIT - 1

MOSFETS:

Device Structure and Physical Operation, V-I Characteristics, MOSFET Circuits at DC, Biasing in MOS amplifier Circuits, Small Signal Operation and Models, MOSFET as an amplifier and as a switch, biasing in MOS amplifier circuits, small signal operation modes, single stage MOS amplifiers. MOSFET internal capacitances and high frequency modes, Frequency response of CS amplifiers, CMOS digital logic inverter, and detection type MOSFET.

UNIT - 2

Single Stage IC Amplifier:

IC Design philosophy, Comparison of MOSFET and BJT, Current sources, Current mirrors and Current steering circuits, high frequency response.

UNIT - 3

Single Stage IC amplifiers:

CS and CF amplifiers with loads, high frequency response of CS and CF amplifiers, CG and CB amplifiers with active loads, high frequency response of CG and CB amplifiers, Cascade amplifiers. CS and CE amplifiers with source (emitter) degeneration source and emitter followers, some useful transfer parings, current mirrors with improved performance. SPICE examples.

UNIT - 4

Differences and Multistage Amplifiers:

The MOS differential pair, small signal operation of MOS differential pair, the BJT differences pair, other non-ideal characteristics and differential pair, Differential amplifier with active loads, frequency response and differential amplifiers. Multistage amplifier. SPICE examples.

UNIT - 5

Feedback

General Feedback structure, Properties of negative feedback. Four basic feedback topologies. Series-Shunt feedback. Determining the loop gain. Stability problem. Effect of feedback on amplifier poles. Stability study using Bode plots. Frequency compensation. SPICE examples.

UNIT - 6

Digital CMOS circuits

Overview, Design and performance analysis of CMOS inverter, Logic Gate Circuits, Pass-transistor logic, Dynamic Logic Circuits, SPICE examples

TEXT/REFERENCE BOOKS

1. "Microelectronic Circuits", Adel Sedra and K.C. Smith, 5th Edition, Oxford University Press, International Version, 2009.
2. "Fundamentals of Microelectronics", Behzad Razavi, John Wiley India Pvt. Ltd, 2008.
3. "Microelectronics – Analysis and Design", Sundaram Natarajan, Tata McGraw-Hill, 2007.

BTEXC504	Digital Signal Processing	3 Credits

Course Objectives:

- To introduce students with transforms for analysis of discrete time signals and systems.
- To understand the digital signal processing, sampling and aliasing.
- To use and understand implementation of digital filters.
- To understand concept of sampling rate conversion and DSP processor architecture.

Course Outcomes:

After successfully completing the course students will be able to:

1. Understand use of different transforms and analyze the discrete time signals and systems.
2. Realize the use of LTI filters for filtering different real world signals.
3. Capable of calibrating and resolving different frequencies existing in any signal.
4. Design and implement multistage sampling rate converter.
5. Design of different types of digital filters for various applications.

UNIT - 1

DSP Preliminaries

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.

UNIT - 2

Discrete Fourier Transform

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

UNIT - 3

Z transform

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 behavior, causality and stability considerations for LTI systems, Inverse Z transform, Power series method, partial fraction expansion method, Solution of difference equations.

UNIT - 4

IIR Filter Design

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)

UNIT - 5

FIR Filter Design

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.

UNIT - 6

Introduction to Multirate signal processing

Concept of Multirate DSP, Introduction to Up sampler, Down sampler and two channel filter bank, Application of Multirate signal processing in communication, Music processing, Image processing and Radar signal processing.

TEXT/REFERENCE BOOKS

1. S.K.Mitra, Digital Signal Processing: A computer based approach.TMH
2. A.V. Oppenheim and Schafer, Discrete Time Signal Processing, Prentice Hall, 1989.
3. John G. Proakis and D.G. Manolakis, Digital Signal Processing: Principles, Algorithms and Applications, Prentice Hall, 1997.
4. S. L. Nalbalwar, Digital Signal Processing, Synergy Knowledgeware Publication, Mumbai, 2018
5. L.R. Rabiner and B. Gold, Theory and Application of Digital Signal Processing, Prentice Hall, 1992.
6. J.R. Johnson, Introduction to Digital Signal Processing, Prentice Hall, 1992.
7. D.J.DeFatta, J. G. Lucas and W.S.Hodgkiss, Digital Signal Processing, John Wiley& Sons, 1988.

BTEXC505	Microcontroller & its Applications	3 Credits

Course Objectives:

- Objective of this course is to introduce to the students the fundamentals of microcontroller.
- After learning Microcontroller course, students will get advantage to pursue higher studies in Embedded Systems or employment in core industries.
- The learner can design microcontroller based systems and thus can become successful entrepreneur and meet needs of Indian and multinational industries.
- The learners will acquaint optimization skills and undergo concepts design metrics for embedded systems.

- The students will get acquainted with recent trends in microcontroller like pipelining, cache memory etc.
- To understand the applications of Microcontrollers.
- To understand need of microcontrollers in embedded system.
- To understand architecture and features of typical Microcontroller.
- To learn interfacing of real world input and output devices.
- To study various hardware and software tools for developing applications.

Course Outcomes:

1. Learner gains ability to apply knowledge of engineering in designing different case studies.
2. Students get ability to conduct experiments based on interfacing of devices to or interfacing to real world applications.
3. Graduates will be able to design real time controllers using microcontroller based system.
4. Students get ability to interface mechanical system to function in multidisciplinary system like in robotics, Automobiles.
5. Students can identify and formulate control and monitoring systems using microcontrollers.
6. Students will design cost effective real time system to serve engineering solution for Global, social and economic context.
7. This course understanding will enforce students to acquire knowledge of recent trends like superscalar and pipelining and thus finds recognition of continuous updation.
8. Learners get acquainted with modern tools like Programmers, Debuggers, cross compilers and current IDE i.e. integrated development environment tools.
9. Learn importance of microcontroller in designing embedded application.
10. Learn use of hardware and software tools.
11. Develop interfacing to real world devices.

UNIT - 1

Fundamentals of Microcontrollers

Introduction to the general structure of 8 and 16 bit Microcontrollers Harward & 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.

UNIT - 2

Interfacing with 8051 PART I

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.

UNIT - 3

Interfacing with 8051 PART II

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, Opto-isolators. All programs in assembly and C.

UNIT - 4

PIC Microcontroller Architecture

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.

UNIT - 5

Real World Interfacing Part I

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.

UNIT - 6

Real World Interfacing Part I

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/REFERENCE BOOKS

1. Mazidi, 8051 microcontroller & embedded system 3rd Edition ,Pearson
2. Mazidi, PIC microcontroller & embedded system 3rd Edition ,Pearson
3. Crisp, introduction to microprocessor & microcontrollers, 2e Elsevier, 2007.
4. Calcut, 8051 microcontrollers: Applications based introduction, Elsevier.
5. Udyashankara V., Mallikarjunaswamy, 8051 microcontroller, TMH.
6. Han-way Huang, using The MCS-51 microcontroller, Oxford university press
7. Ayala, 8051 microcontroller, cengage (Thomson)

BTEXPE506A	Probability Theory and Random Processes	3 Credits

Course Objectives:

- To develop basic of probability and random variables.
- The primary objective of this course is to provide mathematical background and sufficient experience so that the student can read, write, and understand sentences in the language of probability theory, as well as solve probabilistic problems in engineering and applied science.

Course Outcomes:

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

1. Understand representation of random signals
2. Investigate characteristics of random processes
3. Make use of theorems related to random signals

4. To understand propagation of random signals in LTI systems.

UNIT - 1

Introduction to Probability

Definitions, scope and history; limitation of classical and relative- frequency- based definitions, Sets, fields, sample space and events; axiomatic definition of probability, Combinatorics: Probability on finite sample spaces, Joint and conditional probabilities, independence, total probability; Bayes' rule and applications.

UNIT - 2

Random variables

Definition of random variables, continuous and discrete random variables, cumulative distribution function (cdf) for discrete and continuous random variables; probability mass function (pmf);probability density functions (pdf) and properties, Jointly distributed random variables, conditional and joint density and distribution functions, independence; Bayes' rule for continuous and mixed random variables, Function of random a variable, pdf of the function of a random variable; Function of two random variables; Sum of two independent random variables, mean, variance and moments of a random variable, Joint moments, conditional expectation; covariance and correlation, independent, uncorrelated and orthogonal random variables.

UNIT - 3

Random vector and distributions

Mean vector, covariance matrix and properties, Some special distributions: Uniform, Gaussian and Rayleigh distributions; Binomial, and Poisson distributions; Multivariate Gaussian distribution, Vector- space representation of random variables, linear indepe ndence, inner product, Schwarz Inequality, Elements of estimation theory: linear minimum mean - square error and orthogonality principle in estimation; Moment - generating and characteristic functions and their applications, Bounds and approximations: Chebysev inequality and Chernoff Bound.

UNIT - 4

Sequence of random variables and convergence

Almost sure convergence and strong law of large numbers; convergence in mean square sense with examples from parameter estimation; convergence in probability with examples; convergence in distribution, Central limit theorem and its significance.

UNIT - 5

Random process

Random process: realizations, sample paths, discrete and continuous time processes, examples, Probabilistic structure of a random process; mean, autocorrelation and auto - covariance functions, Stationarity: strict - sense stationary (SSS) and wide- sense stationary (WSS) processes, Autocorrelation function of a real WSS process and its properties, cross- correlation function, Ergodicity and its importance.

UNIT - 6

Spectral representation of a real WSS process

Power spectral density, properties of power spectral density, cross- power spectral density and properties; auto- correlation function and power spectral density of a WSS random sequence, Line ar time - invariant system with a WSS process as an input: sationarity of the output, auto -correlation and power - spectral density of the output; examples with white - noise as input; linear shift - invariant discrete- time system with a WSS sequence as input, Spe ctral factorization theorem, Examples of random processes: white noise process and white noise sequence; Gaussian process; Poisson process, Markov Process.

TEXT/REFERENCE BOOKS

1. T. Veerrajan, “Probability, Statistics and Random Processes”, Third Edition, McGraw Hill.
2. Probability and Random Processes by Geoffrey Grimmett, David Stirzaker
3. Probability, random processes, and estimation theory for engineers by Henry Stark, John William Woods.

4. H. Stark and J. Woods, “Probability and Random Processes with Applications to Signal Processing,” Third Edition, Pearson Education
5. A. Papoulis and S. Unnikrishnan Pillai, “Probability, Random Variables and Stochastic Processes,” Fourth Edition, McGraw Hill.
6. K. L. Chung, Introduction to Probability Theory with Stochastic Processes, Springer International
7. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability, UBS Publishers.
8. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Stochastic Processes, UBS Publishers
9. S. Ross, Introduction to Stochastic Models, Harcourt Asia, Academic Press.

BTEXPE506C	Data Structure & Algorithms using Java Programming	3 Credits

Prerequisites: Basic knowledge of C language is required.

Course Objectives:

- To assess how the choice of data structures and algorithm design methods impacts the performance of programs.
- To choose the appropriate data structure and algorithm design method for a specified application.
- To study the systematic way of solving problems, various methods of organizing large amounts of data.
- To solve problems using data structures such as linear lists, stacks, queues, binary trees, binary search trees, and graphs and writing programs for these solutions.
- To employ the different data structures to find the solutions for specific problems

Course Outcomes:

On completion of the course, student will be able to:

1. To impart the basic concepts of data structures and algorithms.
2. To understand concepts about searching and sorting techniques
3. Describe how arrays, records, linked structures are represented in memory and use them in algorithms.
4. To understand basic concepts about stacks, queues, lists trees and graphs.
5. To enable them to write algorithms for solving problems with the help of fundamental data structures.

UNIT - 1

Introduction

Basic Terminologies: Elementary Data Organizations, Data Structure Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off. Searching: Linear Search and Binary Search Techniques and their complexity analysis.

UNIT - 2

Stacks and Queues

ADT Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation – corresponding algorithms and complexity analysis. ADT queue, Types of Queue: Simple Queue, Circular Queue, Priority Queue; Operations on each type of Queues: Algorithms and their analysis.

UNIT - 3

Linked Lists

Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue, Header nodes, doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists: all operations their algorithms and the complexity analysis.

UNIT - 4

Trees

Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree; Tree operations on each of the trees and their algorithms with complexity analysis. Applications of Binary Trees, B Tree, B+ Tree: definitions, algorithms and analysis.

UNIT - 5

Sorting and Hashing

Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort; Performance and Comparison among all the methods, Hashing.

UNIT - 6

Graph

Basic Terminologies and Representations, Graph search and traversal algorithms and complexity analysis.

TEXT/REFERENCE BOOKS

1. "How to Solve it by Computer", 2nd Impression by R. G. Dromey, Pearson Education.
2. Ellis Horowitz, Sartaj Sahni, "Fundamentals of Data Structures", Galgotia Books Source. ISBN 10: 0716782928
3. Java: The Complete Reference, Seventh Edition, Herbert Schildt, McGraw Hill
4. Richard F. Gilberg & Behrouz A. Forouzan, Data Structures: A Pseudocode Approach with C, Cengage Learning, second edition. ISBN-10: 0534390803.
5. Seymour Lipschutz, Data Structure with C, Schaum's Outlines, Tata Mc Graw Hill. ISBN-10: 1259029964.

BTEXPE506D	Introduction to MEMS	3 Credits

Course Objectives:

- The objective of this course is to make students to gain basic knowledge on overview of MEMS (Micro electro Mechanical System) and various fabrication techniques.
- This enables them to design, analysis, fabrication and testing the MEMS based components and to introduce the students various opportunities in the emerging field of MEMS.
- This will enables student to study applications of micro-sensors and micro-actuators, various MEMS fabrication technologies, MEMS-specific design issues and constraints, Dynamics and modeling of microsystems, getting access to fabrication and testing in academia and industry.

Course Outcomes:

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

1. Appreciate the underlying working principles of MEMS and NEMS devices.
2. Design and model MEM devices.

UNIT - 1

Introduction to MEMS

Introduction, History, Concepts of MEMS: Principles, application and design, Scaling Properties/Issues, Micromachining Processes: Substrates, lithography, wet/dry etching processes, deposition processes, film stress, exotic processes. Mechanical Transducers: transduction methods, accelerometers, gyroscopes, pressure sensors, MEMS microphones, mechanical structures, actuators.

UNIT - 2

Control and Materials of MEMS

Controls of MEMS: Analog control of MEMS, Sliding mode control of MEMS, Digital control of MEMS, Materials for MEMS: Substrate and wafers, Active substrate material, silicon, Silicon compound, Silicon pezoresisters, Gallium arsenide, Quartz, piezoelectric crystals, Polymers.

UNIT - 3

Review of Basic MEMS fabrication modules:

MEMS fabrication modules, Oxidation, Deposition Techniques, Lithography (LIGA), and Etching.

UNIT - 4

Micromachining

Micromachining, Surface Micromachining, sacrificial layer processes, Stiction; Bulk Micromachining, Isotropic Etching and Anisotropic Etching, Wafer Bonding

UNIT - 5

Mechanics of solids in MEMS/NEMS

Mechanics of solids in MEMS/NEMS: Stresses, Strain, Hookes's law, Poisson effect, Linear Thermal Expansion, Bending, Energy methods.

UNIT - 6

Finite Element Method and Electromechanical Systems

Overview of Finite Element Method, Modeling of Coupled Electromechanical Systems

TEXT/REFERENCE BOOKS

1. G. K. Ananthasuresh, K. J. Vinoy, S. Gopalkrishnan K. N. Bhat, V. K. Aatre, Micro and Smart Systems, Wiley India, 2012
2. S. E.Lyshevski, Nano-and Micro-Electromechanical systems: Fundamentals of Nano-and Microengineering (Vol. 8). CRC press, (2005).
3. S. D. Senturia, Microsystem Design, Kluwer Academic Publishers, 2001.
4. M. Madou, Fundamentals of Microfabrication, CRC Press, 1997.
5. G. Kovacs, Micromachined Transducers Sourcebook, McGraw-Hill, Boston, 1998.
6. M.H. Bao, Micromechanical Transducers: Pressure sensors, accelerometers, and Gyroscopes, Elsevier, New York, 2000.

BTEXPE506E	Audio & Video Processing	3 Credits

Course Objectives:

- The objective is to provide students with a strong understanding of the fundamental principles and practical applications of audio and video engineering with latest updates.

Course Outcomes:

After successfully completing the course students will be able to

1. Understand the concept of basic television signal processing.
2. Identify globally accepted color TV standards.
3. Demonstrate the need of audio and video compression techniques in real life.
4. Acquire knowledge of latest digital TV systems and applications.
5. Describe the attributes of acoustics, sound engineering and storage media.

UNIT - 1

Fundamentals of Color Television

Aspect, scanning, perception of brightness and colour, colour mixing, composite video signal, synchronisation details, digital TV camera, modulation of audio and video, terrestrial signal transmission, video displays: LCD vs LED.

UNIT - 2

Colour Standards and digital video

Standards: NTSC, PAL, SECAM colour system, generalized colour TV receiver block diagram, study of functionality of each block, alignment issues, sampling of video signal, colour sub sampling, composite vs component video, interlace vs progressive scan.

UNIT - 3

Digital TV

Digital video, resolution, notation, digital video formats, digital video quality measure, video restoration, video streaming, DTH, Video compression: MPEG 2, MPEG 4, comparison of SDTV, EDTV and HDTV.

UNIT - 4

Advanced TV Systems and Techniques

Introduction to UHDTV: 4K and 8K, IPTV/web TV, smart TV, Wi-Fi TV, digital surveillance, 3D TV concept, over view of H.264 features, camcorders, webcams, perspective of TV White spaces.

UNIT - 5

Acoustics

Human Hearing and sound, frequency range, dynamic range, masking, digital representation of sound wave, intensity, decibel sound level, sound waves in rooms, reverberation, room/studio acoustics as a component in speech system, PA systems, special types of microphones and speakers.

UNIT - 6

Audio and Video Recording Systems

Digital sound, sound recording, CD/ DVD player, MP3 player, Blue Ray DVD Player, ITU-T(G) compression standards, multichannel/Dolby 5.1sound in DTV.

TEXT/REFERENCE BOOKS

1. A. M. Dhake, Television and video Engineering, TMH Publication, 2ndEdition, 2001.
2. Kelth jack, Video Demystified: A Handbook for the Digital Engineer, 5thEdition, Newnes, 2007.
3. R.G. Gupta, Audio and Video Systems, McGraw Hill l Education (India), 2nd Edition, 2010.
4. S. P. Bali, Color Television Theory and Practice, McGraw Hill Education (India), 1994.
5. A. M. Tekalp, Digital Video, Prentice Hall, 1995.
6. R. P. Gulathi, Modern Television Practice, 4thedition, New Age International Publisher, 2014.

BTEXC601	Computer Architecture	3 Credits

Course Objectives:

- To introduce basic concepts of computer organization and to illustrate the computer organization concepts by Assembly Language programming.
- To understand operating systems and how they work with the computer and students will understand the relationship between hardware and software specifically how machine organization impacts the efficiency of applications written in a high-level language.
- Students will be able to make use of the binary number system to translate values between the binary and decimal number systems, to perform basic arithmetic operations and to construct machine code instructions and students will be able to design and implement solutions for basic programs using assembly language.
- Students will be able to design logical expressions and corresponding integrated logic circuits for a variety of problems including the basic components of a CPU such as adders, multiplexers, the ALU, a register file, and memory cells and to explain the fetch-execute cycle performed by the CPU and how the various components of the data path are used in this process.

Course Outcomes:

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

1. Learn how computers work

2. Know basic principles of computer's working
3. Analyze the performance of computers
4. Know how computers are designed and built
5. Understand issues affecting modern processors (caches, pipelines etc.).

UNIT - 1

Basics of Computers

Basic Structure of Computers, Functional units, software, performance issues software, machine Instructions and programs, Types of instructions, Instruction sets: Instruction formats, Assembly Language, Stacks, Queues, Subroutines.

UNIT - 2

Processor organization

Processor organization, Information representation, number formats.

UNIT - 3

ALU design

Multiplication & division, ALU design, Floating Point arithmetic, IEEE 754 floating point formats Control Design, Instruction sequencing, Interpretation, Hard wired control - Design methods, and CPU control unit.

UNIT - 4

Memory organization

Memory organization, device characteristics, RAMS, ROM, Memory management, Concept of Cache & associative memories, Virtual memory.

UNIT - 5

System organization

System organization, Input - Output systems, Interrupt, DMA, Standard I/O interfaces.

UNIT - 6

Parallel processing

Concept of parallel processing, Pipelining, Forms of parallel processing, interconnect network.

TEXT/REFERENCE BOOKS

1. V. Carl Hammacher, “Computer Organisation”, Fifth Edition.
2. A. S. Tanenbum, “Structured Computer Organisation”, PHI, Third edition
3. Y.Chu, "Computer Organization and Microprogramming”, II, Englewood Chiffs, N.J., Prentice Hall Edition
4. M. M. Mano, “Computer System Architecture”, Edition
5. C. W. Gear, “Computer Organization and Programming”, McGraw Hill, N.V. Edition
6. Hayes J.P, “Computer Architecture and Organization”, PHI, Second edition

BTEXC602	Power Electronics	3 Credits

Course Objectives:

- To introduce students to different power devices to study their construction, characteristics and turning on circuits.
- To give an exposure to students of working & analysis of controlled rectifiers for different loads, inverters, DC choppers, AC voltage controllers and resonant converters.
- To study the different motor drives, various power electronics applications like UPS, SMPS, etc. and some protection circuits.

Course Outcomes:

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

1. Build and test circuits using power devices such as SCR
2. Analyze and design controlled rectifier, DC to DC converters, DC to AC inverters,
3. Learn how to analyze these inverters and some basic applications.
4. Design SMPS.

UNIT - 1

Characteristics of Semiconductor Power Devices

Thyristor, power MOSFET and IGBT- Treatment should consist of structure, Characteristics, operation, ratings, protections and thermal considerations. Brief introduction to power devices viz. TRIAC, MOS controlled thyristor (MCT), Power Integrated Circuit (PIC) (Smart Power), Triggering/Driver, commutation and snubber circuits for thyristor, power MOSFETs and IGBTs (discrete and IC based).Concept of fast recovery and schottky diodes as freewheeling and feedback diode.

UNIT - 2

Controlled Rectifiers

Single phase: Study of semi and full bridge converters for R, RL, RLE and level loads. Analysis of load voltage and input current- Derivations of load form factor and ripple factor, Effect of source impedance, Input current Fourier series analysis of input current to derive input supply power factor, displacement factor and harmonic factor.

UNIT - 3

Choppers

Quadrant operations of Type A, Type B, Type C, Type D and type E choppers, Control techniques for choppers – TRC and CLC, Detailed analysis of Type A chopper. Step up chopper. Multiphase Chopper.

UNIT - 4

Single-phase inverters

Principle of operation of full bridge square wave, quasi-square wave, PWM inverters and comparison of their performance. Driver circuits for above inverters and mathematical analysis of output (Fourier series) voltage and harmonic control at output of inverter (Fourier analysis of output voltage). Filters at the output of inverters, Single phase current source inverter.

UNIT - 5

Switching Power Supplies

Analysis of fly back, forward converters for SMPS, Resonant converters - need, concept of soft switching, switching trajectory and SOAR, Load resonant converter - series loaded half bridge DC-DC converter.

UNIT - 6

Applications

Power line disturbances, EMI/EMC, power conditioners. Block diagram and configuration of UPS, salient features of UPS, selection of battery and charger ratings, sizing of UPS.
Separately excited DC motor drive. P M Stepper motor Drive.

TEXT/REFERENCE BOOKS

1. Muhammad H. Rashid, “Power electronics” Prentice Hall of India.
2. Ned Mohan, Robbins, “Power electronics”, edition III, John Wiley and sons.
3. P.C. Sen., “Modern Power Electronics”, edition II, Chand& Co.
4. V. R. Moorthi, “Power Electronics”, Oxford University Press.
5. Cyril W., Lander,” Power Electronics”, edition III, McGraw Hill.
6. G K Dubey, S R Doradla,: Thyristorised Power Controllers”, New Age International Publishers. SCR manual from GE, USA.

BTEXPE603A	Digital Communication	3 Credits

Course Objectives:

- To understand the building blocks of digital communication system.
- To prepare mathematical background for communication signal analysis.
- To understand and analyze the signal flow in a digital communication system.
- To analyze error performance of a digital communication system in presence of noise and other interferences.
- To understand concept of spread spectrum communication system.

Course Outcomes:

1. Analyze the performance of a baseband and pass band digital communication system in terms of error rate and spectral efficiency.
2. Perform the time and frequency domain analysis of the signals in a digital communication system.
3. Select the blocks in a design of digital communication system.
4. Analyze Performance of spread spectrum communication system.

UNIT - 1

Digital Transmission of Analog Signal

Introduction to Digital Communication System: Why Digital?, Block Diagram and transformations, Basic Digital Communication Nomenclature. Digital Versus Analog Performance Criteria, Sampling Process, PCM Generation and Reconstruction, Quantization Noise, Non-uniform Quantization and Companding, PCM with noise: Decoding noise, Error threshold, Delta Modulation, Adaptive Delta Modulation, Delta Sigma Modulation, Differential Pulse Code Modulation, LPC speech synthesis.

UNIT - 2

Baseband Digital Transmission

Digital Multiplexing: Multiplexers and hierarchies, Data Multiplexers. Data formats and their spectra, synchronization: Bit Synchronization, Scramblers, Frame Synchronization. Inter-symbol interference, Equalization.

UNIT - 3

Random Processes

Introduction, Mathematical definition of a random process, Stationary processes, Mean, Correlation & Covariance function, Ergodic processes, Transmission of a random process through a LTI filter, Power spectral density, Gaussian process, noise, Narrow band noise, Representation of narrowband noise in terms of in phase & quadrature components.

UNIT - 4

Baseband Receivers

Detection Theory: MAP, LRT, Minimum Error Test, Error Probability, Signal space representation: Geometric representation of signal, Conversion of continuous AWGN channel to vector channel, Likelihood functions, Coherent Detection of binary signals in presence of noise, Optimum Filter, Matched Filter, Probability of Error of Matched Filter, Correlation receiver.

UNIT - 5

Passband Digital Transmission

Pass band transmission model, Signal space diagram, Generation and detection, Error Probability derivation and Power spectra of coherent BPSK, BFSK and QPSK. Geometric representation, Generation and detection of - M-ary PSK, M-ary QAM and their error probability, Generation and detection of -Minimum Shift Keying, Gaussian MSK, Non-coherent BFSK, DPSK and DE PSK ,Introduction to OFDM.

UNIT - 6

Spread Spectrum Techniques

Introduction, Pseudo noise sequences, A notion of spread spectrum, Direct sequence spread spectrum with coherent BPSK, Signal space dimensionality & processing gain, Probability of error, Concept of jamming, Frequency hop spread spectrum, Wireless Telephone Systems, Personal Communication System.

TEXT/REFERENCE BOOKS

1. Simon Haykin, “Digital Communication Systems”, John Wiley & Sons, Fourth Edition.
2. A.B Carlson, P B Crully, J C Rutledge, “Communication Systems”, Fourth Edition, McGraw Hill Publication.
3. Ha Nguyen, Ed Shwedyk, “A First Course in Digital Communication”, Cambridge University Press.

4. B P Lathi, Zhi Ding "Modern Analog and Digital Communication System", Oxford University Press, Fourth Edition.
5. Bernard Sklar, Prabitra Kumar Ray, "Digital Communications Fundamentals and Applications" Second Edition, Pearson Education.
6. Taub, Schilling, "Principles of Communication System", Fourth Edition, McGraw Hill.
7. P Ramkrishna Rao, Digital Communication, Mc Graw Hill Publication.

BTEXPE603B	Computer Network and Cloud Computing	3 Credits

Course Objectives:

- To develop an understanding of modern network architectures from a design and performance perspective.
- To introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs).
- To provide an opportunity to do network programming
- To provide a WLAN measurement ideas.
- Discuss, with confidence, what is cloud computing and what are key security and control
- Considerations within cloud computing environments.
- Identify various cloud services.

Course Outcomes:

1. To master the terminology and concepts of the OSI reference model and the TCP-IP reference model.
2. To master the concepts of protocols, network interfaces, and design/performance issues in local area networks and wide area networks.
3. To be familiar with contemporary issues in networking technologies.
4. To be familiar with network tools and network programming.
5. For a given requirement (small scale) of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) design it based on the market available component.
6. For a given problem related TCP/IP protocol developed the network programming.
7. Configure DNS DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls using open source available software and tools.

8. To impart fundamental concepts in the area of cloud computing.
9. To impart knowledge in applications of cloud computing.
10. Develop applications for cloud computing.

UNIT - 1

Physical Layer and Data Link Layer

Network types, OSI model, TCP / IP protocol suite, Addressing, Guided and Unguided Transmission media. Switching: Circuit switched networks, Packet Switching, Structure of a switch.

DLC Services, DLL protocols, HDLC, PPP, Media Access Control: Random Access, Controlled Access, Channelization. Wired LAN: Ethernet Protocol, Standard Ethernet, Fast Ethernet, Giagabit Ethernet.

UNIT - 2

Network Layer and Transport Layer

Switching, Logical addressing – IPV4, IPV6; Address mapping – ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols.

Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service, QoS improving techniques.

UNIT - 3

Application Layer

Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls, Basic concepts of Cryptography.

UNIT - 4

Wireless LANS & Virtual Circuit Networks

Introduction, Wireless LANS: IEEE 802.11 project, Bluetooth, Zigbee, Connecting devices and Virtual LANS: Connecting devices, Virtual LANS.

UNIT - 5

.Introduction and Cloud Computing Technology

Shift from distributed computing to cloud computing; principles and characteristics of cloud computing- IaaS, PaaS, SaaS; service oriented computing and cloud environment.

Client systems, Networks, server systems and security from services perspectives; accessing the cloud with platforms and applications; cloud storage.

UNIT - 6

Working with Cloud and Cloud Services

Infrastructure and working platform as a Service – conceptual model model and functionalities. Software as a Service –conceptual model and working. Trends inService provisioning with clouds.Using Cloud Services-Cloud collaborative applications and services.

TEXT/REFERENCE BOOKS

1. Data Communication and Networking, 4th Edition, Behrouz A. Forouzan, McGraw-Hill.
2. TCP/IP Protocol Suite, 4th Edition, Behrouz A. Forouzan, Tata McGraw-Hill.
3. Data and Computer Communication, 8th Edition, William Stallings, Pearson Prentice Hall India.
4. Computer Networks, 8th Edition, Andrew S. Tanenbaum, Pearson New International Edition.
5. Internetworking with TCP/IP, Volume 1, 6th Edition Douglas Comer, Prentice Hall of India.
6. TCP/IP Illustrated, Volume 1, W. Richard Stevens, Addison-Wesley, United States of America.
7. Anthony T. Velte, Toby J. Velte and Robert E, Cloud Computing – A Practical Approach, TMH 2010.
8. Michael Miller, Cloud Computing – Web based Applications, Pearson Publishing, 2011.

BTEXPE603C	Nano Electronics	3 Credits

Course Objectives:

- To convey the basic concepts of Nano electronics to engineering students with no background in quantum mechanics and statistical mechanics.
- Main objective of this is to provide the basic platform and deep information of different Nano electronics devices like MOSFET, FINFET, Nano metrology tools used to design the recently developing VLSI applications.

- This subject gives idea about the role and importance of the Nano electronic devices system in engineering world to develop the research ideas in VLSI.
- Recent technology proceeds with MOSFET with 64nm technology, the need Nano electronic Devices and Material subject to achieve transistor size which is less than current technology.
- The content of this course gives platform to the Nano electronics world and innovative ideas to ensure the knowledge of real time applications which helps students to stand them in Indian and multinational industries.

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Understand various aspects of nano-technology and the processes involved in making nano components and material.
2. Leverage advantages of the nano-materials and appropriate use in solving practical problems.
3. Understand various aspects of nano-technology and the processes involved in making nano components and material.
4. Leverage advantages of the nano-materials and appropriate use in solving practical problems.

UNIT - 1

Overview Nano Technology

Introduction to nanotechnology, Nano devices, Nano materials, Nano characterization, Definition of Technology node, Basic CMOS Process flow, meso structures.

UNIT - 2

Basics of Quantum Mechanics

Schrodinger equation, Density of States. Particle in a box Concepts, Degeneracy. Band Theory of Solids. Kronig-Penny Model. Brillouin Zones.

UNIT - 3

MOS Scaling theory

Shrink-down approaches: Introduction, CMOS Scaling, The nanoscale MOSFET, Finfets, Vertical MOSFETs, limits to scaling, system integration limits (interconnect issues etc.)

UNIT - 4

Nano electronics Semiconductor devices

Resonant Tunneling Diode, Coulomb dots, Quantum blockade, Single electron transistors, Carbon nanotube electronics, Band structure and transport, devices, applications, 2D semiconductors and electronic devices, Graphene, atomistic simulation

UNIT - 5

Properties of Nano devices

Vertical transistors -Fin FET and Surround gate FET. Metal source/drain junctions – Properties of schottky functions on Silicon, Germanium and compound semiconductors - Work function pinning.

UNIT - 6

Characterization techniques for Nano materials

FTIR, XRD, AFM, SEM, TEM, EDAX Applications and interpretation of results, Emerging nano material, nano tubes, Nano rods and other Nano structures, LB technique, Soft lithography Microwave assisted synthesis, Self assembly.

TEXT/REFERENCE BOOKS

1. G.W. Hanson, Fundamentals of Nanoelectronics, Pearson, 2009.
2. W. Ranier, Nanoelectronics and Information Technology (Advanced Electronic Material and Novel Devices), Wiley-VCH, 2003.
3. K.E. Drexler, Nanosystems, Wiley, 1992.
4. J.H. Davies, The Physics of Low-Dimensional Semiconductors, Cambridge University Press, 1998.
5. C.P. Poole, F. J. Owens, Introduction to Nanotechnology, Wiley, 2003.

BTEXPE603D	Web Development and Design	3 Credits

Course Objectives:

- Define the principle of Web page design
- Define the basics in web design
- Visualize the basic concept of HTML.
- Recognize the elements of HTML.
- Introduce basics concept of CSS.
- Develop the concept of web publishing

Course Outcomes:

On completion of the course, student will be able to:

1. Develop the skill & knowledge of Web page design
2. Understand the knowhow and can function either as an entrepreneur or can take up jobs in the multimedia and Web site development studio and other information technology sectors.

UNIT - 1

Web Design Principles , Basic principles involved in developing a web site , Planning process , Five Golden rules of web designing , Designing navigation bar , Page design, Layout of pages , Design Concept.

UNIT - 2

Basics in Web Design , Brief History of Internet , What is World Wide Web , Why create a web site , Web Standards , Audience requirement.

UNIT - 3

Introduction to HTML, HTML Documents, Basic structure of an HTML document, Creating an HTML document, Mark up Tags , Heading, Paragraphs , Line Breaks , HTML Tags.

UNIT - 4

Elements of HTML, Working with Text , Lists, Tables and Frames , Hyperlinks, Images and Multimedia Working with Forms and controls.

UNIT - 5

Introduction to Cascading Style Sheets , CSS Properties , CSS Styling (Background, Text Format, Controlling Fonts) , Working with block elements and objects , Working with Lists and Tables , CSS Id and Class, Box Model (Introduction, Border properties, Padding Properties, Margin properties) , CSS Advanced (Grouping, Dimension, Display, Positioning, Floating, Align, Pseudo class, Navigation Bar, Image Sprites, Attribute sector) , CSS Color , Creating page Layout and Site Designs.

UNIT - 6

Introduction to Web Publishing or Hosting , Creating the Web Site ,Saving the site, Working on the web site, Creating web site structure, Creating Titles for web pages, Themes, Publishing web sites.

TEXT/REFERENCE BOOKS

1. J. N. Robbins, Learning Web Design, O'Reilly Media, 4th Edition, 2012
2. Steven M. Schafer, HTML, XHTML, and CSS Bible, Wiley India, 5th Edition, 2010
3. John Duckett, Beginning HTML, XHTML, CSS, and JavaScript, Wiley India, 3rd Edition, 2009
4. Hal Stern, David Damstra, Brad Williams, Professional WordPress: Design and Development, Wrox Publication, 3rd Edition, 2015
5. E. Robson, E. Freeman, Head First HTML & CSS, O’Reilly Media, nd Edition, 2012.

BTEXOE604A	Digital System Design	3 Credits

Course Objectives:

- The concept and theory of digital Electronics are needed in almost all electronics and telecommunication engineering fields and in many other engineering and scientific disciplines as well.
- The main objective of this course is to lay the foundation for further studies in areas such as communication, VLSI, computer, microprocessor etc. One of the most important reasons for the unprecedented growth of digital electronics is the advent of integrated circuit.
- This course will explore the basic concepts of digital electronics.

Course outcomes:

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

1. Design and analyze combinational logic circuits
2. Design & analyze modular combinational circuits with MUX/DEMUX, Decoder, Encoder
3. Design & analyze synchronous sequential logic circuits
4. Use HDL & appropriate EDA tools for digital logic design and simulation.

UNIT - 1

Logic Simplification and Combinational Logic Design

Review of Boolean algebra and De Morgan’s Theorem, SOP & POS forms, Canonical forms, Karnaugh maps up to 6 variables, Binary codes, Code Conversion.

UNIT - 2

MSI devices

Comparators, Multiplexers, Encoder, Decoder, Driver & Multiplexed Display, Half and Full Adders, Subtractors, Serial and Parallel Adders, BCD Adder, Barrel shifter and ALU.

UNIT - 3

Sequential Logic Design

Building blocks like S-R, JK and Master-Slave JK FF, Edge triggered FF, Ripple and Synchronous counters, Shift registers, Finite state machines, Design of synchronous FSM, Algorithmic State Machines charts. Designing synchronous circuits like Pulse train generator, Pseudo Random Binary Sequence generator, Clock generation.

UNIT - 4

Logic Families and Semiconductor Memories

TTL NAND gate, Specifications, Noise margin, Propagation delay, fan-in, fan-out, Tristate TTL, ECL, CMOS families and their interfacing.

UNIT - 5

Memory Elements

Concept of Programmable logic devices like FPGA, Logic implementation using Programmable Devices.

UNIT - 6

VLSI Design flow

Design entry: Schematic, FSM & HDL, different modeling styles in VHDL, Data types and objects, Dataflow, Behavioral and Structural Modeling, Synthesis and Simulation VHDL constructs and codes for combinational and sequential circuits.

TEXT/REFERENCE BOOKS

1. R.P. Jain, “Modern digital Electronics”, Tata McGraw Hill, 4th edition, 2009.
2. Douglas Perry, “VHDL”, Tata McGraw Hill, 4th edition, 2002.
3. W.H. Gothmann, “Digital Electronics- An introduction to theory and practice”, PHI, 2nd edition, 2006.
4. D.V. Hall, “ Digital Circuits and Systems” , Tata McGraw Hill, 1989
5. Charles Roth, “Digital System Design using VHDL”, Tata McGraw Hill 2nd edition 2012.

BTEXOE604B	Neural Network & Fuzzy System	3 Credits

Course Objectives:

- This course covers basic concepts of artificial neural networks, fuzzy logic systems and their applications.
- Its focus will be on the introduction of basic theory, algorithm formulation and ways to apply these techniques to solve real world problems.
- It deals with Introduction and different architectures of neural network
- It deals with the Application of Neural Networks.
- It deals with Fuzzy Logic Controller.
- It deals with applications of Fuzzy logic

Course Outcomes:

1. The student will be able to obtain the fundamentals and types of neural networks.
2. The student will have a broad knowledge in developing the different algorithms for neural networks.
3. Student will be able analyze neural controllers.
4. Student will have a broad knowledge in Fuzzy logic principles.
5. Student will be able to determine different methods of Deffuzification.

UNIT - 1

Introduction

Biological neurons, McCulloch and Pitts models of neuron, Types of activation function, Network architectures, Knowledge representation, Learning process: Error-correction learning, Supervised learning, Unsupervised learning, Learning Rules.

UNIT - 2

Single Layer Perception

Perception convergence theorem, Method steepest descent - least mean square algorithms.

UNIT - 3

Multilayer Perception

Derivation of the back-propagation algorithm, Learning Factors.

UNIT - 4

Radial Basis and Recurrent Neural Networks

RBF network structure theorem and the reparability of patterns, RBF learning strategies, K-means and LMS algorithms, comparison of RBF and MLP networks, Hopfield networks: energy function, spurious states, error performance.

UNIT - 5

Neuro-dynamics

Attractors, Neuro dynamical model, Adaptive Resonance theory, Towards the Self Organizing Feature Map. Brain-state-in- a-box model,

UNIT - 6

Fuzzy logic

Fuzzy sets, Properties, Operations on fuzzy sets, Fuzzy relation Operations on fuzzy relations, The extension principle, Fuzzy mean Membership functions, Fuzzification and defuzzification methods, Fuzzy controllers.

TEXT/REFERENCE BOOKS

1. Simon Haykin, "Neural Network a - Comprehensive Foundation", Pearson Education.
2. Dr. S. N. Sivanandam, Mrs S.N. Deepa Introduction to Soft computing tool Wiley Publication.
3. Satish Kumar Neural Networks: A classroom Approach Tata McGraw-Hill.
4. Zurada J.M., "Introduction to Artificial Neural Systems, Jaico publishers.
5. Thimothv J. Ross, "Fuzz V Logic with Engineering Applications", McGraw.
6. Ahmad Ibrahim, "Introduction to Applied Fuzzy Electronics', PHI.

7. Rajsekaran S, VijaylakshmiPai, Neural Networks, Fuzzy Logic, and Genetic Algorithms, PHI.

8. Hagan, Demuth, Beale, ëNeural Network Designí, Thomson Learning

9. Christopher M Bishop Neural Networks for Pattern Recognition, Oxford Publication.

10. William W Hsieh Machine Learning Methods in the Environmental Sciences Neural Network and Kernels Cambridge Publication.

11. Dr. S. N. Sivanandam, Dr. S. Sumathi Introduction to Neural Network Using Matlab Tata McGraw-Hill

BTEXOE604D	Analog Integrated Circuit Design	3 Credits

Course Objectives:

- Introduction to Circuit Simulation & EM Simulations
- Deep Understanding of MOS Device Physics & Modeling
- Understanding of few transistor circuits like common gate, common source & common drain amplifiers with their frequency response
- Understanding of Operational Amplifier Design & Trade-offs
- Advanced Op-Amps and OTAs
- Temperature Compensated Biasing Schemes.

Course Outcomes:

At the end of the course, the student must be able to:

1. Design MOSFET based analog integrated circuits.
2. Analyze analog circuits at least to the first order.
3. Appreciate the trade-offs involved in analog integrated circuit design.
4. Understand and appreciate the importance of noise and distortion in analog circuits.

UNIT - 1

Introduction to Simulations

Introduction to Advanced Design System and Cadence Virtuoso, DC Simulations, AC Simulations, Harmonic Balance, Envelope Simulation, Electromagnetic Simulations- FEM, MOM, FDTD, Circuit Net listing.

UNIT - 2

MOSFET Device Physics & Modeling

MOSFET Structure, Threshold Voltage, Drain Current Equation, Transfer & Output Characteristics, Weak/Moderate/Strong Inversion, Linear/Triode/Saturation Region of Operation, Device Leakages and Losses, Short Channel Effects, High Frequency Small Signal Model of MOSFET, Cubic, BSIM and Materka Models of MOSFET.

UNIT - 3

Few Transistor Circuits

Current Mirrors, Common Source/Common Gate/Common Drain Amplifiers, Design and Analysis of CS/CG/CD Amplifiers, Cascode Amplifiers, Differential Gain Stage, Frequency Response & Design Trade-offs, Telescopic Cascode and Wide Swing Cascode Current Mirrors, PTAT, CTAT & Bandgap Bias Circuits.

UNIT - 4

Operational Amplifiers & OTAs

Design of Classical Op-Amps, Op-Amp Characteristics, Analysis and Trade-offs, Wideband Op-Amps, High Speed Op-Amps, Very High Gain Op-Amps, Operational Transconductance Amplifiers, Ultra Low Power OTAs for Medical Implants, Folded Cascode Op-Amps.

UNIT - 5

Biasing Schemes

Voltage and Current References, Vt reference bias, PTAT Current Reference, CTAT and Bandgap Voltage References, High Precision Voltage References, Voltage Level Shifters.

UNIT - 6

Non-Linear Circuits

Single and Balanced Diode Mixers, Translinear Cell, Gilbert Cell Mixers, Power Amplifiers, Even & Odd Order Mixing, In-Modulation (AM, PM Conversions) Distortions, Intermodulation Distortions, Intermodulation Products, ACPR & EVM.

TEXT/REFERENCE BOOKS

1. Tony Chan Carusone, David A. Johns, Kenneth W. Martin, "Analog Integrated Circuit Design", John Wiley & Sons
2. Keliu Shu, Edgar Sanchez-Sinencio, "CMOS PLL Synthesizers", Springer
3. Jose´ Carlos Pedro, Nuno Borges Carvalho, "Intermodulation Distortion in Microwave and Wireless Circuits", Artech House
4. Stephen A. Maas, "Microwave Mixers", Artech House.

BTEXOE605A	Embedded System Design	3 Credits

Course Objectives:

- To understand the embedded system design issues.
- To learn real time operating system concepts.
- To understand the Embedded Linux environment.
- To learn embedded software development and testing process.

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Suggest design approach using advanced controllers to real-life situations.
2. Design interfacing of the systems with other data handling / processing systems.
3. Appreciate engineering constraints like energy dissipation, data exchange speeds etc.
4. Get to know the hardware – software co design issues and testing methodology for embedded system.

UNIT - 1

Introduction to Embedded Computing

The concept of embedded systems design, Characteristics of Embedding Computing Applications, Concept of Real time Systems.

UNIT - 2

Design Process

Requirements, Specifications, Architecture Design, Designing of Components, Embedded microcontroller cores, embedded memories. Examples of embedded systems.

UNIT - 3

Technological aspects of embedded systems

Interfacing between analog and digital blocks, signal conditioning, digital signal processing, subsystem interfacing, interfacing with external systems, user interfacing.

UNIT - 4

Design tradeoffs

Design tradeoffs due to process compatibility, thermal considerations, etc., Software aspects of embedded systems: real time programming languages and operating systems for embedded systems.

UNIT - 5

Operating System

Basic Features of an Operating System, Kernel Features: Real-time Kernels, Polled Loops System, Co-routines, Interrupt-driven System, Multi-rate System Processes and Threads, Context Switching: Cooperative Multi-tasking, Pre-emptive Multi- tasking.

UNIT - 6

Scheduling and Inter-process Communication

Rate-Monotonic Scheduling, Earliest-Deadline First Scheduling, Task Assignment, Fault-Tolerant Scheduling Signals, Shared Memory Communication, Message-Based Communication.

TEXT/REFERENCE BOOKS

1. J.W. Valvano, "Embedded Microcomputer System: Real Time Interfacing", Brooks/Cole, 2000.
2. Jack Ganssle, "The Art of Designing Embedded Systems", Newness, 1999.

3. V.K. Madisetti, "VLSI Digital Signal Processing", IEEE Press (NY, USA), 1995.
4. David Simon, "An Embedded Software Primer", Addison Wesley, 2000.
5. K.J. Ayala, "The 8051 Microcontroller: Architecture, Programming, and Applications", Penram Intl, 1996

BTEXOE605B	Electronics System Design	3 Credits

Course Objectives:

- To understand the various processes and systems to address human needs by creating tangible Electronic Products.
- To pursue learners with emphasis on learning-by-doing and following a comprehensive process of design, engineering and producing products and systems.

Course Outcomes:

On completion of the course, student will be able to

1. Design electronic products using user centered design process
2. Develop sketches, virtual and physical appearance models to communicate proposed designs
3. Refine product design considering engineering design & manufacturing requirements and constraints.
4. Make mock-up model and working prototype along with design documentation.

UNIT - 1

Introduction to Industrial Design

General introduction in the course, role of ID in the domain of industry, product innovation, designer’s philosophy and role in product design. Product development tools and methods.

UNIT - 2

Product Design Methodology and Product Planning

Electronic product design and development, Methodology, creativity techniques, brain storming, documentation, Defining the task, scheduling the task, estimation of labor cost and amount of documentation.

UNIT - 3

Ergonomics

Ergonomics of electronics electronic use of ergonomics at work places and plan layouts, ergonomics of panel design, case study.

UNIT - 4

Aesthetics and Visual Communication Techniques

Elements of aesthetics, aesthetics of control design, Visual Communication Techniques: perspective, band sketching and rendering technique, elements of Engineering drawing, assembly drawing part drawing , exploded views.

UNIT - 5

Product Anatomy and Product Detailing

Layout design, structure design, standard and non-standard structures, Industrials standards, Product detailing in sheet metal and plastics for ease of assembly, maintenance and aesthetics.

UNIT - 6

Product Manufacturing and Value Engineering

Different manufacturing processes in sheet metal and plastics, product finishing, finishing methods like platting, anodization, spray painting, powder coating etc, Introduction to marketing, graphics & packing.

TEXT/REFERENCE BOOKS

1. Peter Z. , "German Design Standard Vol 2", Reddot(2006)
2. Jordan P. W., "Designing Pleasurable Products: An Introduction to the New Human Factors." Taylor and Francis(2002)
3. Otto K. and Wood K., "Product design: Techniques in Reverse Engineering and New Product development", Prentice Hall. (2001)

4. Cross N. "Engineering Design Methods: Strategies for Product Design", Willey.(2000)
5. Cagan J. and Vogel C. M. (2007) Creating Breakthrough Products, "Innovation from Product Planning to Program Approval". Pearson Education
6. Coats D. , "Watches Tell More than Time: Product Design, Information, Quest for elegance" McGraw Hill(2002)
7. Norman D. A., "The design of everyday things, Basic Books."(2002)
8. Chakrabarty D., "Indian Anthropometric Dimensions for Ergonomic Design Practice", NID, Ahmedabad (1999).
9. E.J. McCormic, Human factors in engineering design, McGraw Hill 1976

Journals

1. Behaviour & Information Technology, Taylor & Francis
2. The Journal of Sustainable Product Design, Publisher: Springer
3. International Journal of Design; College of Design, National Taiwan University of Science and Technology, Taiwan.
4. Virtual & Physical Prototyping, Taylor & Francis

Internet Sites

1. http://www.ulrich-eppinger.net/
2. http://www.npd-solutions.com
3. http://www.qfdi.org
4. http://www.cheshirehenbury.com/rapid/

BTEXOE605C	Project Management and Operation Research	3 Credits

Course Objectives:

- To help students understand Evolution of Management Thought, Concepts, basic functions and recent trends managerial concepts and practices for better business decisions.
- To introduce students to framework those are useful for diagnosing problems involving human behavior.
- To enable the students apply mathematical, computational and communication skills needed for the practical utility of Operations Research.

- To teach students about networking, inventory, queuing, decision and replacement models.
- To introduce students to research methods and current trends in Operations Research.

Course Outcomes:

Student will be able to

1. Apply operations research techniques like L.P.P, scheduling and sequencing in industrial optimization problems.

2. Solve transportation problems using various OR methods.

3. Illustrate the use of OR tools in a wide range of applications in industries.

4. Analyze various OR models like Inventory, Queing, Replacement, Simulation, Decision etc and apply them for optimization.

5. Gain knowledge on current topics and advanced techniques of Operations Research for industrial solutions.

UNIT - 1

Definition, need and importance of organizational behaviour , nature and scope , frame work , organizational behaviour models.

UNIT - 2

Organization structure, formation, groups in organizations, influence, group dynamics, emergence of informal leaders and working norms, group decision making techniques, interpersonal relations, communication, control.

UNIT - 3

Evolution of Management thoughts, Contribution of Selected Management Thinkers, Various approaches to management, contemporary management practice, Managing in global environment, Managerial functions.

UNIT - 4

Importance of planning, Types of planning, decision making process, Approaches to decision making, Decision models, Pay off Matrices, Decision trees, Break Even Analysis.

UNIT - 5

Departmentation, Span of Control, Delegation, Centralisation and Decentralisation, Commitees, Line and Staff relationships, Recent trends in organisation structures.

UNIT - 6

Process of Recruitment, Selection, Induction Training, Motivation, Leading, Leadership styles and qualities, Communication, process and barriers. Managements control systems, techniques, Types of control.

TEXT/REFERENCE BOOKS

1. Bateman Snell, Management: Competing in the new era, McGraw,Hill Irwin, 2002.

2. Chandan J.S., Management Concepts and Strategies, Vikas Publishing House, 2002.

3. Hellriegel, Jackson and Slocum, Management: A Competency,Based Approach, South Western, 9th edition, 2002.

4. Koontz, Essentials of Management, Tata McGraw,Hill, 5th Edition, 2001.

5. Stephen P. Robbins and David A. Decenzo, Fundamentals of Management, Pearson Education, Third Edition, 2001.

6. Tim Hannagan, Management Concepts and Practices, Macmillan India Ltd., 1997.

BTEXOE605D	Android Programming	3 Credits

Course Objectives:

Android Application Development course is designed to quickly get you up to speed with writing apps for Android devices. The student will learn the basics of Android platform and get to understand the application lifecycle

Course Outcomes:

At the end of the course, students will demonstrate the ability to write simple GUI applications, use built-in widgets and components, work with the database to store data locally, and much more.

UNIT - 1

Introduction to Mobile Operating Systems and Mobile Application Development

Introduction to Mobile OS:

Palm OS, Windows CE, Embedded Linux, J2ME (Introduction), Symbian (Introduction),

Overview of Android: Devices running android, Why Develop for Android, Features of android, Architecture of Android, Libraries

How to setup Android Development Environment: Android development Framework - Android-SDK, Eclipse, Emulators – What is an Emulator / Android AVD? , Creating & setting up custom Android emulator, Android Project Framework, My first android application.

UNIT - 2

Android Activities, UI Design and Database

Understanding Intent, Activity, Activity Lifecycle and Manifest, Form widgets, Text Fields, Layouts: Relative Layout ,Table Layout, Frame Layout, Linear Layout, Nested layouts.

UI design: Time and Date, Images and media, Composite, Alert Dialogs & Toast, Popup.

Menu: Option menu, Context menu, Sub menu.

Database: Introducing SQLite, SQLite Open Helper, SQLite Database, Cursor,

Content providers: defining and using content providers, example- Sharing database among two different applications using content providers, Reading and updating Contacts, Reading bookmarks.

UNIT - 3

Preferences, Intents and Notifications

Preferences: Shared Preferences, Preferences from xml, Intents:Explicit Intents, Implicit intents. Notifications: Broadcast Receivers, Services (Working in background) and notifications, Alarms.

UNIT - 4

Telephony, SMS and Location Based Services

Telephony: Accessing phone and Network Properties and Status, Monitoring Changes in Phone State, Phone Activity and data Connection.

SMS: Sending SMS and MMS from your Application, sending SMS Manually, Listening for incoming SMS

Location based Services: Using Location Based Services, Working with Google Maps, Geocoder.

UNIT - 5

Accessing Android Hardware

Networking: An overview of networking, checking the network status, communicating with a server socket, Working with HTTP, Web Services.

Bluetooth: Controlling local Bluetooth device, Discovering and bonding with Bluetooth devices, Managing Bluetooth connections, communicating with Bluetooth.

UNIT - 6

Audio Video Handling

Playing Audio and Video, Recording Audio and Video, Using Camera and Taking Picture.

TEXT/REFERENCE BOOKS

1. Reto Meier “Professional Android™ Application Development”, Wrox Publications.
2. Lauren Dercy and Shande Conder “Sams teach yourself Android application development” , Sams publishing
3. Hello Android, Introducing Google’s Mobile Development Platform, Ed Burnette, Pragmatic Programmers, ISBN: 978-1-93435-617-3

BTHM606	Employability & Skill Development	2 Credits

Course Objectives:

- To develop analytical abilities.
- To develop communication skills.
- To introduce the students to skills necessary for getting, keeping and being successful in a profession.
- To expose the students to leadership and team-building skills.

Course Outcomes:

On completion of the course, student will be able to:

1. Have skills and preparedness for aptitude tests.
2. Be equipped with essential communication skills (writing, verbal and non-verbal)
3. Master the presentation skill and be ready for facing interviews.
4. Build team and lead it for problem solving.

UNIT - 1

Soft Skills & Communication basics

Soft skills Vs hard skills, Skills to master, Interdisciplinary relevance, Global and national perspectives on soft skills. Resume, Curriculum vitae, How to develop an impressive resume, Different formats of resume – Chronological, Functional, Hybrid, Job application or cover letter, Professional presentation- planning, preparing and delivering presentation, Technical writing.

UNIT - 2

Arithmetic and Mathematical Reasoning

Aspects of intelligence, Bloom taxonomy, multiple intelligence theory, Number sequence test, mental arithmetic (square and square root, LCM and HCF, speed calculation, reminder theorem).

UNIT - 3

Analytical Reasoning and Quantitative Ability

Matching, Selection, Arrangement, Verifications (Exercises on each of these types). Verbal aptitude (Synonym, Antonym, Analogy).

UNIT - 4

Grammar and Comprehension

English sentences and phrases, Analysis of complex sentences, Transformation of sentences, Paragraph writing, Story writing, Reproduction of a story, Letter writing, précis writing, Paraphrasing and e-mail writing.

UNIT - 5

Skills for interviews

Interviews- types of interviews, preparatory steps for job interviews, interview skill tips, Group discussion- importance of group discussion, types of group discussion, difference between group discussion, panel discussion and debate, personality traits evaluated in group discussions, tips for successful participation in group discussion, Listening skills- virtues of listening, fundamentals of good listening, Non-verbal communication-body movement, physical appearance, verbal sounds, closeness, time.

UNIT - 6

Problem Solving Techniques

Problem solving model: 1. Define the problem, 2. Gather information, 3. Identify various solution, 4. Evaluate alternatives, 5. Take actions, 6. Evaluate the actions.

Problem solving skills: 1. Communicate. 2. Brain storming, 3. Learn from mistakes.

TEXT/REFERENCE BOOKS

1. R. Gajendra Singh Chauhan, Sangeeta Sharma, “Soft Skills- An integrated approach to maximize personality”, ISBN: 987-81-265-5639-7, First Edition 2016, Wiley.
2. Wren and Martin, "English grammar and Composition", S. Chand publications.
3. R. S. Aggarwal, "A modern approach to verbal reasoning", S. Chand publications.
4. Philip Carter, "The Complete Book of Intelligence Test", John Willey & Sons Ltd.
5. Philip Carter, Ken Russell, "Succeed at IQ test", Kogan Page.
6. Eugene Ehrlich, Daniel Murphy, "Schaum’s Outline of English Grammar", McGraw Hills.
7. David F. Beer, David A. Mc Murrey, “A Guide to Writing as an Engineer”, ISBN: 978-1-118-30027-5 4th Edition, 2014, Wiley.

B. Tech (Electronics & Telecommunication Engineering)

Proposed Curriculum for Semester V [Third Year]

Sr. No.	Course Code	Type of Course	Course Title	Hours Per Week			Evaluation Scheme			Total Marks	Credits
				L	T	P	MSE	CA	ESE		
1	BTEXC501	Professional Core Course 1	Electromagnetic Field Theory	2	1	0	20	20	60	100	3
2	BTEXC502	Professional Core Course 2	Control System Engineering	3	0	0	20	20	60	100	3
3	BTETC503	Professional Core Course 3	Computer Architecture	3	0	0	20	20	60	100	3
4	BTEXC504	Professional Core Course 4	Digital Signal Processing	2	1	0	20	20	60	100	3
5	BTEXC505	Professional Core Course 5	Microcontroller and its Applications	3	0	0	20	20	60	100	3
6	BTEXPE506A	Program Elective Course 1	Probability Theory and Random Processes	3	0	0	20	20	60	100	3
	BTEXPE506B		NSQF (Level 7 Course)								
	BTEXPE506C		Data Structure & Algorithms Using Java Programming								
	BTEXPE506D		Introduction to MEMS								

7	BTETL507	Control System Engineering Lab	0	0	2	--	30	20	50	1
8	BTETL508	Digital Signal Processing Lab	0	0	2	--	30	20	50	1
9	BTETL509	Microcontroller and its Applications Lab	0	0	2	--	30	20	50	1
10	BTETP510	Mini Project	0	0	2	--	30	20	50	1
11	BTETS511	Seminar	0	0	2	--	30	20	50	1
12	BTEXF412	Field Training/ Internship/Industrial Training Evaluation	--	--	--	--	--	50	50	1
		Total	**16**	**02**	**10**	**120**	**270**	**510**	**900**	**24**

B. Tech (Electronics & Telecommunication Engineering)

Proposed Curriculum for Semester VI [Third Year]

Sr. No.	Course Code	Type of Course	Course Title	Hours Per Week			Evaluation Scheme			Total Marks	Credits
				L	T	P	MSE	CA	ESE		
1	BTETC601	Professional Core Course 1	Antennas and Wave Propagation	3	0	0	20	20	60	100	3
2	BTETC602	Professional Core Course 2	Computer Network & Cloud Computing	3	0	0	20	20	60	100	3
3	BTETC603	Professional Core Course 3	Digital Image Processing	3	0	0	20	20	60	100	3
4	BTETPE604A	Program Elective Course 2	CMOS Design	3	0	0	20	20	60	100	3
	BTETPE604B		Information Theory and Coding								
	BTETPE604C		Power Electronics								
	BTETPE604D		Nano Electronics								
	BTETPE604E		NSQF (Level 7 Course)								
	BTETPE604F		Android Programming								
5	BTETOE605A	Open Elective Course 1	Digital System Design	3	0	0	20	20	60	100	3
	BTETOE605B		Optimization Techniques								
	BTETOE605C		Project Management and Operation Research								

	BTETOE605D		Augmented, Virtual and Mixed Reality								
	BTETOE605E		Python Programming								
	BTETOE605F		Web Development and Design								
6	BTHM606	Humanities & Social Science including Management Courses	Employability & Skill Development	2	0	0	20	20	60	100	2
7	BTETL607	Computer Network & Cloud Computing Lab		0	0	2	--	30	20	50	1
8	BTETL608	Program Elective 2 Lab		0	0	2	--	30	20	50	1
9	BTETL609	Open Elective 1 Lab		0	0	2	--	30	20	50	1
10	BTETP610	Mini-project		0	0	2	--	30	20	50	1
11	BTETF611	Field Training/ Internship/ Industrial Training (Minimum 4 weeks)		--	--	--	--	--	--	--	1* (To be evaluated in VIIth Semester)
			Total	**17**	**0**	**8**	**120**	**240**	**440**	**800**	**21**

Program Elective 2	Open Elective 1
(A) CMOS Design	(A) Digital System Design
(B) Information Theory and Coding	(B) Optimization Techniques
(C) Power Electronics	(C) Project Management and Operation Research
(D) Nano Electronics	(D) Augmented, Virtual and Mixed Reality
(E) NSQF (Level 7 Course)	(E) Python Programming
(F) Android Programming	(F) Web Development and Design

* To be evaluated in VIIth Semester

BTEXC501	Electromagnetic Field Theory	3 Credits

Course Objectives:

- Learners can be able to explore their knowledge in the area of EM Waves and its analysis.
- To learn basic coordinate system, significance of divergence, gradient, curl and its applications to EM Waves.
- To understand the boundary conditions for different materials /surfaces.
- To get insight on finding solution for non-regular geometrical bodies using Finite Element Method, Method of Moments, Finite Difference Time Domain.
- To get the basics of microwave, transmission lines and antenna parameters.
- 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

UNIT - 1

Maxwell's Equations

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

UNIT - 2

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.

UNIT - 3

Transmission Lines

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.

UNIT - 4

Plane Waves at a Media Interface

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

UNIT - 5

Wave propagation

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

UNIT - 6

Radiation

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.

BTEXC502	Control System Engineering	3 Credits

Course Objectives:

- To introduce the elements of control system and their modeling using various Techniques.
- To introduce methods for analyzing the time response, the frequency response and the stability of systems.
- To introduce the concept of root locus, Bode plots, Nyquist plots.
- To introduce the state variable analysis method.
- To introduce concepts of PID controllers and digital and control systems.
- To introduce concepts programmable logic controller.

Course Outcomes:

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

1. Understand the modeling of linear-time-invariant systems using transfer function and state-space representations.
2. Understand the concept of stability and its assessment for linear-time invariant systems.
3. Design simple feedback controllers.

UNIT - 1

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 diagram reduction techniques, Signal flow graph analysis.

UNIT - 2

Time Response Analysis

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.

UNIT - 3

Stability Analysis

Concept of Stability, Routh-Hurwitz Criteria, Relative Stability analysis, Root-Locus technique. Construction of Root-loci, Dominant Poles, Application of Root Locus Diagram,

UNIT - 4

Frequency-response analysis

Relationship between time and frequency response, Polar plots, Bode plots. Nyquist stability criterion, Relative stability using Nyquist criterion – gain and phase margin. Closed-loop frequency response

UNIT - 5

Introduction to Controller Design

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.

UNIT - 6

State variable Analysis

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 discrete-time systems.

TEXT/REFERENCE BOOKS

1. N. J. Nagrath and M.Gopal, “Control System Engineering”, New Age International Publishers, 5th Edition, 2009.

2. Benjamin C. Kuo, "Automatic control systems", Prentice Hall of India, 7th Edition,1995.
3. M. Gopal, "Control System – Principles and Design", Tata McGraw Hill, 4th Edition, 2012.
4. Schaum's Outline Series, "Feedback and Control Systems" Tata McGraw-Hill, 2007.
5. John J. D'Azzo& Constantine H. Houpis, "Linear Control System Analysis and Design", Tata McGraw-Hill, Inc., 1995.
6. Richard C. Dorf and Robert H. Bishop, "Modern Control Systems", Addison – Wesley, 1999.

BTETC503	Computer Architecture	3 Credits

Course Objectives:

- To introduce basic concepts of computer organization and to illustrate the computer organization concepts by Assembly Language programming.
- To understand operating systems and how they work with the computer and students will understand the relationship between hardware and software specifically how machine organization impacts the efficiency of applications written in a high-level language.
- Students will be able to make use of the binary number system to translate values between the binary and decimal number systems, to perform basic arithmetic operations and to construct machine code instructions and students will be able to design and implement solutions for basic programs using assembly language.
- Students will be able to design logical expressions and corresponding integrated logic circuits for a variety of problems including the basic components of a CPU such as adders, multiplexers, the ALU, a register file, and memory cells and to explain the fetch-execute cycle performed by the CPU and how the various components of the data path are used in this process.

Course Outcomes:

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

1. learn how computers work
2. know basic principles of computer's working
3. analyze the performance of computers
4. know how computers are designed and built

5. Understand issues affecting modern processors (caches, pipelines etc.).

UNIT - 1

Basics of Computers

Basic Structure of Computers, Functional units, software, performance issues software, machine instructions and programs, Types of instructions, Instruction sets: Instruction formats, Assembly language, Stacks, Queues, Subroutines.

UNIT - 2

Processor organization

Processor organization, Information representation, number formats.

UNIT - 3

ALU design

Multiplication & division, ALU design, Floating Point arithmetic, IEEE 754 floating point formats Control Design, Instruction sequencing, Interpretation, Hard wired control - Design methods, and CPU control unit.

UNIT - 4

Memory organization

Memory organization, device characteristics, RAMS, ROM, Memory management, Concept of Cache & associative memories, Virtual memory.

UNIT - 5

System organization

System organization, Input - Output systems, Interrupt, DMA, Standard I/O interfaces.

UNIT - 6

Parallel processing

Concept of parallel processing, Pipelining, Forms of parallel processing, interconnect network.

TEXT/REFERENCE BOOKS

1. V.Carl Hammacher, “Computer Organisation”, Fifth Edition.
2. A.S.Tanenbum, “Structured Computer Organisation”, PHI, Third edition
3. Y.Chu, "Computer Organization and Microprogramming”, II, Englewood Chiffs, N.J.,

4. Prentice Hall Edition
5. M.M.Mano, “Computer System Architecture”, Edition
6. C.W.Gear, “Computer Organization and Programming”, McGraw Hill, N.V. Edition
7. Hayes J.P, “Computer Architecture and Organization”, PHI, Second edition

BTEXC504	Digital Signal Processing	3 Credits

Course Objectives:

- To introduce students with transforms for analysis of discrete time signals and systems.
- To understand the digital signal processing, sampling and aliasing.
- To use and understand implementation of digital filters.
- To understand concept of sampling rate conversion and DSP processor architecture.

Course Outcomes:

After successfully completing the course students will be able to

1. Understand use of different transforms and analyze the discrete time signals and systems.
2. Realize the use of LTI filters for filtering different real world signals.
3. Capable of calibrating and resolving different frequencies existing in any signal.
4. Design and implement multistage sampling rate converter.
5. Design of different types of digital filters for various applications.

UNIT - 1

DSP Preliminaries

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.

UNIT - 2

Discrete Fourier Transform

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

UNIT - 3

Z transform

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 behavior, causality and stability considerations for LTI systems, Inverse Z transform, Power series method, partial fraction expansion method, Solution of difference equations.

UNIT - 4

IIR Filter Design

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)

UNIT - 5

FIR Filter Design

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.

UNIT - 6

Introduction to Multirate signal processing

Concept of Multirate DSP, Introduction to Up sampler, Down sampler and two channel filter bank, Application of Multirate signal processing in communication, Music processing, Image processing and Radar signal processing.

TEXT/REFERENCE BOOKS

1. S.K.Mitra, Digital Signal Processing: A computer based approach.TMH
2. A.V. Oppenheim and Schafer, Discrete Time Signal Processing, Prentice Hall, 1989.
3. John G. Proakis and D.G. Manolakis, Digital Signal Processing: Principles, Algorithms

And Applications, Prentice Hall, 1997.

4. L.R. Rabiner and B. Gold, Theory and Application of Digital Signal Processing, Prentice Hall, 1992.
5. J.R. Johnson, Introduction to Digital Signal Processing, Prentice Hall, 1992.
6. D.J.DeFatta, J. G. Lucas andW.S.Hodgkiss, Digital Signal Processing, John Wiley& Sons, 1988

BTEXC505	Microcontroller and its Applications	3 Credits

Course Objectives:

- Objective of this course is to introduce to the students the fundamentals of microcontroller.
- After learning Microprocessor course, students will get advantage to pursue higher studies in Embedded Systems or employment in core industries.
- The learner can microcontroller design based systems and thus can become successful entrepreneur and meet needs of Indian and multinational industries.
- The students can design and develop processor which can be used in Robotics, Automobiles, Space and many research areas.
- The learners will acquaint optimization skills and undergo concepts design metrics for embedded systems.
- The students will get acquainted with recent trends in microcontroller like pipelining, cache memory etc.
- To understand the applications of Microcontrollers.
- To understand need of microcontrollers in embedded system.
- To understand architecture and features of typical Microcontroller.
- To learn interfacing of real world input and output devices.
- To study various hardware and software tools for developing applications.

Course Outcomes:

1. Learner gains ability to apply knowledge of engineering in designing different case studies.
2. Students get ability to conduct experiments based on interfacing of devices to or interfacing to real world applications.
3. Graduates will be able to design real time controllers using microcontroller based system.

4. Students get ability to interface mechanical system to function in multidisciplinary system like in robotics, Automobiles.
5. Students can identify and formulate control and monitoring systems using microcontrollers.
6. Students will design cost effective real time system to serve engineering solution for Global, social and economic context.
7. Learners get acquainted with modern tools like Programmers, Debuggers, cross compilers and current IDE i.e. integrated development environment tools.
8. Learn importance of microcontroller in designing embedded application.
9. Learn use of hardware and software tools.
10. Develop interfacing to real world devices.

UNIT - 1

Fundamentals of Microcontrollers

Introduction to the general structure of 8 and 16 bit Microcontrollers Harward & 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.

UNIT - 2

Interfacing with 8051 PART I

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.

UNIT - 3

Interfacing with 8051 PART II

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, Opto-isolators. All programs in assembly and C

UNIT - 4

PIC Microcontroller Architecture

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

UNIT - 5

Real World Interfacing Part I

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.

UNIT - 6

Real World Interfacing Part II

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/REFERENCE BOOKS

1. Mazidi & Mazidi, The 8085 microcontroller & embedded system, using assembly and C, 2nd edi, pearson edu.
2. Microprocessor and interfacing 8085, Douglas V Hall, Tata Mc Gram Hill.
3. Microprocessor-Architecture, programming and application with 8085, gaonkar, penram international.
4. Crisp, introduction to microprocessor & microcontrollers, 2e Elsevier, 2007.
5. ARM system-on-chip architecture, 2e pearson education.
6. Calcut, 8051 microcontrollers: Applications based introduction, Elsevier.
7. D V kodavade, S. Narvadkar, 8085-86 microprocessors Architecture progg and interfaces, wiley.
8. Udyashankara V., Mallikarjunaswamy, 8051 microcontroller, TMH.
9. Han-way Huang, using The MCS-51 microcontroller, Oxford university press.

10. Ayala, 8051 microcontroller, cengage (Thomson).
11. Rout 8085 microcontroller-architecture, programming and application, 2nd edi, penram international.

BTEXPE506A	Probability Theory and Random Processes	3 Credits

Course Objectives:

- To develop basic of probability and random variables.
- The primary objective of this course is to provide mathematical background and sufficient experience so that the student can read, write, and understand sentences in the language of probability theory, as well as solve probabilistic problems in engineering and applied science.

Course Outcomes:

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

1. Understand representation of random signals
2. Investigate characteristics of random processes
3. Make use of theorems related to random signals
4. To understand propagation of random signals in LTI systems.

UNIT - 1

Introduction to Probability

Definitions, scope and history; limitation of classical and relative- frequency- based definitions, Sets, fields, sample space and events; axiomatic definition of probability, Combinatorics: Probability on finite sample spaces, Joint and conditional probabilities, independence, total probability; Bayes' rule and applications.

UNIT - 2

Random variables

Definition of random variables, continuous and discrete random variables, cumulative distribution function (cdf) for discrete and continuous random variables; probability mass function (pmf); probability density functions (pdf) and properties, Jointly distributed random variables, conditional and joint density and distribution functions, independence; Bayes' rule for continuous and mixed random variables, Function of random a variable, pdf of the function of a random variable; Function of two random variables; Sum of two independent random variables, mean, variance and moments of a random variable, Joint moments, conditional expectation; covariance and correlation, independent, uncorrelated and orthogonal random variables.

UNIT - 3

Random vector and distributions

Mean vector, covariance matrix and properties, Some special distributions: Uniform, Gaussian and Rayleigh distributions; Binomial, and Poisson distributions; Multivariate Gaussian distribution, Vector- space representation of random variables, linear indepe ndence, inner product, Schwarz Inequality, Elements of estimation theory: linear minimum mean - square error and orthogonality principle in estimation; Moment - generating and characteristic functions and their applications, Bounds and approximations: Chebysev inequality and Chernoff Bound. .

UNIT - 4

Sequence of random variables and convergence

Almost sure convergence and strong law of large numbers; convergence in mean square sense with examples from parameter estimation; convergence in probability with examples; convergence in distribution, Central limit theorem and its significance.

UNIT - 5

Random process

Random process: realizations, sample paths, discrete and continuous time processes, examples, Probabilistic structure of a random process; mean, autocorrelation and auto - covariance functions, Stationarity: strict - sense stationary (SSS) and wide- sense stationary (WSS) processes, Autocorrelation function of a real WSS process and its properties, cross- correlation function, Ergodicity and its importance.

UNIT - 6

Spectral representation of a real WSS process

Power spectral density, properties of power spectral density, cross- power spectral density and properties; auto- correlation function and power spectral density of a WSS random sequence, Line ar time - invariant system with a WSS process as an input: sationarity of the output, auto -correlation and power - spectral density of the output; examples with white - noise as input; linear shift - invariant discrete- time system with a WSS sequence as input, Spe ctral factorization theorem, Examples of random processes: white noise process and white noise sequence; Gaussian process; Poisson process, Markov Process.

TEXT/REFERENCE BOOKS

1. T. Veerrajan, "Probability, Statistics and Random Processes", Third Edition, McGraw Hill.
2. Probability and Random Processes by Geoffrey Grimmett, David Stirzaker
3. Probability, random processes, and estimation theory for engineers by Henry Stark, John William Woods.
4. H. Stark and J. Woods, ``Probability and Random Processes with Applications to Signal Processing," Third Edition, Pearson Education
5. A. Papoulis and S. Unnikrishnan Pillai, "Probability, Random Variables and Stochastic Processes," Fourth Edition, McGraw Hill.
6. K. L. Chung, Introduction to Probability Theory with Stochastic Processes, Springer International
7. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability, UBS Publishers.
8. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Stochastic Processes, UBS Publishers
9. S. Ross, Introduction to Stochastic Models, Harcourt Asia, Academic Press.

BTEXPE506C Data Structure & Algorithms Using Java Programming 03 Credits

Prerequisites: Basic knowledge of C language is required.

Course Objectives:

- To assess how the choice of data structures and algorithm design methods impacts the performance of programs.
- To choose the appropriate data structure and algorithm design method for a specified application.
- To study the systematic way of solving problems, various methods of organizing large amounts of data.

- To solve problems using data structures such as linear lists, stacks, queues, binary trees, binary search trees, and graphs and writing programs for these solutions.
- To employ the different data structures to find the solutions for specific problems

Course Outcomes:

On completion of the course, student will be able to:

1. To impart the basic concepts of data structures and algorithms.
2. To understand concepts about searching and sorting techniques
3. Describe how arrays, records, linked structures are represented in memory and use them in algorithms.
4. To understand basic concepts about stacks, queues, lists trees and graphs.
5. To enable them to write algorithms for solving problems with the help of fundamental data structures.

UNIT - 1

Introduction

Basic Terminologies: Elementary Data Organizations, Data Structure Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off. Searching: Linear Search and Binary Search Techniques and their complexity analysis

UNIT - 2

Stacks and Queues

ADT Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation – corresponding algorithms and complexity analysis. ADT queue, Types of Queue: Simple Queue, Circular Queue, Priority Queue; Operations on each type of Queues: Algorithms and their analysis.

UNIT - 3

Linked Lists

Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue, Header nodes, doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists: all operations their algorithms and the complexity analysis.

UNIT - 4

Trees

Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree; Tree operations on each of the trees and their algorithms with complexity analysis. Applications of Binary Trees, B Tree, B+ Tree: definitions, algorithms and analysis.

UNIT - 5

Sorting and Hashing

Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort; Performance and Comparison among all the methods, Hashing.

UNIT - 6

Graph

Basic Terminologies and Representations, Graph search and traversal algorithms and complexity analysis.

TEXT/REFERENCE BOOKS

1. Algorithms, Data Structures, and Problem Solving with C++", Illustrated Edition by Mark Allen Weiss, Addison-Wesley Publishing Company
2. "How to Solve it by Computer", 2nd Impression by R. G. Dromey, Pearson Education.
3. Ellis Horowitz, Sartaj Sahni, "Fundamentals of Data Structures", Galgotia Books Source. ISBN 10: 0716782928.
4. Richard F. Gilberg & Behrouz A. Forouzan, Data Structures: A Pseudocode Approach with C, Cengage Learning, second edition. ISBN-10: 0534390803.
5. Seymour Lipschutz, Data Structure with C, Schaum's Outlines, Tata Mc Graw Hill. ISBN-10: 1259029964.
6. E Balgurusamy - Programming in ANSI C, Tata McGraw-Hill, Third Edition. ISBN-10: 1259004619.
7. Yedidyah Langsam, Moshe J Augenstein, Aaron M Tenenbaum – Data structures using C and C++ - PHI Publications, Second Edition). ISBN 10: 8120311779

BTEXPE506D	Introduction to MEMS	3 Credits

Course Objectives:

- The objective of this course is to make students to gain basic knowledge on overview of MEMS (Micro electro Mechanical System) and various fabrication techniques.
- This enables them to design, analysis, fabrication and testing the MEMS based components and to introduce the students various opportunities in the emerging field of MEMS.
- This will enables student to study applications of micro-sensors and micro-actuators, various MEMS fabrication technologies, MEMS-specific design issues and constraints, Dynamics and modeling of microsystems, getting access to fabrication and testing in academia and industry.

Course Outcomes:

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

1. Appreciate the underlying working principles of MEMS and NEMS devices.
2. Design and model MEM devices.

UNIT - 1

Introduction to MEMS

Introduction, History, Concepts of MEMS: Principles, application and design, Scaling Properties/Issues, Micromachining Processes: Substrates, lithography, wet/dry etching processes, deposition processes, film stress, exotic processes. Mechanical Transducers: transduction methods, accelerometers, gyroscopes, pressure sensors, MEMS microphones, mechanical structures, actuators.

UNIT - 2

Control and Materials of MEMS

Controls of MEMS: Analog control of MEMS, Sliding mode control of MEMS, Digital control of MEMS, Materials for MEMS: Substrate and wafers, Active substrate material, silicon, Silicon compound, Silicon pezoresisters, Gallium arsenide, Quartz, piezoelectric crystals, Polymers.

UNIT - 3

Review of Basic MEMS fabrication modules:

MEMS fabrication modules, Oxidation, Deposition Techniques, Lithography (LIGA), and Etching

UNIT - 4

Micromachining

Micromachining, Surface Micromachining, sacrificial layer processes, Stiction; Bulk Micromachining, Isotropic Etching and Anisotropic Etching, Wafer Bonding

UNIT - 5

Mechanics of solids in MEMS/NEMS

Mechanics of solids in MEMS/NEMS: Stresses, Strain, Hookes's law, Poisson effect, Linear Thermal Expansion, Bending, Energy methods.

UNIT - 6

Overview of Finite Element Method, Modeling of Coupled Electromechanical Systems.

TEXT/REFERENCE BOOKS

1. G. K. Ananthasuresh, K. J. Vinoy, S. Gopalkrishnan K. N. Bhat, V. K. Aatre, Micro and Smart Systems, Wiley India, 2012.
2. S. E.Lyshevski, Nano-and Micro-Electromechanical systems: Fundamentals of Nano-and Microengineering (Vol. 8). CRC press, (2005).
3. S. D. Senturia, Microsystem Design, Kluwer Academic Publishers, 2001.
4. M. Madou, Fundamentals of Microfabrication, CRC Press, 1997.
5. G. Kovacs, Micromachined Transducers Sourcebook, McGraw-Hill, Boston, 1998.
6. M.H. Bao, Micromechanical Transducers: Pressure sensors, accelerometers, and Gyroscopes, Elsevier, New York, 2000.

BTETC601	Antennas and Wave Propagation	3 Credits

Course Objectives:

- To understand the applications of electromagnetic engineering.
- To formulate and solve the Helmholtz wave equation and solve it for Uniform Plane Wave.
- To analyze and understand the Uniform plane wave propagation in various media.
- To solve the electric field and magnetic fields for a given wire antenna.

Course Outcomes:

After successfully completing the course students will be able to

1. Formulate the wave equation and solve it for uniform plane wave.
2. Analyze the given wire antenna and its radiation characteristics.
3. Identify the suitable antenna for a given communication system.

UNIT - 1

Uniform Plane Waves

Maxwell Equations in phasor form, Wave Equation, Uniform Plane wave in Homogeneous, free space, dielectric, conducting medium. Polarization: Linear, circular & Elliptical polarization, unpolarized wave. Reflection of plane waves, Normal incidence, oblique incidence, Electromagnetic Power and Poynting theorem and vector.

UNIT - 2

Wave Propagation

Fundamental equations for free space propagation, Friis Transmission equation, Attenuation over reflecting surface, Effect of earth's curvature. Ground, sky & space wave propagations. Structure of atmosphere. Characteristics of ionized regions. Effects of earth's magnetic field. Virtual height, MUF, Skip distance. Ionospheric abnormalities. Multi-hop propagation. Space link geometry. Characteristics of Wireless Channel: Fading, Multipath delay spread, Coherence Bandwidth, and Coherence Time.

UNIT - 3

Antenna Fundamentals

Introduction, Types of Antenna, Radiation Mechanism, Antenna Terminology: Radiation pattern, radiation power density, radiation intensity, directivity, gain, antenna efficiency, half power beam width, bandwidth, antenna polarization, input impedance, antenna radiation efficiency, effective length, effective area, reciprocity. Radiation Integrals: Vector potentials A, J, F, M, Electric and magnetic fields electric and magnetic current sources, solution of inhomogeneous vector potential wave equation, far field radiation.

UNIT - 4

Wire Antennas

Analysis of Linear and Loop antennas: Infinitesimal dipole, small dipole, and finite length dipole half wave length dipole, small circular loop antenna. Complete Analytical treatment of all these elements.

UNIT - 5

Antenna Arrays

Antenna Arrays: Two element array, pattern multiplication N-element linear array, uniform amplitude and spacing, broad side and end-fire array, N-element array: Uniform spacing, nonuniform amplitude, array factor, binomial and Dolph Tchebyshev array. Planar Array, Circular Array, Log Periodic Antenna, Yagi Uda Antenna Array.

UNIT - 6

Antennas and Applications

Structural details, dimensions, radiation pattern, specifications, features and applications of following Antennas: Hertz & Marconi antennas, V- Antenna, Rhombic antenna. TW antennas. Loop antenna, Whip antenna, Biconical, Helical, Horn, Slot, Microstrip, Turnstile, Super turnstile & Lens antennas. Antennas with parabolic reflectors.

TEXT/REFERENCE BOOKS

1. C. A. Balanis, “Antenna Theory - Analysis and Design", John Wiley.
2. Mathew N O Sadiku, “Elements of Electromagnetics” 3rd edition, Oxford University Press.
3. John D Kraus, Ronald J Marhefka, Ahmad S Khan, Antennas for All Applications, 3rd Edition, the McGraw Hill Companies.
4. K. D. Prasad, “Antenna & Wave Propagation”, Satya Prakashan, New Delhi.
5. John D Kraus, “Antenna& Wave Propagation”, 4th Edition, McGraw Hill, 2010.
6. Vijay K Garg, Wireless Communications and Networking, Morgan Kaufmann Publishers, An Imprint of Elsevier, 2008.

BTETC602	Computer Network & Cloud Computing	3 Credits

Course Objectives:

- To develop an understanding of modern network architectures from a design and performance perspective.
- To introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs).
- To provide an opportunity to do network programming
- To provide a WLAN measurement ideas.

Course Outcomes:

1. To master the terminology and concepts of the OSI reference model and the TCP-IP reference model.
2. To master the concepts of protocols, network interfaces, and design/performance issues in local area networks and wide area networks.
3. To be familiar with wireless networking concepts.
4. To be familiar with contemporary issues in networking technologies.
5. To be familiar with network tools and network programming.
6. For a given requirement (small scale) of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) design it based on the market available component.
7. For a given problem related TCP/IP protocol developed the network programming.
8. Configure DNS DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls using open source available software and tools.

UNIT - 1

Physical Layer

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.

UNIT - 2

Data Link Layer

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.

UNIT - 3

Wireless LANS & Virtual Circuit Networks

Introduction, Wireless LANS: IEEE 802.11 project, Bluetooth, Zigbee, Connecting devices and Virtual LANS: Connecting devices, Virtual LANS.

UNIT - 4

Network Layer

Switching, Logical addressing – IPV4, IPV6; Address mapping – ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols.

UNIT - 5

Transport Layer

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.

UNIT - 6

Application Layer

Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls, Basic concepts of Cryptography

TEXT/REFERENCE BOOKS

1. Data Communication and Networking, 4th Edition, Behrouz A. Forouzan, McGraw-Hill.
2. TCP/IP Protocol Suite, 4th Edition, Behrouz A. Forouzan, Tata McGraw-Hill.
3. Data and Computer Communication, 8th Edition, William Stallings, Pearson Prentice Hall India.
4. Computer Networks, 8th Edition, Andrew S. Tanenbaum, Pearson New International Edition.

5. Internetworking with TCP/IP, Volume 1, 6th Edition Douglas Comer, Prentice Hall of India.
6. TCP/IP Illustrated, Volume 1, W. Richard Stevens, Addison-Wesley, United States of America.

BTETC603	Digital Image Processing	3 Credits

Course Objectives:

An ability to use current techniques, skills, and tools necessary for computing practice with an understanding of the limitations

Course Outcomes:

After completion of this course students will be able to

1. Review the fundamental concepts of digital image processing system.
2. Analyze images in the frequency domain using various transforms.
3. Categories various compression techniques.
4. Interpret image segmentation and representation techniques.

UNIT - 1

Concept of Visual Information

Introduction, Digital Image definitions, Common Values, Characteristics of Image Operations, Types of Operations, Types of neighborhoods, Video parameters, Tools, 2D convolution, Properties of 2D convolution, 2D Fourier Transforms, Properties of 2D Fourier Transforms, Importance of phase and magnitude, Circularly Symmetric Signals, Examples of 2D Signals and transforms, Statistical Description of Images

UNIT - 2

Image Perception

Statistical Description of Images, Perception, Brightness Sensitivity, Wavelength Sensitivity, Stimulus Sensitivity, Spatial Frequency Sensitivity, Psychophysics of Color vision, Perceived color, Color metrics, CIE chromaticity coordinates, Spatial effects in color vision, Optical illusions.

UNIT - 3

Image Sampling

Two dimensional Sampling theory, Extensions of sampling theory, Non rectangular Grid sampling, Hexagonal sampling, Optimal sampling, Image Quantization: The optimum Mean Square Lloyd-Max quantiser, Optimum mean square uniform quantiser for non-uniform densities, Analytic Models for practical quantiers, Visual quantization, Vector Quantization

UNIT - 4

Image Transforms

Two dimensional orthogonal and unitary transforms, Separable unitary transforms, Basis images, Dimensionality of Image Transforms, Discrete linear orthogonal, DFT, WHT, KLT, DCT and SVD, Quantisation of Transform coefficients, Transform Coding of Color images

UNIT - 5

Image Enhancement

Contrast and dynamic Range Modification, Histogram-based operations, Smoothing operations, Edge Detection-derivative based operation, Image Interpolation and Motion Estimation, Pseudo coloring

UNIT - 6

Image Restoration

Image Restoration, Degradation Estimation, Reduction of Additive Noise, Reduction of Image Blurring, Simultaneous reduction of noise and blurring, Reduction of Signal dependent noise, Temporal filtering.

TEXT/REFERENCE BOOKS

1. Rafael C. Gonzalez and Woods, "Digital Image Processing", Addison Wesley, 1998

2. A. K. Jain, "Digital Image Processing", PHI, New Delhi, 1997

3. Pratt W.K., "Digital Image Processing", 2nd Edition, John Wiley, New York, 2001

4. Edward R. Dougherty, "Random Processes for Image and Signal Processing", PHI-2001

BTETPE604A	CMOS Design	3 Credits

Course Objectives:

- To develop an understanding of design different CMOS circuits using various logic families along with their circuit layout.
- To introduce the student how to use tools for VLSI IC design.

Course Outcomes:

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

1. Design different CMOS circuits using various logic families along with their circuit layout.
2. Use tools for VLSI IC design.

UNIT - 1

Review of MOS transistor models, Non-ideal behavior of the MOS Transistor, Transistor as a switch. Inverter characteristics

UNIT - 2

Integrated Circuit Layout: Design Rules, Parasitics

UNIT - 3

Delay: RC Delay model, linear delay model, logical path efforts

UNIT - 4

Power, interconnect and Robustness in CMOS circuit layout

UNIT - 5

Combinational Circuit Design: CMOS logic families including static, dynamic and dual rail logic

UNIT - 6

Sequential Circuit Design: Static circuits. Design of latches and Flip-flops.

TEXT/REFERENCE BOOKS

1. N.H.E. Weste and D.M. Harris, CMOS VLSI design: A Circuits and Systems Perspective, 4th Edition, Pearson Education India, 2011.
2. C. Mead and L. Conway, Introduction to VLSI Systems, Addison Wesley, 1979.

3. J. Rabaey, Digital Integrated Circuits: A Design Perspective, Prentice Hall India, 1997.
4. P. Douglas, VHDL: programming by example, McGraw Hill, 2013.
5. L. Glaser and D. Dobberpuhl, The Design and Analysis of VLSI Circuits, Addison Wesley, 1985.

BTETPE604B	Information Theory and Coding	3 Credits

Course Objectives:

- To provide in-depth understanding of principles and applications of information theory.
- To provide in-depth understanding of how information is measured in terms of probability and entropy and how these are used to calculate the capacity of a communication channel.
- To provide in-depth understanding of different coding techniques for error detection and correction.

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Understand the concept of information and entropy
2. Understand Shannon's theorem for coding
3. Calculation of channel capacity
4. Apply coding techniques

UNIT - 1

Theory of Probability and Random Processes

Concept of probability, random variables, random process, power spectral density of a random process, probability models, statistical averages, central limit theorem, correlation, linear mean square estimation

UNIT - 2

Noise in Communication Systems

Behavior of analog and digital communication systems in the presence of noise, Sources of noise, Noise representation, Noise filtering, Noise bandwidth, Performance of analog and digital communication systems in the presence of noise.

UNIT - 3

Information Theory

Measure of information, Joint entropy and conditional entropy, Relative entropy and mutual information, Markov sources, Source encoding, Shannon-Fano coding and Huffman coding, Shannon's first and second fundamental theorems, Channel capacity theorem.

UNIT - 4

Error Correcting Codes

Galois fields, Vector spaces and matrices, Block codes, Cyclic codes, Burst-error detecting and correcting codes, Multiple error correcting codes, Convolutional codes, ARQ

UNIT - 5

Markov sources

Shannon's noisy coding theorem and converse for discrete channels; Calculation of channel capacity and bounds for discrete channels; Application to continuous channels

UNIT - 6

Speech Coding

Characteristics of speech signal, Quantization techniques, Frequency domain coding, Vocoders, Linear predictive coders, Codecs for mobile communication, GSM codec, USDC codec, Performance evaluation of speech coders.

TEXT/REFERENCE BOOKS

1. B. P. Lathi; Modern Digital and Analog Communication Systems; Oxford Publication.
2. Das, Mullick, Chaterjee; Principles of Digital Communication; New Age International.
3. Taub, Schilling, Principles of Communication Engineering (2nd Edition), TMH.
4. Thomas M. Cover, Joy A. Thomas, Elements of Information Theory, Wiley Inter science.
5. R.P.Singh, S.D. Sapre; Communication systems: Analog and Digital; TMH.
6. Theodore S. Rappaport; Wireless Communication: Principles and Practice (2nd Edition), Pearson India.
7. N. Abramson, Information and Coding, McGraw Hill, 1963.
8. M. Mansurpur, Introduction to Information Theory, McGraw Hill, 1987.

BTETPE604C	Power Electronics	3 Credits

Course Objectives:

- To introduce students to different power devices to study their construction, characteristics and turning on circuits.
- To give an exposure to students of working & analysis of controlled rectifiers for different loads, inverters, DC choppers, AC voltage controllers and resonant converters.
- To study the different motor drives, various power electronics applications like UPS, SMPS, etc. and some protection circuits.

Course Outcomes:

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

1. Build and test circuits using power devices such as SCR
2. Analyze and design controlled rectifier, DC to DC converters, DC to AC inverters,
3. Learn how to analyze these inverters and some basic applications.
4. Design SMPS.

UNIT - 1

Characteristics of Semiconductor Power Devices

Thyristor, power MOSFET and IGBT- Treatment should consist of structure, Characteristics, operation, ratings, protections and thermal considerations. Brief introduction to power devices viz. TRIAC, MOS controlled thyristor (MCT), Power Integrated Circuit (PIC) (Smart Power), Triggering/Driver, commutation and snubber circuits for thyristor, power MOSFETs and IGBTs (discrete and IC based).Concept of fast recovery and schottky diodes as freewheeling and feedback diode.

UNIT - 2

Controlled Rectifiers

Single phase: Study of semi and full bridge converters for R, RL, RLE and level loads. Analysis of load voltage and input current- Derivations of load form factor and ripple factor, Effect of source impedance, Input current Fourier series analysis of input current to derive input supply power factor, displacement factor and harmonic factor.

UNIT - 3

Choppers

Quadrant operations of Type A, Type B, Type C, Type D and type E choppers, Control techniques for choppers – TRC and CLC, Detailed analysis of Type A chopper. Step up chopper. Multiphase Chopper.

UNIT - 4

Single-phase inverters

Principle of operation of full bridge square wave, quasi-square wave, PWM inverters and comparison of their performance. Driver circuits for above inverters and mathematical analysis of output (Fourier series) voltage and harmonic control at output of inverter (Fourier analysis of output voltage). Filters at the output of inverters, Single phase current source inverter.

UNIT - 5

Switching Power Supplies

Analysis of fly back, forward converters for SMPS, Resonant converters - need, concept of soft switching, switching trajectory and SOAR, Load resonant converter - series loaded half bridge DC-DC converter.

UNIT - 6

Applications

Power line disturbances, EMI/EMC, power conditioners. Block diagram and configuration of UPS, salient features of UPS, selection of battery and charger ratings, sizing of UPS, Separately excited DC motor drive. P M Stepper motor Drive

TEXT/REFERENCE BOOKS

1. Muhammad H. Rashid, “Power electronics” Prentice Hall of India.
2. Ned Mohan, Robbins, “Power electronics”, edition III, John Wiley and sons.
3. P.C. Sen., “Modern Power Electronics”, edition II, Chand& Co.
4. V. R. Moorthi, “Power Electronics”, Oxford University Press.
5. Cyril W., Lander,” Power Electronics”, edition III, McGraw Hill.
6. G K Dubey, S R Doradla,: Thyristorised Power Controllers”, New Age International Publishers. SCR manual from GE, USA.

BTETPE604D	Nano Electronics	3 Credits

Course Objectives:

- To convey the basic concepts of Nano electronics to engineering students with no background in quantum mechanics and statistical mechanics.
- Main objective of this is to provide the basic platform and deep information of different Nano electronics devices like MOSFET, FINFET, Nano metrology tools used to design the recently developing VLSI applications.
- This subject gives idea about the role and importance of the Nano electronic devices system in engineering world to develop the research ideas in VLSI.
- Recent technology proceeds with MOSFET with 64nm technology, the need Nano electronic Devices and Material subject to achieve transistor size which is less than current technology.
- The content of this course gives platform to the Nano electronics world and innovative ideas to ensure the knowledge of real time applications which helps students to stand them in Indian and multinational industries.

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Understand various aspects of nano-technology and the processes involved in making nano components and material.
2. Leverage advantages of the nano-materials and appropriate use in solving practical problems.
3. Understand various aspects of nano-technology and the processes involved in making nano components and material.
4. Leverage advantages of the nano-materials and appropriate use in solving practical problems.

UNIT - 1

Overview Nano Technology

Introduction to nanotechnology, Nano devices, Nano materials, Nano characterization, Definition of Technology node, Basic CMOS Process flow, meso structures.

UNIT - 2

Basics of Quantum Mechanics

Schrodinger equation, Density of States, Particle in a box Concepts, Degeneracy, Band Theory of Solids, Kronig-Penny Model. Brillouin Zones

UNIT - 3

MOS Scaling theory

Shrink-down approaches: Introduction, CMOS Scaling, The nanoscale MOSFET, Finfets, Vertical MOSFETs, limits to scaling, system integration limits (interconnect issues etc.)

UNIT - 4

Nano electronics Semiconductor devices

Resonant Tunneling Diode, Coulomb dots, Quantum blockade, Single electron transistors, Carbon nanotube electronics, Band structure and transport, devices, applications, 2D semiconductors and electronic devices, Graphene, atomistic simulation

UNIT - 5

Properties of Nano devices

Vertical transistors, Fin FET and Surround gate FET. Metal source/drain junctions – Properties of schottky functions on Silicon, Germanium and compound semiconductors - Work function pinning.

UNIT - 6

Characterization techniques for Nano materials

FTIR, XRD, AFM, SEM, TEM, EDAX Applications and interpretation of results, Emerging nano material, nano tubes, Nano rods and other Nano structures, LB technique, Soft lithography Microwave assisted synthesis, Self-assembly.

TEXT/REFERENCE BOOKS

1. G.W. Hanson, Fundamentals of Nanoelectronics, Pearson, 2009.
2. W. Ranier, Nanoelectronics and Information Technology (Advanced Electronic Material and Novel Devices), Wiley-VCH, 2003.
3. K.E. Drexler, Nanosystems, Wiley, 1992.
4. J.H. Davies, The Physics of Low-Dimensional Semiconductors, Cambridge University Press, 1998.

5. C.P. Poole, F. J. Owens, Introduction to Nanotechnology, Wiley, 2003.

BTETPE604F	Android Programming	3 Credits

Course Objectives:

Android Application Development course is designed to quickly get you up to speed with writing apps for Android devices. The student will learn the basics of Android platform and get to understand the application lifecycle

Course Outcomes:

At the end of the course, students will demonstrate the ability to write simple GUI applications, use built-in widgets and components, work with the database to store data locally, and much more.

UNIT - 1

Introduction to Mobile Operating Systems and Mobile Application Development

Introduction to Mobile OS:

Palm OS, Windows CE, Embedded Linux, J2ME (Introduction), Symbian (Introduction), Overview of Android: Devices running android, Why Develop for Android, Features of android, Architecture of Android, Libraries

How to setup Android Development Environment: Android development Framework - Android-SDK, Eclipse, Emulators – What is an Emulator / Android AVD? , Creating & setting up custom Android emulator, Android Project Framework, My first android application.

UNIT - 2

Android Activities, UI Design and Database

Understanding Intent, Activity, Activity Lifecycle and Manifest, Form widgets, Text Fields, Layouts: Relative Layout ,Table Layout, Frame Layout, Linear Layout, Nested layouts.

UI design: Time and Date, Images and media, Composite, Alert Dialogs & Toast, Popup.

Menu: Option menu, Context menu, Sub menu.

Database: Introducing SQLite, SQLite Open Helper, SQLite Database, Cursor,

Content providers: defining and using content providers, example- Sharing database among two different applications using content providers, Reading and updating Contacts, Reading bookmarks.

UNIT - 3

Preferences, Intents and Notifications

Preferences: Shared Preferences, Preferences from xml, Intents:Explicit Intents, Implicit intents. Notifications: Broadcast Receivers, Services (Working in background) and notifications, Alarms.

UNIT - 4

Telephony, SMS and Location Based Services

Telephony: Accessing phone and Network Properties and Status, Monitoring Changes in Phone State, Phone Activity and data Connection.

SMS: Sending SMS and MMS from your Application, sending SMS Manually, Listening for incoming SMS

Location based Services: Using Location Based Services, Working with Google Maps, Geocoder.

UNIT - 5

Accessing Android Hardware

Networking: An overview of networking, checking the network status, communicating with a server socket, Working with HTTP, Web Services.

Bluetooth: Controlling local Bluetooth device, Discovering and bonding with Bluetooth devices, Managing Bluetooth connections, communicating with Bluetooth

UNIT - 6

Audio Video Handling

Playing Audio and Video, Recording Audio and Video, Using Camera and Taking Picture

TEXT/REFERENCE BOOKS

1. Reto Meier “Professional Android™ Application Development”, Wrox Publications.
2. Lauren Dercy and Shande Conder “Sams teach yourself Android application development” , Sams publishing
3. Hello Android, Introducing Google’s Mobile Development Platform, Ed Burnette, Pragmatic Programmers, ISBN: 978-1-93435-617-3

BTETOE605A	Digital System Design	3 Credits

Course Objectives:

- The concept and theory of digital Electronics are needed in almost all electronics and telecommunication engineering fields and in many other engineering and scientific disciplines as well.
- The main objective of this course is to lay the foundation for further studies in areas such as communication, VLSI, computer, microprocessor etc. One of the most important reasons for the unprecedented growth of digital electronics is the advent of integrated circuit.
- This course will explore the basic concepts of digital electronics.

Course outcomes:

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

1. Design and analyze combinational logic circuits
2. Design & analyze modular combinational circuits with MUX/DEMUX, Decoder, Encoder
3. Design & analyze synchronous sequential logic circuits
4. Use HDL & appropriate EDA tools for digital logic design and simulation.

UNIT - 1

Logic Simplification and Combinational Logic Design

Review of Boolean algebra and De Morgan's Theorem, SOP & POS forms, Canonical forms, Karnaugh maps up to 6 variables, Binary codes, Code Conversion.

UNIT - 2

MSI devices

Comparators, Multiplexers, Encoder, Decoder, Driver & Multiplexed Display, Half and Full Adders, Subtractors, Serial and Parallel Adders, BCD Adder, Barrel shifter and ALU

UNIT - 3

Sequential Logic Design

Building blocks like S-R, JK and Master-Slave JK FF, Edge triggered FF, Ripple and Synchronous counters, Shift registers, Finite state machines, Design of synchronous FSM, Algorithmic State Machines charts. Designing synchronous circuits like Pulse train generator, Pseudo Random Binary Sequence generator, Clock generation

UNIT - 4

Logic Families and Semiconductor Memories

TTL NAND gate, Specifications, Noise margin, Propagation delay, fan-in, fan-out, Tristate TTL, ECL, CMOS families and their interfacing.

UNIT - 5

Memory Elements

Concept of Programmable logic devices like FPGA, Logic implementation using Programmable Devices

UNIT - 6

VLSI Design flow

Design entry: Schematic, FSM & HDL, different modeling styles in VHDL, Data types and objects, Dataflow, Behavioral and Structural Modeling, Synthesis and Simulation VHDL constructs and codes for combinational and sequential circuits.

TEXT/REFERENCE BOOKS

1. R.P. Jain, "Modern digital Electronics", Tata McGraw Hill, 4th edition, 2009.
2. Douglas Perry, "VHDL", Tata McGraw Hill, 4th edition, 2002.
3. W.H. Gothmann, "Digital Electronics- An introduction to theory and practice", PHI, 2nd edition, 2006.
4. D.V. Hall, " Digital Circuits and Systems" , Tata McGraw Hill, 1989
5. Charles Roth, "Digital System Design using VHDL", Tata McGraw Hill 2nd edition 2012.

BTETOE605B	Optimization Techniques	3 Credits

Course Objectives:

- Introduction to optimization techniques using both linear and non-linear programming
- The focus of the course is on convex optimization though some techniques will be covered for non-convex function optimization.

Course Outcomes:

1. After completion of this course students will be able to

2. Cast engineering minima/maxima problems into optimization framework
3. Learn efficient computational procedures to solve optimization problems

UNIT - 1

Introduction and Basic Concepts

Historical Development; Engineering applications of Optimization; Art of Modeling, Objective function; Constraints and Constraint surface; Formulation of design problems as mathematical programming problems, Classification of optimization problems, Optimization techniques – classical and advanced techniques

UNIT - 2

Optimization using Calculus

Stationary points; Functions of single and two variables; Global Optimum, Convexity and concavity of functions of one and two variables, Optimization of function of one variable and multiple variables; Gradient vectors; Examples, Optimization of function of multiple variables subject to equality constraints; Lagrangian function, Optimization of function of multiple variables subject to equality constraints; Hessian matrix formulation; Eigen values, Kuhn-Tucker Conditions; Examples

UNIT - 3

Linear Programming

Standard form of linear programming (LP) problem; Canonical form of LP problem; Assumptions in LP Models; Elementary operations, Graphical method for two variable optimization problem; Examples, Motivation of simplex method, Simplex algorithm and construction of simplex tableau; Simplex criterion; Minimization versus maximization problems, Revised simplex method; Duality in LP; Primal-dual relations; Dual Simplex method; Sensitivity or post optimality analysis, Other algorithms for solving LP problems – Karmarkar’s projective scaling method

UNIT - 4

Dynamic Programming

Sequential optimization; Representation of multistage decision process; Types of multistage decision problems; Concept of sub optimization and the principle of optimality, Recursive equations – Forward and backward recursions; Computational procedure in dynamic programming (DP), Discrete versus continuous dynamic programming; Multiple state variables; curse of dimensionality in DP

UNIT - 5

Integer Programming

Integer linear programming; Concept of cutting plane method, Mixed integer programming; Solution algorithms; Examples

UNIT - 6

Advanced Topics in Optimization

Piecewise linear approximation of a nonlinear function, Multi objective optimization – Weighted and constrained methods; Multi level optimization, Direct and indirect search methods, Evolutionary algorithms for optimization and search

TEXT/REFERENCE BOOKS

1. S.S. Rao, "Engineering Optimization: Theory and Practice", New Age International, New Delhi, 2000.
2. G. Hadley, "Linear programming", Narosa Publishing House, New Delhi, 1990.
3. H.A. Taha, "Operations Research: An Introduction", 5th Edition, Macmillan, New York, 1992.
4. K. Deb, "Optimization for Engineering Design-Algorithms and Examples", Prentice-Hall of India Pvt. Ltd., New Delhi, 1995.
5. K. Srinivasa Raju and D. Nagesh Kumar, "Multicriterion Analysis in Engineering and Management", PHI Learning Pvt. Ltd., New Delhi, India, ISBN 978-81-203-3976-7, pp.288, 2010.

BTETOE605C	Project Management and Operation Research	3 credits

Course Objectives:

- To help students understand Evolution of Management Thought, Concepts, basic functions and recent trends managerial concepts and practices for better business decisions.
- To introduce students to framework that are useful for diagnosing problems involving human behavior.
- To enable the students apply mathematical, computational and communication skills needed for the practical utility of Operations Research.

- To teach students about networking, inventory, queuing, decision and replacement models.
- To introduce students to research methods and current trends in Operations Research.

Course Outcomes:

Student will be able to

1. Apply operations research techniques like L.P.P, scheduling and sequencing in industrial optimization problems.

2. Solve transportation problems using various OR methods.

3. Illustrate the use of OR tools in a wide range of applications in industries.

4. Analyze various OR models like Inventory, Queing, Replacement, Simulation, Decision etc and apply them for optimization.

5. Gain knowledge on current topics and advanced techniques of Operations Research for industrial solutions.

UNIT - 1

Definition, need and importance of organizational behaviour , nature and scope , frame work , organizational behaviour models.

UNIT - 2

Organization structure , formation , groups in organizations , influence , group dynamics , emergence of informal leaders and working norms , group decision making techniques , interpersonal relations , communication , control.

UNIT - 3

Evolution of Management thoughts, Contribution of Selected Management Thinkers, Various approaches to management, contemporary management practice, Managing in global environment, Managerial functions.

UNIT - 4

Importance of planning , Types of planning , decision making process , Approaches to decision making , Decision models , Pay off Matrices , Decision trees , Break Even Analysis.

UNIT - 5

Departmentation, Span of Control, Delegation, Centralisation and Decentralisation, Commitees, Line and Staff relationships , Recent trends in organization structures.

UNIT - 6

Process of Recruitment, Selection, Induction Training, Motivation, Leading, Leadership styles and qualities, Communication, process and barriers. Managements control systems, techniques, Types of control.

TEXT/REFERENCE BOOKS

1. Bateman Snell, Management: Competing in the new era, McGraw,Hill Irwin, 2002.

2. Chandan J.S., Management Concepts and Strategies, Vikas Publishing House, 2002.

3. Hellriegel, Jackson and Slocum, Management: A Competency,Based Approach, South Western, 9th edition, 2002.

4. Koontz, Essentials of Management, Tata McGraw,Hill, 5th Edition, 2001.

5. Stephen P. Robbins and David A. Decenzo, Fundamentals of Management, Pearson Education, Third Edition, 2001.

6. Tim Hannagan, Management Concepts and Practices, Macmillan India Ltd., 1997.

BTETOE605D	Augmented, Virtual and Mixed Reality	3 Credits

Course Objectives:

An ability to use current techniques, skills, and tools necessary for computing practice with an understanding of the limitations

Course Outcomes:

After completion of this course students will be able to

1. To develop 3D virtual environments.
2. To develop 3D interaction techniques and immersive virtual reality applications.

UNIT - 1

Introduction & Geometry of Virtual Worlds

Course mechanics, Goals and VR definitions, Historical perspective, Birds-eye view

Geometric modeling, Transforming models, Matrix algebra and 2D rotations, 3D rotations and yaw, pitch, and roll, 3D rotations and yaw, pitch, and roll, Axis-angle representations, Quaternions, Converting and multiplying rotations, Homogeneous transforms, The chain of viewing transforms, Eye transforms, Canonical view transform, Viewport transform

UNIT - 2

Light and Optics

Three interpretations of light, Refraction, Simple lenses, Diopters, Imaging properties of lenses, Lens aberrations, Optical system of eyes

UNIT - 3

Visual Physiology & Visual Perception

Photoreceptors, Sufficient resolution for VR, light intensity, Eye movements, Eye movements, Eye movement issues for VR, Neuroscience of vision, Depth perception, Depth perception, Motion perception, Frame rates and displays, Frame rates and displays

UNIT - 4

Tracking Systems & Visual Rendering

Overview, Orientation tracking, Tilt drift correction, Yaw drift correction, Tracking with a camera, Perspective n-point problem, Filtering, Lighthouse approach,Visual Rendering-overview, Shading models, Rasterization, Pixel shading, VR-specific problems, Distortion shading, Post-rendering image warp

UNIT - 5

Audio & Interfaces

Physics and physiology, auditory perception, Auditory localization, Rendering , Spatialization and display, combining other senses, Interfaces, Locomotion, Manipulation, System control, Social interaction, Evaluation of VR Systems.

UNIT - 6

Augmented Reality

System Structure of Augmented Reality; Key Technology in AR; General solution for calculating geometric & illumination consistency in the augmented environment

TEXT/REFERENCE BOOKS

1. http://msl.cs.uiuc.edu/vr/

2. George Mather, Foundations of Sensation and Perception:Psychology Press; 2 edition, 2009.

3. Peter Shirley, MichaelAshikhmin, and Steve Marschner, Fundamentals of Computer Graphics, A K Peters/CRC Press; 3 edition, 2009.

BTETOE605E	Python Programming	3 Credits

Course Objective:

- Provide an understanding of the role computation can play in solving problems.
- Help students, including those who do not plan to major in Computer Science and Electrical Engineering, feel confident of their ability to write small programs that allow them to accomplish useful goals.
- Position students so that they can compete for research projects and excel in subjects with programming components.

Course Outcomes:

1. Experience with an interpreted Language.
2. To build software for real needs
3. Prior Introduction to testing software

UNIT - 1

Introduction: 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

UNIT - 2

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

UNIT - 3

Data Structures Lists – Operations, Slicing, Methods; Tuples, Sets, Dictionaries, Sequences, Comprehensions

UNIT - 4

Default Arguments, 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

UNIT - 5

Object-Oriented Programming OOP in Python: 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

UNIT - 6

Brief Tour of the Standard Library – 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/REFERENCE BOOKS

1. Python Programming: A Modern Approach, Vamsi Kurama, Pearson
2. Learning Python, Mark Lutz, Orielly
3. Think Python, Allen Downey, Green Tea Press
4. Core Python Programming, W.Chun, Pearson
5. Introduction to Python, Kenneth A. Lambert, Cengage

BTETOE605F	Web Development and Design	3 Credits

Course Objectives:

- Define the principle of Web page design
- Define the basics in web design
- Visualize the basic concept of HTML.
- Recognize the elements of HTML.
- Introduce basics concept of CSS.

- Develop the concept of web publishing

Course Outcomes:

On completion of the course, student will be able to:

1. Develop the skill & knowledge of Web page design
2. Understand the knowhow and can function either as an entrepreneur or can take up jobs in the multimedia and Web site development studio and other information technology sectors.

UNIT - 1

Web Design Principles , Basic principles involved in developing a web site , Planning process , Five Golden rules of web designing , Designing navigation bar , Page design, Layout of pages , Design Concept

UNIT - 2

Basics in Web Design , Brief History of Internet , What is World Wide Web , Why create a web site , Web Standards , Audience requirement

UNIT - 3

Introduction to HTML, HTML Documents, Basic structure of an HTML document, Creating an HTML document, Mark up Tags, Heading, Paragraphs, Line Breaks, HTML Tags

UNIT - 4

Elements of HTML, Working with Text, Lists, Tables and Frames, Hyperlinks, Images and Multimedia Working with Forms and controls

UNIT - 5

Introduction to Cascading Style Sheets, CSS Properties, CSS Styling (Background, Text Format, Controlling Fonts), Working with block elements and objects, Working with Lists and Tables, CSS Id and Class, Box Model (Introduction, Border properties, Padding Properties, Margin properties) , CSS Advanced (Grouping, Dimension, Display, Positioning, Floating, Align, Pseudo class, Navigation Bar, Image Sprites, Attribute sector) , CSS Color , Creating page Layout and Site Designs

UNIT - 6

Introduction to Web Publishing or Hosting , Creating the Web Site ,Saving the site, Working on the web site, Creating web site structure, Creating Titles for web pages, Themes, Publishing web sites

TEXT/REFERENCE BOOKS

1. J. N. Robbins, Learning Web Design, O'Reilly Media, 4th Edition, 2012
2. Steven M. Schafer, HTML, XHTML, and CSS Bible, Wiley India, 5th Edition, 2010
3. John Duckett, Beginning HTML, XHTML, CSS, and JavaScript, Wiley India, 3rd Edition, 2009
4. Hal Stern, David Damstra, Brad Williams, Professional WordPress: Design and Development, Wrox Publication, 3rd Edition, 2015
5. E. Robson, E. Freeman, Head First HTML & CSS, O'Reilly Media, nd Edition, 2012.

BTHM606	Employability & Skill Development	2 Credits

Course Objectives:

- To develop analytical abilities.
- To develop communication skills.
- To introduce the students to skills necessary for getting, keeping and being successful in a profession.
- To expose the students to leadership and team-building skills.

Course Outcomes:

On completion of the course, student will be able to:

1. Have skills and preparedness for aptitude tests.
2. Be equipped with essential communication skills (writing, verbal and non-verbal)
3. Master the presentation skill and be ready for facing interviews.
4. Build team and lead it for problem solving.

UNIT - 1

Soft Skills & Communication basics

Soft skills Vs hard skills, Skills to master, Interdisciplinary relevance, Global and national perspectives on soft skills, Resume, Curriculum vitae, How to develop an impressive resume, Different formats of resume – Chronological, Functional, Hybrid, Job application or cover letter, Professional presentation- planning, preparing and delivering presentation, Technical writing.

UNIT - 2

Arithmetic and Mathematical Reasoning

Aspects of intelligence, Bloom taxonomy, multiple intelligence theory, Number sequence test, mental arithmetic (square and square root, LCM and HCF, speed calculation, reminder theorem).

UNIT - 3

Analytical Reasoning and Quantitative Ability

Matching, Selection, Arrangement, Verifications (Exercises on each of these types). Verbal aptitude (Synonym, Antonym, Analogy)

UNIT - 4

Grammar and Comprehension

English sentences and phrases, Analysis of complex sentences, Transformation of sentences, Paragraph writing, Story writing, Reproduction of a story, Letter writing, précis writing, Paraphrasing and e-mail writing

UNIT - 5

Skills for interviews

Interviews- types of interviews, preparatory steps for job interviews, interview skill tips, Group discussion- importance of group discussion, types of group discussion, difference between group discussion, panel discussion and debate, personality traits evaluated in group discussions, tips for successful participation in group discussion, Listening skills- virtues of listening, fundamentals of good listening, Non-verbal communication-body movement, physical appearance, verbal sounds, closeness, time

UNIT - 6

Problem Solving Techniques

Problem solving model: 1. Define the problem, 2. Gather information, 3. Identify various solution, 4. Evaluate alternatives, 5. Take actions, 6. Evaluate the actions.

Problem solving skills: 1. Communicate. 2. Brain storming, 3. Learn from mistakes.

TEXT/REFERENCE BOOKS

1. R. Gajendra Singh Chauhan, Sangeeta Sharma, “Soft Skills- An integrated approach to maximize personality”, ISBN: 987-81-265-5639-7, First Edition 2016, WileyWren and Martin, "English grammar and Composition", S. Chand publications.

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

Second Year

B. Tech program in Computer Engineering/ Computer Science/ Computer Science & Engineering

With effective from

Academic year July 2018-19

Approved in the 11th meeting of Academic Council 8th June 2018

Teaching and Evaluation Scheme Second Year B. Tech. (Computer Engineering)

Sr. No.	Code	Course title	Weekly Teaching hours			Evaluation Scheme			Credit
			L	T	P	MSE	CA	ESE	
		Semester III							
1	BTBSC301	Engineering Mathematics -III	3	1	-	20	20	60	4
2	BTCOC302	Discrete Mathematics	2	1	-	20	20	60	3
3	BTCOC303	Data Structures	2	1	-	20	20	60	3
4	BTCOC304	Computer Architecture & Organization	2	1	-	20	20	60	3
5	BTCOC305	Digital Electronics & Microprocessors	2	1	-	20	20	60	3
6	BTHMC306	Basic Human Rights	2	-	-	-	50	-	Audit
7	BTCOL307	Python Programming	1	-	2	-	60	40	2
8	BTCOL308	HTML and Javascript	1		2		60	40	2
8	BTCOL309	Data Structures Lab	-	-	2	-	60	40	1
9	BTCOL310	Digital Electronics & Microprocessor Lab	-	-	2	-	60	40	1
10	BTCOF311	Field Training / Internship/Industrial Training Evaluations	-	-	-	-	-	100	1
		Total	**15**	**5**	**8**	**100**	**390**	**560**	**23**
		Semester IV							
1	BTCOC401	Design & Analysis of Algorithms	2	1	-	20	20	60	3
2	BTCOC402	Probability & Statistics	2	1	-	20	20	60	3
3	BTCOC403	Operating System	2	1	-	20	20	60	3
4	BTCOE404	**Elective-I** A) Object Oriented Programming in C++ B) Object Oriented Programming in Java	2	1	-	20	20	60	3
5	BTCOE405	**Elective-II** A) Numerical Methods B) Physics of Engineering Materials C) Soft Skills and Personality Development	2	1	-	20	20	60	3
6	BTXXC406	Product Design Engineering	2	-	-	20	20	60	2
7	BTCOL407	Design & Analysis of Algorithms Lab	-	-	2	-	60	40	1
8	BTCOL408	Introduction to Data Science with R	1	-	2	-	60	40	2
9	BTCOL409	Object Oriented Programming Lab	-	-	2	-	60	40	1
10	BTCOL410	Operating System Lab	-	-	2		60	40	1
11	BTCOF411	Field Training / Internship/Industrial Training (minimum 4 weeks which can be completed partially in first semester and second Semester or in at one time.)						100	Credits to be evaluated at in V Sem.
		Total	**13**	**5**	**8**	**120**	**360**	**620**	**22**

(BTBSC301) Engineering Mathematics III

Unit 1: Laplace Transform

Definition – conditions for existence ; Transforms of elementary functions; Properties of Laplace transforms - Linearity property, first shifting property, second shifting property, transforms of functions multiplied by t^n, scale change property, transforms of functions divided by t, transforms of integral of functions, transforms of derivatives ; Evaluation of integrals by using Laplace transform Transforms of some special functions- periodic function, Heaviside-unit step function, Dirac delta function. **[07 Hours]**

Unit 2: Inverse Laplace Transform

Introductory remarks ; Inverse transforms of some elementary functions ; General methods of finding inverse transforms ; Partial fraction method and Convolution Theorem for finding inverse Laplace transforms ; Applications to find the solutions of linear differential equations and simultaneous linear differential equations with constant coefficients. **[07 Hours]**

Unit 3: Fourier Transform

Definitions – integral transforms ; Fourier integral theorem (without proof) ; Fourier sine and cosine integrals ; Complex form of Fourier integrals ; Fourier sine and cosine transforms ; Properties of Fourier transforms ; Parseval's identity for Fourier Transforms. **[07 Hours]**

Unit 4: Partial Differential Equations and Their Applications

Formation of Partial differential equations by eliminating arbitrary constants and functions; Equations solvable by direct integration; Linear equations of first order (Lagrange's linear equations); Method of separation of variables – applications to find solutions of one dimensional heat flow equation $\left(\frac{\partial u}{\partial t}=c^2\frac{\partial^2 u}{\partial x^2}\right)$, and two dimensional heat flow equation (i.e. Laplace equation : $\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial y^2}=0$). **[07 Hours]**

Unit 5: Functions of Complex Variables (Differential calculus)

Limit and continuity of f(z); Derivative of f(z) ; Analytic functions; Cauchy- Riemann equations in Cartesian and polar forms; Harmonic functions in Cartesian form; Mapping: Translation, magnification and rotation, inversion and reflection , bilinear transformation; Conformal mapping. **[07 Hours]**

Unit 6: Functions of Complex Variables (Integral calculus)

Cauchy's integral theorem; Cauchy's integral formula; Residues; Cauchy's residue theorem (All theorems 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 III) by Dr. B. B. Singh, Synergy Knowledge ware, Mumbai.
4. A Text Book of Applied Mathematics (Vol I & II) by P. N. Wartikar and J. N. Wartikar, Pune Vidyarthi Griha Prakashan, Pune.
5. Higher Engineering Mathematics by H. K. Das and Er. Rajnish Verma, S. Chand & CO. Pvt. Ltd., New Delhi.

Reference Books

1. Higher Engineering Mathematics by B. V. Ramana, Tata McGraw-Hill Publications, New Delhi.
2. A Text Book of Engineering Mathematics by Peter O' Neil, Thomson Asia Pte Ltd., Singapore.
3. Advanced Engineering Mathematics by C. R. Wylie & L. C. Barrett, Tata Mcgraw-Hill Publishing Company Ltd., New Delhi.
4. Integral Transforms and Their Engineering Applications by Dr. B. B. Singh, Synergy . Knowledge ware, Mumbai.
5. Integral Transforms by I. N. Sneddon, Tata McGraw-Hill, New York.

BTCOC302 Discrete Mathematics

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.

BTCOC303 Data Structures

Unit 1 **6 hrs**

Introduction: Data, Data types, Data structure, Abstract Data Type (ADT), representation of Information, characteristics of algorithm, program, analyzing programs.

Unit 2 **6 hrs**

Arrays and Hash Tables: Concept of sequential organization, linear and non-linear data structure, storage representation, array processing sparse matrices, transpose of sparse matrices. Hash Tables, Direct address tables, Hash tables, Hash functions, Open addressing, Perfect hashing.

Unit 3 **6 hrs**

Searching and Sorting: Sequential, binary searching, skip lists – dictionaries, linear list representation, skip list representation, operations – insertion, deletion and searching. Insertion sort, selection sort, radix sort, File handling.

Unit 4 **6 hrs**

Linked Lists: Concept of linked organization, singly and doubly linked list and dynamic storage management, circular linked list, operations such as insertion, deletion, concatenation, traversal of linked list, dynamic memory management, garbage collection.

Unit 5 **6 hrs**

Stacks and Queues: Introduction, stack and queue as ADT, representation and implementation of stack and queue using sequential and linked allocation, Circular queue and its implementation, Application of stack for expression evaluation and expression conversion, recursion, priority queue.

Unit 6 **6 hrs**

Trees and Graphs: Basic terminology, binary trees and its representation, insertion and deletion of nodes in binary tree, binary search tree and its traversal, threaded binary tree, Heap, Balanced Trees. Terminology and representation of graphs using adjacency matrix, Warshall's algorithm.

Reference Books:

1. E. Horowitz, S. Sahani, *Fundamentals of Data Structures*, Galgotia Publication, 1st Edition, 1983.
2. Thomas Cormen, *Introduction to Algorithms*, PHI Publication, 2nd Edition, 2002.
3. Venkatesan & Rose, *Data Structures*, Wiley Publication, 1st Edition, 2015.
4. Goodrich & Tamassia, *Data Structure & Algorithm in C++*, Wiley Publication, 2nd Edition, 2011.
5. R. G. Dromey, *"How to Solve it by Computer"*, 2nd Impression, Pearson Education.
6. Kyle Loudon, *Mastering Algorithms with C: Useful Techniques from Sorting to Encryption*, O'Reilly Media, 1st Edition, 1999.

Text Books:

1. Mark Allen Weiss, *Data structures and algorithms analysis in C++*, Pearson Education, 4th Edition, 2013.
2. S. Lipschutz, *Data Structures*, McGraw-Hill Publication, Revised 1st Edition, 2014.
3. Y. Langsm, M. Augenstin, A. Tanenbaum, *Data Structure using C and C++*, Prentice Hall India Learning Private Limited, 2nd Edition, 1998.
4. Trembley and Sorenson, *Introduction to Data Structures*, PHI Publication, 2nd Revised Edition, 1983.
5. Vishal Goyal, Lalit Goyal, *A Simplified Approach To Data Structure*, SPD Publication, 1st Edition, 2014.

BTCOC304 Computer Architecture and Organization

Unit 1 **6 hrs**

Introduction: Concept of computer organization and architecture, Fundamental unit, Computer function and interconnection, CPU structure and function.

Unit 2 **6 hrs**

Instruction Sets: Characteristics, Types of operands, Types of operations, Assembly language, Addressing modes, Instruction format, Types of instruction, Instruction execution, Machine state and processor status, Structure of program, Introduction to RISC and CISC architecture.

Unit 3 **6 hrs**

Computer Arithmetic: The arithmetic and logic Unit, Integer representation, Integer arithmetic, Floating point representation, Floating point arithmetic, Introduction of arithmetic co-processor.

Unit 4 **6 hrs**

Memory Organization: Internal Memory: Semiconductor main memory, Error correction, Advanced DRAM organization, Virtual memory systems and cache memory systems. External Memory: Organization and characteristics of magnetic disk, Magnetic tape, Optical memory, RAID, Memory controllers.

Unit 5 **6 hrs**

Control Unit: Control unit operation: Micro-operations, Control of the processor, Hardwired implementation, Micro-programmed Control Unit, Basic concepts, Micro-instruction sequencing, Micro-instruction execution, Applications of micro-programming.

Unit 6 **6 hrs**

Input/ Output Organization: External devices, I/O module, Programmed I/O, Interrupt driven I/O, Direct memory access, I/O channels and processors, External interface.
Instruction pipe-lining: Concepts. Parallel processing: Multiple processor organization, Symmetric multiprocessor, Cache coherence and the MESI protocol.

Reference Books:

- Hennessy and Patterson, *Computer Architecture: A Quantitative Approach*, Morgan and Kaufman Publication, 4th Edition, 2007.
- Morris Mano, *Computer System Architecture*, Pearson Education India, 3rd Edition, 2007.
- Mostafa Abd-El-Barr, Hesham El-Rewini, *Fundamentals of Computer Organization and Architecture*, Wiley Publication, 1st Edition, 2004.
- Miles J. Murdocca, Vincent P. Heuring, *Computer Architecture and Organization: An Integrated Approach*, Wiley Publication, 1st Edition, 2007.
- Sajjan G. Shiva, *Computer Organization, Design, and Architecture*, CRC Press, 5th Edition, 2013.

Text Books:

- William Stalling, *Computer Organization and Architecture: Designing for Performance*, Prentice Hall Publication, 8th Edition, 2009.
- Hayes, *Computer Architecture and Organization*, McGraw-Hill Publication, 3rd Edition, 2012.
- Zaky, *Computer Organization*, McGraw-Hill Publication, 5th Edition, 2011.

BTCOC305 Digital Electronics & Microprocessor

Unit 1 **6 hrs**

Digital signals, digital circuits, AND, OR, NOT, NAND, NOR and Exclusive-OR operations, Boolean algebra, examples ofICgates, **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 **6 hrs**

Combinational Digital Circuits:
Standard representation for logic functions, K-map representation, 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 3 **6 hrs**

Sequential circuits and systems:
A 1-bit memory, the circuit properties of Bistable 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 4 **6 hrs**

Fundamentals of Microprocessors:
Fundamentals of Microprocessor, Comparison of 8-bit, (8085) 16-bit (8086), and 32-bit microprocessors (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 **6 hrs**

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

Unit 6 **6 hrs**

8086 Instruction Set and Programming:
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 Publication, Revised 2nd Edition, 2006.

BTHMC306-Basic Human Rights

Unit 1 **6 hrs**

The Basic Concepts:
Individual, Group, Civil Society, State, Equality, Justice, Human Values: - Humanity, Virtues, Compassion.

Unit 2 **6 hrs**

Human Rights and Human Duties:
Origin, Civil and Political Rights, Contribution of American Bill of Rights, French Revolution, Declaration of Independence, Rights of Citizen, Rights of working and Exploited people, Fundamental Rights and Economic program, India's Charter of freedom.

Unit 3 **6 hrs**

Society, Religion, Culture, and their Inter-Relationship:
Impact of Social Structure on Human behaviour, Roll of Socialization in Human Values, Science and Technology, Modernization, Globalization, and Dehumanization.

Unit 4 **6 hrs**

Social Structure and Social Problems:
Social and Communal Conflicts and Social Harmony, Rural Poverty, Unemployment, Bonded Labour, Migrant workers and Human Rights Violations, Human Rights of mentally and physically challenged.

Unit 5 **6 hrs**

State, Individual Liberty, Freedom and Democracy:
The changing of state with special reference to developing countries, Concept of development under development and Social action, need for Collective action in developing societies and methods of Social action, NGOs and Human Rights in India: - Land, Water, Forest issues.

Unit 6 **6 hrs**

Human Rights in Indian Constitution and Law:
The constitution of India:
(i) Preamble
(ii) Fundamental Rights
(iii) Directive principles of state policy
(iv) Fundamental Duties
(v) Some other provisions
Universal declaration of Human Rights and Provisions of India, Constitution and Law, National Human Rights Commission and State Human Rights Commission.

Text / Reference Books:

- Shastry, T. S. N., India and Human rights: Reflections, Concept Publishing Company India (P Ltd.), 2005.
- Nirmal, C.J., Human Rights in India: Historical, Social and Political Perspectives (Law in India), Oxford India.

BTCOL307 Python Programming

One hour per week is for program demonstration and instruction which can be conducted as a classroom session or lab session.

Module 1: **2 Hrs.**
Informal introduction to programming, algorithms and data structures, Downloading and installing Python, run a simple program on Python interpreter.

Module 2: **2 Hrs.**
Variables, operations, control flow – assignments, conditionals, loops, functions: optional arguments, default values, Passing functions as arguments.

Module 3: **2 Hrs.**
Statements, Expressions, Strings: String processing. Exception handling, Basic input/output, Handling files.

Module 4: **2 Hrs.**
Class and Object, Data Structure: List, Tuple and Sequences, Set, Dictionaries.

Module 5: **4 Hrs.**
Using Database and Structured Query Languages (SQL): SQLite manager, Spidering Twitter using a Database, Programming with multiple tables, JOIN to retrieve data.

***Programming assignments are mandatory.**

Reference Books:

1. Mark Lutz, *Learning Python*, O'Reilly Media, 5th Edition, 2013.
2. Mark Pilgrim, *Dive into Python 3*, Apress Publication, 2nd Edition, 2009.
3. Allen B. Downey, *Think Python*, O'Reilly Media, 2nd Edition, 2012.
4. Jon Kleinberg and Eva Tardos, *Algorithm Design*, Pearson Education, 1st Edition, 2006.

Text Books:

1. Michael Urban and Joel Murach, *Murach's Python Programming*, Murach's Publication, 2016.
2. Charles Severance, *Python for Informatics: Exploring Information*, University of Michigan, Version 2.7.0, 2014.
3. Dr. R. Nageswara Rao, *Core Python Programming*, Dreamtech Press, 1st Edition, 2016.

BTCOL308 HTML and JavaScript

Unit 1 **2 hrs**

Web Site development Essentials: Overview of Web Design Concepts, Web Development Teams, Web Project Management Fundamentals, Web Site Development Process, Web Page Layout and Elements, Web Site Usability and Accessibility, Configure Browsers Setting, Navigation Concepts, Web Graphics, Multimedia and the Web.

Unit 2 **2 hrs**

Hyper Text Markup Language (HTML): HTML and the Evolution of Markup languages, Create Hyperlinks, Create Tables, Create Web Forms, Image Inserting Techniques, Create Frames, GUI HTML Editors, Site Content and Metadata.

Unit 3 **2 hrs**

Introduction to Client-Server Model: Features of Dreamweaver Interface, Setting Up a Site with Dreamweaver, FTP -Site Upload Feature of Dreamweaver, Create various types of Links, Insert multimedia including text, image, animation & video, Finding a Home for your WordPress Site, Installing WordPress on Your Site, Content Management using WordPress, Selecting the Right Tools, Image Formats, Fonts and Colors, Designing Your WordPress Site, The WordPress Default Layout, Creating a Custom Site.

Unit 4 **2 hrs**

Cascading Style Sheets: Cascading Style Sheets for Web page design, Creating CSS rules in Dreamweaver, Format Text with CSS, Use of CSS Selectors, Embed Style Sheets, and Attach External Style Sheets.

Using CSS with Tables: Insert and Styling Tables, Import Table Data, Style Tables with CSS, Sort Data in Table.

Unit 5 **4 hrs**

JavaScript first steps; JavaScript first steps overview; What is JavaScript?; A first splash into JavaScript; What went wrong? Troubleshooting JavaScript; Storing the information you need — Variables; Basic in JavaScript — Numbers and operators; Handling text — Strings in JavaScript; Useful string methods; Arrays; Making decisions in your code — Conditionals; Looping code; Functions — Reusable blocks of code; Build your own function; Function return values; Introduction to events

***Programming assignments are mandatory.**

Reference Books:

J. N. Robbins, *Learning Web Design*, O'Reilly Media, 4th Edition, 2012.
Steven M. Schafer, *HTML, XHTML, and CSS Bible*, Wiley India, 5th Edition, 2010.
John Duckett, *Beginning HTML, XHTML, CSS, and JavaScript*, Wiley India, 3rd Edition, 2009.
Hal Stern, David Damstra, Brad Williams, Professional WordPress: Design and Development, Wrox Publication, 3rd Edition, 2015.
E. Robson, E. Freeman, *Head First HTML & CSS*, O'Reilly Media, 2nd Edition, 2012.

BTCOL309 Data Structure Laboratory

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 (dequeue) 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 programs to implement the following data structures: (a) Single linked list (b) Double linked list.
10. 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.
11. Write a program to create a binary search tree (BST) by considering the keys in given order and perform the following operations on it. (a) Minimum key (b) Maximum key (c) Search for a given key (d) Find predecessor of a node (e) Find successor of a node (f) delete a node with given key.
12. Write a program to construct an AVL tree for the given set of keys. Also write function for deleting a key from the given AVL tree.
13. Write a program to implement hashing with (a) Separate Chaining and (b) Open addressing methods.
14. Implement the following sorting algorithms: (a) Insertion sort (b) Merge sort (c) Quick sort (d) Heap sort.
15. Write programs for implementation of graph traversals by applying: (a) BFS (b) DFS

BTCOL310 Digital Electronics and Microprocessor Laboratory

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-3code conversion & 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.

BTCOC401 Design and Analysis of Algorithms

Unit 1 **6 hrs**

Introduction to Algorithms: Definition of Algorithms, Properties of Algorithms, Expressing Algorithm, Flowchart, Algorithm Design Techniques, Performance Analysis of Algorithms, Types of Algorithm's Analysis, Order of Growth, Asymptotic Notations, Recursion, Recurrences Relation, Substitution Method, Iterative Method, Recursion Tree, Master Theorem, Changing Variable, Heap Sort.

Unit 2 **6 hrs**

Divide and Conquer: Introduction to Divide and Conquer Technique, Binary Search, Merge Sort, Quick Sort, Strassen's Matrix Multiplication.

Unit 3 **6 hrs**

Greedy Algorithms: Introduction to Greedy Technique, Greedy Method, Optimal Merge Patterns, Huffman Coding, Knapsack Problem, Activity Selection Problem, Job Sequencing with Deadline, Minimum Spanning Tree, Single-Source Shortest Path Algorithm.

Unit 4 **6 hrs**

Dynamic Programming: Introduction, Characteristics of Dynamic Programming, Component of Dynamic Programming, Comparison of Divide-and-Conquer and Dynamic Programming Techniques, Longest Common Sub-sequence, matrix multiplication, shortest paths: Bellman Ford, Floyd Warshall, Application of Dynamic Programming.

Unit 5 **6 hrs**

Backtracking: Backtracking Concept, N–Queens Problem, Four–Queens Problem, Eight–Queen Problem, Hamiltonian Cycle, Sum of Subsets Problem, Graph Coloring Problem.

Branch and Bound: Introduction, Traveling Salesperson Problem, 15-Puzzle Problem, Comparisons between Backtracking and Branch and Bound.

Unit 6 **6 hrs**

Tree: Introduction, B-tree, Red-Black Tree (RBT): Insertion, Deletion.
NP Completeness: Introduction, The Complexity Class P, The Complexity Class NP, Polynomial-Time Reduction, The Complexity Class NP-Complete.

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.

Text Books:

1. Cormen, *Introduction to Algorithms*, PHI Publication, 2nd Edition, 2002.
2. Ellise Horowitz, Sartaj Sahni, S. Rajasekaran, *Fundamentals of Computer Algorithms*, University Press (India) Private Ltd, 2nd Edition, 2008.
3. Sara Base, *Computer algorithms: Introduction to Design and Analysis*, Addison-Wesley Publication, 2nd Edition, 1988.

BTCOC402 Probability and Statistics

Unit 1 **6 hrs**

Probability Theory: Definition of probability: classical, empirical and axiomatic approach of probability, Addition theorem of probability, Multiplication theorem of probability, Bayes' theorem of inverse probability, Properties of probabilities with proofs, Examples.

Unit 2 **6 hrs**

Random Variable and Mathematical Expectation: Random variables, Probability distributions, Probability mass function, Probability density function, Mathematical expectation, Join and marginal probability distributions, Properties of expectation and variance with proofs.

Unit 3 **6 hrs**

Theoretical Probability Distributions: Binomial distribution, Poisson distribution, Normal distribution, Fitting of binomial distributions, Properties of binomial, Poisson and normal distributions, Relation between binomial and normal distributions, Relation between Poisson and normal distributions, Importance of normal distribution, Examples.

Unit 4 **6 hrs**

Correlation: Introduction, Types of correlation, Correlation and causation, Methods of studying correlation, Karl Pearson's correlation coefficient, Spearman's rank correlation, Coefficient, Properties of Karl Pearson's correlation coefficient and Spearman's rank correlation coefficient, Probable errors.

Unit 5 **6 hrs**

Linear Regression Analysis: Introduction, Linear and non-linear regression, Lines of regression, Derivation of regression lines of y on x and x on y, Angle between the regression lines, Coefficients of regression, Theorems on regression coefficient, Properties of regression coefficient.

Unit 6 **6 hrs**

Applied Statistics: Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.

Reference Books:

1. Kishor S. Trivedi, *Probability, Statistics with Reliability, Queuing and Computer Science Applications*, Wiley India Pvt. Ltd, 2nd Edition, 2001.
2. Vijay K. Rohatgi, A. K. Md. Ehsanes Saleh, *An Introduction To Probability And Statistics*, Wiley Publication, 2nd Edition, 2001.

Text Books:

1. S. C. Gupta, *Fundamentals of Statistics*, Himalaya Publishing House, 7th Revied and Enlarged Edition, 2016.
2. G. V. Kumbhojkar, *Probability and Random Processes*, C. Jamnadas and Co., 14th Edition, 2010.
3. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
4. Veerarajan T., Engineering Mathematics (for semester III), Tata McGraw-Hill, New Delhi, 2010.
5. G. Haribaskaran, *Probability, Queuing Theory and Reliability Engineering*, Laxmi Publications, 2nd Edition, 2009.
6. Murray Spiegel, John Schiller, R. ALU Srinivasan, *Probability And Statistics*, Schaum's Outlines, 4th Edition, 2013.

BTCOC403 Operating System

Unit 1 **6 hrs**

Introduction and Operating system structures: Definition, Types of Operating system, Real-Time operating system, System Components- System Services, Systems Calls, System Programs, System structure. Virtual Machines, System Design and Implementation, System Generations.

Unit 2 **6 hrs**

Processes and CPU Scheduling: Process Concept, Process Scheduling, Operation on process, Cooperating processes. Threads, Inter-process Communication, Scheduling criteria, scheduling Algorithms, Multiple-Processor Scheduling, Real-Time Scheduling, Scheduling Algorithms and performance evaluation.

Unit 3 **6 hrs**

Process Synchronization The critical-section problem, Critical regions, Synchronization Hardware, Semaphores, Classical Problems of synchronization, and Monitors Synchronizations in Solaris.

Unit 4 **6 hrs**

Deadlocks: Systems Model, Deadlock characterization, Methods for handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock, Combined approach to deadlock Handling.

Unit 5 **6 hrs.**

Memory Management: Basic concept, Logical and Physical address map, Memory allocation: Continuous Memory Allocation, Fixed and variable partition, Internal and external fragmentation and compaction, Paging: Principle of operation, Page allocation – Hardware support for paging, Protection and sharing, Disadvantages of paging.

Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault, Working Set, Dirty page/Dirty bit – Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used (LRU).

Unit 6 **6 hrs.**

I/O Hardware: I/O devices, Device controllers, Direct memory access Principles of I/O Software: Goals of Interrupt handlers, Device drivers, sDevice independent I/O software, Secondary-Storage Structure: Disk structure, Disk scheduling algorithms.

File Management: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency and performance.

Reference Books:

1. D. M. Dhamdhere, *Systems Programming and Operating Systems*, McGraw-Hill, 2nd 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, 2nd Edition, 1990.
4. Thomas W. Doeppner, *Operating System in Depth: Design and Programming*, Wiley Publication, 2011.

Text Books:

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, 4th Edition, 2015.

BTCOE404(A) Object-Oriented Programming using C++ (Elective I)

Unit 1 **6 hrs**

Introduction to Object Oriented Programming and Objects and Classes: Need of object oriented programming, The object oriented approach, Characteristics of object oriented languages. A class, Objects as data types, Constructors, Objects as function arguments, Returning objects.

Unit 2 **6 hrs**

Operator Overloading and Inheritance: Overloading unary and binary operators, Data conversion. Derived and base class, Public and private inheritance, Levels of inheritance, Multiple inheritance Examples.

Unit 3 **6 hrs**

Polymorphism: Virtual functions, Dynamic binding, Abstract classes and pure virtual functions, Friend functions, this pointer.

Unit 4 **6 hrs**

Streams and Files: Streams, Stream output and input, Stream manipulators, Files and streams, Creating, Reading, Updating sequential and random files.

Unit 5 **6 hrs**

Templates and Exception Handling: Function templates, Overloading function templates, Class templates, Exception handling overview, Need of exceptions, An exception example, Multiple exceptions, Exception specifications.

Unit 6 **6 hrs**

Standard Template Library (STL): Introduction to STL-Containers, Iterators, Algorithms, Sequence containers, Associative containers, Container adapters.

Reference Books:

1. Bjarne Stroustrup, The C++ Programming Language, Addison-Wesley Publication, 4th Edition, 2013.
2. P. J. Deitel, H. M. Deitel, *C++ How to Program*, PHI Publication, 9th Edition, 2012.
3. John Hubbard, *Programming with C++*, Schaum's Outlines, McGraw-Hill Publication, 2nd Edition, 2000.
4. Nicolai M. Josuttis, *Object-Oriented Programming in C++*, Wiley Publication, 1st Edition, 2002.

Text Books:

1. E. Balagurusamy, *Object Oriented Programming with C++*, McGraw-Hill Publication, 6th Edition, 2013.
2. Robert Lafore, *Object Oriented Programming in C++*, Sams Publishing, 4th Edition, 2001.
3. Dr. B. B. Meshram, *Object Oriented Paradigms with C++ Beginners Guide for C and C++*, SPD Publication, 1st Edition, 2016.
4. Rajesh R. Shukla, *Object-Oriented Programming in C++*, Wiley India Publication, 1st Edition, 2008.

BTCOE404(B) Object-Oriented Programming using Java (Elective I)

Unit 1 **6 hrs**

Introduction to Computers and Java: Computers: Hardware and Software, Data Hierarchy, Computer Organization, Machine Languages, Assembly Languages and High-Level Languages, Introduction to Object Technology, Operating Systems, Programming Languages, Java and a Typical Java Development Environment, Your First Program in Java: Printing a Line of Text, Modifying Your First Java Program, Displaying Text with printf, Another Application: Adding Integers, Memory Concepts, Arithmetic, Decision Making: Equality and Relational Operators.

Unit 2 **6 hrs**

Introduction to Classes, Objects, Methods and Strings: Introduction, Declaring a Class with a Method and Instantiating an Object of a Class, Declaring a Method with a Parameter, Instance Variables, set Methods and get Methods, Primitive Types vs. Reference Types, Initializing Objects with Constructors Floating-Point Numbers and Type double.

Unit 3 **6 hrs**

Control Statements: Algorithms, Pseudocode, Control Structures, if Single-Selection Statement, if...else Double-Selection Statement, while Repetition Statement, Formulating Algorithms: Counter-Controlled Repetition, Formulating Algorithms: Sentinel-Controlled Repetition, Formulating Algorithms: Nested Control Statements, Compound Assignment Operators, Increment and Decrement Operators, Primitive Types, Essentials of Counter-Controlled Repetition, for Repetition Statement, Examples Using for Statement, do...while Repetition Statement, switch Multiple-Selection Statement, break and continue Statements, Logical Operators.

Unit 4 **6 hrs**

Array: Introduction, Declaring and Creating Arrays, Examples Using Arrays, Case Study: Card Shuffling and Dealing Simulation, Enhanced for Statement, Passing Arrays to Methods, Case Study: Class GradeBook Using an Array to Store Grades, Multidimensional Arrays, ase Study: Class GradeBook Using a Two-Dimensional Array, Variable-Length Argument Lists, Using Command-Line Arguments, Class Arrays.

Unit 5 **6 hrs**

Classes and Objects: Introduction, Controlling Access to Members, Referring to the Current Object's Members with the this Reference, Time Class Case Study: Overloaded Constructors, Time, Default and No-Argument Constructors, Notes on Set and Get Methods, Composition, Enumerations, Garbage Collection and Method finalize, static Class Members, static Import, final Instance Variables, Time Class Case Study: Creating Packages, Package Access.

Unit 6 **6 hrs**

Inheritance: Introduction, Superclasses and Subclasses, protected Members, Relationship between Superclasses and Subclasses, Hierarchy Using private Instance Variables, Constructors in Subclasses Software Engineering with Inheritance, Class Object.
Polymorphism: Introduction, Polymorphism Examples, Demonstrating Polymorphic Behavior, Abstract Classes and Methods, Case Study: Payroll System Using Polymorphism, final Methods and Classes, Case Study: Creating and Using Interfaces.

Reference Book:

1. Paul Deitel and Harvey Detail, *Java: How to Program*, Pearson's Publication, 9th Edition,
2. Joel Murach and Michael Urban, *Murach's Beginning Java with Eclipse*, Murach's Publication, 1st Edition, 2016.
3. Doug Lowe, *Java All-in-One For Dummies*, Wiley Publication, 4th Edition, 2014.
4. Herbert Schildt, *Java The Complete Reference*, McGraw-Hill Publication, 9th Edition,
5. Patrick Niemeyer, Daniel Leuck, *Learning Java*, O'Reilly Media, 4th Edition, 2013.

BTCOE405(A) Numerical Methods (Elective-II)

This course preferably offered as a SWAYAM course

Unit 1 [5 Hrs.]
Solution of Algebraic and Transcendental Equation: Bisection method, Method of false position, Newton's method and Newton-Raphson method.

Unit 2 [5 Hrs.]
Solution of Linear Simultaneous Equation: Gauss elimination method, Gauss-Jordan method, Iterative method of solution- Jacobi iteration method, Gauss-Seidal iteration method, Relaxation method.

Unit 3 [5 Hrs.]
Finite Differences: Forward difference operator, Backward difference operator, Central difference operator, Newton's interpolation formulae, Newton's forward–backward-central interpolation formulae.

Unit 4 [5 Hrs.]
Differentiation and Integration: Newton-Cortes formula, Trapezoidal rule, Simpson one–third rule, Simpson three- eighth rule.

Unit 5 Numerical Solution of ODE: Picard's methods, Taylor series method, Euler's method, Modified Euler's method, Runge - Kutta method. [5 Hrs.]

Text Books:

1. B.S Grewal, Higher Engineering Mathematics, 40 th edition, Khanna publication.
2. S. S. Shastri, Introduction to Numerical Methods, PHI publication.
3. V. Rajaraman, Computer Oriented Methods, 3 rd edition, PHI publication.

Reference Books:

1. Conte and De boor, Elementary Numerical Analysis, BPB publication.
2. E. Kreyszig, Advanced Engineering Mathematics, BPB publication.
3. Steven C Chapra, Numerical Methods for Engineers, 5 th edition, McGraw Hill publication.

Equivalent SWAYAM/NPTEL Course

BTCOE405(B) Physics of Engineering Material (Elective-II)

Unit I Magnetic Materials: **5hrs**

Magnetic Materials: Origin of magnetization using atomic theory, classification of magnetic materials and properties, Langevin's theory of Dia, Para and ferromagnetism, Soft and Hard magnetic materials and their uses, Domain theory of ferromagnetism, Hysteresis loss, Ant ferromagnetic and Ferromagnetic materials, Ferrites and Garnets, magnetic bubbles, magnetic recording.

Unit II Conducting and Superconducting Materials: Band theory of solids, Classical free electron theory of metals, Quantum free electron theory, Density of energy states and carrier concentration, Fermi energy, Temperature and Fermi energy distribution, Superconductivity, Factor affecting Superconductivity, Meissner effect, Type-I and Type-II superconductors, BCS theory, Josephson effect, High temperature superconductors, Application of superconductors (Cryotron, magnetic levitation) **5hrs**

Unit III Semiconducting Materials: Band structure of semiconductor, Charge carrier concentration, Fermi level and temperature, Electrical conductivity, Hall effect in semiconductors, P-N junction diode, Preparation of single crystals, LED, Photovoltaic Cell **5hrs**

Unit IV Dielectric Materials: Dielectric constant and polarizability, types of polarization, temperature and frequency dependences of Dielectric parameter, internal fields in solids, Clausius-Mosotti equation, dielectric loss, dielectric breakdown, ferroelectric, pyroelectric and piezoelectric materials, applications of dielectric materials **5hrs**

Unit V Nano Materials: Nanomaterials : Introduction and properties, synthesis of nanomaterials, Carbon Nano Tubes, Characterization techniques of nanomaterials- SEM, TEM, EDAX, FMR, XRD. Applications of nanomaterials. **5hrs**

Text Books:

1. C. Kittle ,"***Introduction to Solid state Physics***".
2. C. M. Srivastava , C. Srinivasan , "***Science of Engineering Materials and Carbon Nanotubes***".
3. A. J. Dekker, "***Solid State Physics***".

Reference Books:

1. V. Raghavan, "***Material Science and Engineering***".
2. A. J. Dekker, "***Electrical Engineering Materials***".

BTCOE405(C) Soft Skills and Persnolity Development (Elective-II)

This course preferably offered as a SWAYAM course

UNIT I

Self Management:
Self Management, Self Evaluation, Self discipline, Self criticism, Recognition of one's own limits and deficiencies, dependency, etc.
Self Awareness, Self Management, Identifying one's strengths and weaknesses, Planning & Goal setting, Managing self-emotions, ego, pride,- Leadership & Team Dynamics

UNIT II

Time Management Techniques
Practice by game playing and other learning strategies to achieve the set targets Time Management Concept, Attendance, Discipline & Punctuality, Acting in time, Quality /Productive time.

UNIT III

Motivation/ Inspiration
Ability to shape and direct working methods according to self-defined criteria, Ability to think for oneself, Apply oneself to a task independently with self-motivation,
Motivation techniques : Motivation techniques based on needs and field situations

Unit IV

Interpersonal Skills Development
Positive Relationship, Positive Attitudes, Empathies: comprehending others' opinions, points of views, and face them with understanding, Mutuality, Trust, Emotional Bonding, Handling Situations (Interview), Importance of interpersonal skills

Unit V

Effective Computing Skills
Designing an effective Presentation: Contents, appearance, themes in a presentation, Tone and Language in a presentation, Role and Importance of different tools for effective presentation

Reference books:

1. Mitra, Barun, "***Personality Development and Soft Skills***", Oxford University Press, 2016.
2. Ramesh, Gopalswamy, "***The Ace of Soft Skills: Attitude, Communication and Etiquette for Success***", Pearson Education, 2013.
3. Covey, Stephen R., "***Seven Habits of Highly Effective People: Powerful Lessons in Personal Change***"
4. Rosenberg Marshall B., "***Nonviolent Communication: A Language of Life***".

BTXXC406 Product Design Engineering

Unit 1 **6 hrs**

Creating Simple Products and Modules.

Unit 2 **6 hrs**

Document Creation and Knowledge Sharing.

Unit 3 **6 hrs**

Self and Work Management.

Unit 4 **6 hrs**

Team Work and Communication.

Unit 5 **6 hrs**

Managing Health and Safety.

Unit 6 **6 hrs**

Data and Information Management.

Text / Reference Books:

1. Model Curriculum for “Product Design Engineer – Mechanical”, NASSCOM (Ref. ID: SSC/Q4201, Version 1.0, NSQF Level: 7)
2. Eppinger, S., & Ulrich, K.(2015). Product design and development. McGraw - Hill Higher Education.
3. Green, W., & Jordan, P. W. (Eds.). (1999).Human factors in product design: current practice and future trends. CRC Press.
4. Sanders, M. S., & McCormick, E. J. (1993). Human factors in engineering and design Mc-GRAW- HILL book company.
5. Roozenburg, N. F., &Eekels, J. (1995). Product design: fundamentals and methods (Vol. 2). John Wiley & Sons Inc.
6. Lidwell, W., Holden, K., & Butler, J.(2010). Universal principles of designs, revised and updated: 125 ways to enhance usability, influence perception, increase appeal, make better design decisions, and teach through design. Rockport Pub.

BTCOL407 Design and Analysis of Algorithm Laboratory

List of Experiments:

1. Divide and conquer method (quick sort, merge sort, Strassen's matrix multiplication).
2. Greedy method (knapsack problem, job sequencing, optimal merge patterns, minimal spanning trees).
3. Dynamic programming (multistage graphs, OBST, 0/1 knapsack, traveling sales person problem).
4. Obtain the Topological ordering of vertices in a given digraph.
5. Back tracking (n-queens problem, graph coloring problem, Hamiltonian cycles).
6. Selection: Minimum/ Maximum, K^{th} smallest element.
7. Find optimal ordering of matrix multiplication. (Use Dynamic programming method).
8. Use dynamic programming algorithm to solve optimal binary search tree problem.
9. Compute the transitive closure of a given directed graph using Warshall's algorithm.
10. Write programs to find out a minimum spanning tree of a simple connected undirected graph by applying: (a) Prim’s algorithm (b) Kruskal’s algorithm.
11. Write a program to implement Dijkstra’s algorithm for solving single source shortest path problem using priority queue.
12. Write a program to implement Floyd-Warshall algorithm for solving all pairs shortest path problem.

BTCOL408 Introduction to data science with R

Unit 1: Introduction to Basics **2 hrs**

The basic data types in R. Variables.

Module 2 Vectors and Matrices **4hrs**

Vectors. Create, name and select elements from vectors. Learn how to work with matrices in R. Do basic computations with them and demonstrate your knowledge by analyzing the Star Wars box office figures.

Module 3: Factors & Data Frames **2 hrs**

Storeing Categorical data in factors. Learn how to create, subset and compare categorical data. When working R, you'll probably deal with Data Frames all the time. Therefore, you need to know how to create one, select the most interesting parts of it, and order them.

Module 4: Lists **2 hrs**

Create, name and select elements from Lists

Module 5: Basic Graphics **2 hrs**

Discover R's packages to do graphics and create your own data visualizations.

***Programming assignments are mandatory.**

Reference Books:

1. Joel Grus, *Data Science from Scratch: First Principles with Python*, O'Reilly Media, 1st Edition, 2015.
2. Hadley Wickham, Garrett Grolemund, *R for Data Science Import, Tidy, Transform, Visualize, and Model Data*, O'Reilly Media, 1st Edition, 2017.
3. Nina Zumel, John Mount,"Practical Data Science with R", Manning, 2014.

Text Books:

1. Rajendra Patil, Hiren dand, Rupali Dahake, *A practical approach to R Tool*, SPD Publication, 1st Edition, 2017.

BTCOL409 Object Oriented Programming Laboratory

List of Experiments:

1. Programs on Operators, Arithmetic Promotion, Method Calling.
2. Programs on dealing with Arrays.
3. Programs on Classes: String and Math.
4. Programs on Inheritance and Polymorphism.
5. Programs on Garbage collection, packaging, access Modifiers, as well as static and abstract modifiers.
6. Programs on Interfaces, block initializers, final Modifier, as well as static and dynamic binding.
7. Programs on file handling and stream manipulation.
8. Programs on Dynamic Polymorphism.
9. Programs on Dynamic Memory Management.
10. Programs on Exception Handling.
11. Programs on generic programming using templates.
12. Programs on STL-containers and iterators.

BTCOL410 Operating Systems Laboratory

1. Hands on Unix Commands
2. Shell programming for file handling.
3. Shell Script programming using the commands grep, awk, and sed.
4. Implementation of various CPU scheduling algorithms (FCFS, SJF, Priority).
5. Implementation of various page replacement algorithms (FIFO, Optimal, LRU).
6. Concurrent programming; use of threads and processes, system calls (fork and v-fork).
7. Study pthreads and implement the following: Write a program which shows the performance
8. Improvement in using threads as compared with process.(Examples like Matrix Multiplication,
9. Hyper Quick Sort, Merge sort, Traveling Sales Person problem).
10. Implementation of Synchronization primitives – Semaphore, Locks and Conditional Variables.
11. Implementation of Producer-Consumer problem, Bankers algorithm.
12. Implementation of various memory allocation algorithms, (First fit, Best fit and Worst fit), Disk
13. Scheduling algorithms (FCFS, SCAN, SSTF, C-SCAN).
14. Kernel reconfiguration, device drivers and systems administration of different operating systems.
15. Writing utilities and OS performance tuning.

PROPOSED SYLLABUS OF COMPUTER SCIENCE AND ENGINEERING

RTM NAGPUR UNIVERSITY, NAGPUR

FOR VII AND VIII SEMESTER

ACADEMIC SESSION: 2015-2016

FOUR YEAR BACHELOR OF ENGINEERING (B.E.) DEGREE COURSE

SEMESTER: SEVENTH (C.B.S.)

BRANCH: COMPUTER SCIENCE & ENGINEERING

Sr. No.	Subject	Workload				Credit				Marks				
		L	P	T	Total	L	P	T	Total	Theory		Practical		Total Marks
										Sess.	Univ.	Sess.	Uni.	
1 BECSE401T	Data Warehousing & Mining	4	-	1	5	4	-	1	5	20	80	-	-	100
2 BECSE401P	Data Warehousing & Mining Lab	-	2	-	2	-	1	-	1	-	-	25	25	50
3 BECSE402T	Language Processor	4	-	1	5	4	-	1	5	20	80	-	-	100
4 BECSE402P	Language Processor Lab	-	2	-	2	-	1	-	1	-	-	25	25	50
5 BECSE403T	ELECTIVE-I	4	-	1	5	4	-	1	5	20	80	-	-	100
6 BECSE404T	ELECTIVE-II	4	-	1	5	4	-	1	5	20	80	-	-	100
7 BECSE405P	Project and Seminar	-	3	-	3	-	3	-	3	-	-	25	25	50
	Total	**16**	**7**	**4**	**27**	**16**	**5**	**4**	**25**	**80**	**320**	**75**	**75**	**550**

Elective I: TCP and IP, Advanced Computer Architecture, Big Data Analysis & Business Intelligence, Parallel and Network Algorithm.

Elective II: Computational Geometry, Mobile Computing, Real Time Operating System, Software Architecture, Mainframe Technologies.

FOUR YEAR BACHELOR OF ENGINEERING (B.E.) DEGREE COURSE

SEMESTER: EIGHTH (C.B.S.)

BRANCH: COMPUTER SCIENCE & ENGINEERING

Sr. No.	Subject	Workload				Credit				Marks				
										Theory		Practical		Total Marks
		L	P	T	Total	L	P	T	Total	Sess.	Univ.	Sess.	Uni.	
1 BECSE406T	Distributed Operating system	4	-	1	5	4	-	1	5	20	80	-	-	100
2 BECSE406P	Distributed Operating system Lab	-	2	-	2	-	1	-	1	-	-	25	25	50
3 BECSE407T	Information & Cyber Security	4	-	1	5	4	-	1	5	20	80	-	-	100
4 BECSE407P	Information & Cyber Security Lab	-	2	-	2	-	1	-	1	-	-	25	25	50
5 BECSE408T	ELECTIVE-III	4	-	1	5	4	-	1	5	20	80	-	-	100
6 BECSE409T	ELECTIVE-IV	4	-	1	5	4	-	1	5	20	80	-	-	100
7 BECSE410P	Project & Seminar	-	5	-	5	-	5	-	5	-	-	75	75	150
	Total	**16**	**9**	**4**	**29**	**16**	**7**	**4**	**27**	**80**	**320**	**125**	**125**	**650**

Elective III: Pattern Recognition, Soft Computing Techniques, Optimization Techniques, Clustering & Cloud Computing.

Elective IV: Advance Wireless Sensor Network, Digital Image Processing, Natural Language Processing, Digital Forensic.

BECSE401T: Data Warehousing & Mining

Load	Credit	Total marks	Sessional marks	University marks	Total
4 hrs (Theory) 1 hr (Tutorial)	5	100	20	80	100

Unit I: Introduction: Fundamentals of data mining, Data Mining Functionalities, Classification of Data Mining systems, Data Mining Task Primitives, Integration of a Data Mining System with a Database or a Data Warehouse System, Major issues in Data Mining. Data Preprocessing: Need for Preprocessing the Data, Data Cleaning, Data Integration and Transformation, Data Reduction, Discretization and Concept Hierarchy Generation.

Unit II: Data Warehouse and OLAP Technology for Data Mining**:** Data Warehouse, Multidimensional Data Model, Data Warehouse Architecture, Data Warehouse Implementation, Further Development of Data Cube Technology, From Data Warehousing to Data Mining Data Cube Computation and Data Generalization: Efficient Methods for Data Cube Computation, Further Development of Data Cube and OLAP Technology, Attribute-Oriented Induction.

Unit III: Mining Frequent Patterns, Associations and Correlations**:** Basic Concepts, Efficient and Scalable Frequent Item set Mining Methods, Mining various kinds of Association Rules, From Association Mining to Correlation Analysis, Constraint-Based Association Mining

Unit IV: Classification and Prediction: Issues Regarding Classification and Prediction, Classification by Decision Tree Induction, Bayesian Classification, Rule-Based Classification, Classification by Back propagation, Support Vector Machines, Associative Classification, Lazy Learners, Other Classification Methods, Prediction, Accuracy and Error measures, Evaluating the accuracy of a Classifier or a Predictor, Ensemble Methods

Unit V: Cluster Analysis Introduction: Types of Data in Cluster Analysis, A Categorization of Major Clustering Methods, Partitioning Methods, Hierarchical Methods, Density-Based Methods, Grid-Based Methods, Model-Based Clustering Methods, Clustering High-Dimensional Data, Constraint-Based Cluster Analysis, Outlier Analysis.

Unit VI: Mining Streams, Time Series and Sequence Data: Mining Data Streams, Mining Time-Series Data, Mining Sequence Patterns in Transactional Databases, Mining Sequence Patterns in Biological Data, Graph Mining, Social Network Analysis and Multirelational Data Mining.

Text Book:

1. Data Mining – Concepts and Techniques, Jiawei Han & Micheline Kamber, Morgan Kaufmann Publishers, Elsevier, 2nd Edition, 2006.

Reference Books:

1. Data Mining Techniques, Arun K Pujari, 3rd edition, Orient Blackswan/Universities Press, 2013.
2. Data Warehousing Fundamentals, Paulraj Ponnaiah, John Wiley & Sons, 2001.

BECSE401P: Data Warehousing & Mining Lab

Load	Credit	Total marks	Sessional marks	University marks	Total
2 hrs (Practical)	1	50	25	25	50

Practical based on the syllabus for the course **BECSE401T.**

BECSE402T: Language Processor

Load	Credit	Total marks	Sessional marks	University marks	Total
4 hrs (Theory) 1 hr (Tutorial)	5	100	20	80	100

Unit I: Introduction to compilers, compilers and translators, Cross Compiler, Phases of compilation and overview.

Lexical Analysis (scanner): Regular languages, finite automata, regular expressions, scanner generator (lex, flex).

Unit II: Syntax Analysis: Syntax specification of programming languages, Design of top-down & bottom-up parsing technique, Design of LL(1) parser. LR parsing: Design of SLR, CLR, LALR parsers. Dealing with ambiguity of the grammar, Parser generator (yacc, bison)

Unit III: Syntax directed definitions, implementation of SDTS, Intermediate code representations (postfix, syntax tree, TAC), Intermediate code generation using syntax directed translation schemes for translation of controls structures, declarations, procedure calls, and Array reference.

Unit IV: Table Management: Storage allocation and run time storage administration, symbol table management.

Error detection and recovery: Error recovery in LR parsing, Error recovery in LL parsing, automatic error recovery in YACC.

Unit V: Code optimization: Sources of optimization, loop optimization, control flow analysis, data flow analysis, setting up data flow equations to compute reaching definitions, available expressions, Live variables, Induction Variable, Common sub expression elimination.

Unit VI: Code generation: Problems in code generation, Simple code generator, Register allocation and assignment, Code generation from DAG, Peephole optimization.

Text Books:

1. Aho, Sethi, and Ullman; Compilers – Principles, Techniques and Tools; Second Edition, Pearson Education, 2008.
2. Alfred V. Aho and Jeffery D. Ullman; Principles of Compiler Design; Narosa Publishing House, 1977.
3. Vinu V. Das; Compiler Design using Flex and Yacc; PHI Publication, 2008.

Reference Books:

1. Compiler Design, O. G. Kakde, Laxmi Publications, 2006.
2. Principles of Compiler Design, V. Raghavan, Tata McGraw Hill, 2009.

BECSE402P: Language Processor Lab

Load	Credit	Total marks	Sessional marks	University marks	Total
2 hrs (Practical)	1	50	25	25	50

Practical based on the syllabus for the course **BECSE402T.**

BECSE403T: Elective I: TCP & IP

Load	Credit	Total marks	Sessional marks	University marks	Total
4 hrs (Theory) 1 hr (Tutorial)	5	100	20	80	100

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

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

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

Unit VI: IP security protocol-IPv6 addresses, Packet format, Multicast, Anycast, ICMPv6, Interoperation between IPv4 and IPv6-QoS, Auto configuration.

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.

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.

BECSE403T: Elective I: Advanced Computer Architecture

Load	Credit	Total marks	Sessional marks	University marks	Total
4 hrs (theory) 1 hr (tutorial)	5	100	20	80	100

Unit I: Fundamentals of Computer Design: Defining computer architecture, trends in technology, trends in power in integrated circuits, trends in cost, dependability, and measuring, reporting and summarizing performance.

Unit II: Instruction-Level Parallelism: Concepts and challenges in ILP, basic compiler techniques for Exposing ILP – reducing branch costs with prediction, overcoming data hazards with dynamic scheduling, hardware-based speculation, exploiting ILP using static and dynamic scheduling, limitations of ILP, using ILP support to exploit thread-level parallelism.

Unit III: Vector architecture: SIMD instruction set, extensions for multimedia, graphics processing units, detecting and enhancing loop-level parallelism, centralized shared-memory architectures, performance of shared-memory, multiprocessors, distributed shared memory, directory based coherence, basics of synchronization, models of memory consistency.

Unit IV: Memory Hierarchy Design: Cache performance: Eleven advanced cache optimizations, Protection via virtual memory and virtual machine, Impact of virtual machines on virtual memory and I/O, memory hierarchies, design of memory hierarchies.

Unit V: Introduction to Message passing Architecture: Routing in message passing architecture, message passing programming model, processor support for message passing, message passing versus shared memory architecture.

Unit VI: Storage Systems: Advanced topics in disk storage, definition and examples of real faults and failures, i/o performance, reliability measures and benchmarks – designing and evaluating an i/o system.

Text Books:

1. Computer Organization and Architecture - Designing for Performance, William Stallings, 8th Edition, Prentice Hall, 2010.
2. Advanced Computer Architecture, Kai Hwang, 2nd Edition, Tata McGraw-Hill, 2011.
3. Advanced Computer Architecture and Parallel Processing, Hesham El-Rewini and Mostafa Abd-El-Barr, Wiley, 2005.

Reference Books:

1. Parallel Computing architecture: A hardware / software approach, David E. Culler and Jaswinder Pal Singh, Morgan Kaufmann, 1998.
2. Computer Architecture and Organization, 3rd Edition, J. P. Hayes, McGraw Hill, 1999.

BECSE409T: Elective I: Big Data Analytics and Business Intelligence

Load	Credit	Total marks	Sessional marks	University marks	Total
4 hrs (Theory) 1 hr (Tutorial)	5	100	20	80	100

Unit I: 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 II: Understanding the basics of MapReduce, The Hadoop MapReduce, The Hadoop MapReduce fundamentals, writing a Hadoop MapReduce example, learning the different ways to write MapReduce in R. Integrating R and Hadoop – the RHIPE architecture and RHadoop.

Unit III: Learning Data Analytics with R and Hadoop – The data analytics project cycle, the data analytics problems (web page categorization, stock market change), supervised and unsupervised machine-learning algorithms.

Unit IV: Introduction to Business Intelligence : evolution of BI, BI value chain, introduction to business analytics, BI Definitions & Concepts, Business Applications of BI, BI Framework, Role of Data Warehousing in BI, BI Infrastructure Components – BI Process, BI Technology, BI Roles & Responsibilities

Unit V: Basics of Data Integration: Concepts of data integration need and advantages of using data integration, introduction to common data integration approaches, data integration technologies, Introduction to data quality, data profiling concepts and applications, the multidimensional data model, star and snowflake schema.

Unit VI: BI Project Lifecycle: Typical BI Project Lifecycle, Requirements Gathering and Analysis - Functional and Non-Functional Requirements, Testing in a BI Project, BI Project Deployment , Post Production Support.

Text Books:

1. Big Data Analytics with R and Hadoop, Vignesh Prajapati, PACKT Publishing, 2013.
2. Fundamentals of Business Analytics, R N Prasad and S Acharya, Wiley India, 2011
3. Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph; David Loshin, Morgan Kaufmann, 2013.

Reference Books:

1. Business Intelligence - A Managerial Approach, 2nd Edition, Efraim Turban, Ramesh Sharda, Dursun Delen and David King, Prentice Hall, 2010.
2. Business Intelligence for Dummies, Swain Scheps, Wiley Publishing, 2007.

BECSE403T: Elective I: Parallel and Network Algorithm

Load	Credit	Total marks	Sessional marks	University marks	Total
4 hrs (Theory) 1 hr (Tutorial)	5	100	20	80	100

Unit I: Introduction: Parallel computation models, Parallel architectures and topologies, Notion of space and time complexity in parallel and interconnect network environment.

Unit II: Dependence Concept: Single Loop, Double Loop and Perfect Loop Nest. Loop carried and Loop independence dependence, Preliminary loop transformation techniques.

Unit III: Parallel Algorithms and Techniques 1: Parallel Searching and Sorting Techniques. Hyper quick sort.

Unit IV: Parallel Algorithms and Techniques 2: Parallel solutions to linear system of equations, finding roots of non-linear equations, Parallel discrete Fourier transforms.

Unit V: Graph and Network Theory 1: Introduction, Shortest Paths, Spanning Trees, Connected Components.

Unit VI: Graph and Network Theory 2: Parallel Breadth First Search and Depth First Search, Greedy Algorithms and matroids, Coloring and Matching, Network Flow.

Text Books:

1. Graphs, Networks, and Algorithms, Dieter Jungnickel, Third Edition, Springer, 2010.
2. The Design and Analysis of Parallel Algorithms, S.G.Akl, PHI, 1989.
3. Introduction to Parallel Computing, Ananth Grama, Anshul Gupta, George Karypis and Vipin Kumar, Second edition, Addison Wesley, 2003.

Reference Books:

1. An Introduction to Parallel Algorithms, J. JaJa, Addison Wesley, 1992.
2. Parallel Programming in C with MPI and OpenMP, M.J.Quinn, McGraw Hill, 2003.

BECSE404T: Elective II: Computational Geometry

Load	Credit	Total marks	Sessional marks	University marks	Total
4 hrs (Theory) 1 hr (Tutorial)	4	100	20	80	100

Unit I: Introduction to Computational Geometry; Line Segment Intersection – The Doubly-Connected Edge List, Computing Overlay of Two Subdivisions, Boolean Operations; Polygon Triangulation – Guarding and triangulations, Partitioning a polygon into monotone pieces, triangulating a monotone polygon.

Unit II: Linear Programming – The geometry of casting, Half-plane intersection, Incremental and Randomized linear programming; Orthogonal range Searching – One Dimensional range searching, kd-trees, Range trees, higher dimensional range trees.

Unit III: Point location – Point location and trapezoidal maps, a Randomized incremental algorithm, dealing with degenerate cases; Voronoi Diagrams – Definition and basic properties, computing the Voronoi diagram; Arrangemnets and Duality – Computing the discrepancy, duality, arrangements of lines, levels and discrepancy.

Unit IV: Delaunay Triangulations – Triangulations of planar point sets, the Delaunay triangulation, computing the Delaunay triangulation, the analysis; Geometric Data Structures – Interval trees, priority search trees, segment trees.

Unit V: Convex Hulls – The complexity of convex hulls in 3-space, computing convex hulls in 3-space, the analysis, convex hulls and half-space intersection; Binary Space Partitions – the definition of BSP trees, BSP trees and the Painter's algorithm, constructing a BSP tree, the size of BSP tree in 3-space.

Unit VI: Quadtrees – Uniform and non-uniform meshes, quadtrees for point sets, from quadtree to meshes; Simplex Range Searching – Partition trees, multi-level partition trees, cutting trees.

Text Books:

1. Computational Geometry – Algorithms and Applications, Second Revised Edition, Mark de Berg, et al., Springer, 1998.
2. Discrete and Computational Geometry, Satyan L. Devadoss and Joseph O'Rourke, Princeton University Press, 2011.

Reference Books:

1. Computational Geometry – an Introduction, Franco Preparata and Michael Shamos, Springer-Verlag, 1985.

BECSE404T: Elective II: Mobile Computing

Load	Credit	Total marks	Sessional marks	University marks	Total
4 hrs (Theory) 1 hr (Tutorial)	4	100	20	80	100

Unit I: History of Wireless Communication, Applications of Wireless Communication, A simplified Reference Model, A second generation 2G services systems, radio link, channel types, antennas and its types. Advantages of Wireless Network over Wired Network.

Unit II: Introduction to Cellular system,(Wireless) Medium Access Control: Motivation for a specialized MAC Hidden and exposed terminals, Near and far terminals), SDMA, FDMA, TDMA, CDMA, Comparison of SDMA/FDMA/TDMA/CDMA.

Unit III: Introduction to GSM system, GSM background, GSM operational and technical requirements. cell layout and frequency planning, mobile station, base station systems, switching sub systems, home locations register(HLR), Visiting Location Register (VLR), equipment identity register, echo canceller. GSM network structure, Protocols, Localization and calling, Handovers,

Unit IV: Mobile Network Layer: Mobile IP, Dynamic Host Configuration Protocol (DHCP). TCP over Wireless Networks – Traditional TCP, Indirect TCP, Snooping TCP, Fast retransmit/fast recovery, Transmission /time-out freezing, Selective retransmission, Transaction oriented TCP.

Unit V: Mobile Ad hoc Networks (MANETs): Overview, Properties of a MANET, spectrum of MANET applications, routing and various routing algorithms, multicast routing, security in MANETs.

Unit VI: Protocols and Tools: Wireless Application Protocol-WAP; Introduction, protocol architecture, and treatment of protocols of all layers; Bluetooth – User scenarios, physical layer, MAC layer, networking, security, link management; Wireless LAN and J2ME.

Text Books:

1. Mobile Computing for beginners, Raksha Shende, Arizona Business Alliance, 2012.
2. Mobile Communications, Jochen Schiller, Second edition, Addison-Wesley, 2004.
3. Handbook of Wireless Networks and Mobile Computing, Stojmenovic and Cacute, Wiley, 2002.

Reference Books:

1. Mobile Computing Principles: Designing and Developing Mobile Applications with UML and XML, Reza Behravanfar, Cambridge University Press, 2004.
2. Fundamentals of Mobile and Pervasive Computing, Adelstein, Frank, Gupta and Sandeep KS, McGraw-Hill, 2005.
3. Principles of Mobile Computing, Hansmann, Merk and Nicklous, Stober, Springer, Second Edition, 2003.
4. Mobile and Wireless Design Essentials, Martyn Mallick, Wiley DreamTech, 2003.

BECSE404T: Elective II: Real Time Operating System

Load	Credit	Total marks	Sessional marks	University marks	Total
4 hrs (Theory) 1 hr (Tutorial)	5	100	20	80	100

Unit I: Introduction to Real Time Systems: Real time systems, soft vs. hard real time systems, Concept of computer control, sequence, loop and supervisor control, centralized, hierarchical and distributed systems, applications of real time systems, hardware requirement for real time applications, specialized processors, interfaces, communications.

Unit II: Real Time Scheduling: Clock Driven approach, Weighted Round robin approach, Priority Driven approach, Concept of effective release time and deadline, Optimality and non optimality of EDF & LST.

Real Time operating System: Task management, Real Time Clock Handler, Code sharing, Resource Control, Inter task Communication and control.

Unit III: Design of Real Time System: Specification, Preliminary Design, multitasking Approach, monitors, Rendezvous.

Design Analysis: Introduction, Petri nets, Analysis of Petri Nets, Scheduling problem, Real Time Database, Real Time Vs General Purpose Databases, Transaction priorities and Aborts, Concurrency Control, Disk Scheduling Algorithms, Maintaining Serialization Consistency.

Unit IV: Programming Language and Tools: Desired language characteristics, Data typing, Control structures, Facilitating hierarchical decomposition , packages, Run time error handling, Overloading and generics, Multitasking, Low level programming, Task scheduling, Timing specifications, Programming environments, Run time support.

Unit V: Fault Tolerance Techniques: Introduction, Faults, Errors and Failures, Fault types, Detection and Containment, Redundancy, Integrated Failure Handling.

Unit VI: Reliability Evolutions: Introduction, Parameters, Reliability Models for Hardware, Software Error Models.

Commercial Real Time Systems: General concepts, Unix and Windows as RTOS.

Text Book:-

1. Real-Time Systems, Jane W. Liu, Pearson Education, 2001.

Reference Books:

1. Real-Time Systems: Theory and Practice, Rajib Mall, Pearson, 2008.
2. Real-Time Systems, Jane W. Liu, Pearson Education, 2001.
3. Real-Time Systems, Krishna and Shin, Tata McGraw Hill. 1999.

BECSE404T: Elective II: Software Architecture

Load	Credit	Total marks	Sessional marks	University marks	Total
4 hrs (Theory) 1 hr (Tutorial)	5	100	20	80	100

Unit I: Introduction: Software process and the role of modeling and analysis, software architecture and software design, architectural styles, architectural patterns, analysis of architectures, formal descriptions of software architectures, architectural description languages and tools, scalability and interoperability issues, web application architectures, case studies.

Unit II: Quality Attributes: Introduction to Quality Attributes, Need of quality attributes, Understanding quality attributes, architecture and quality attributes, achieving quality attributes. Quality attributes in software architecture templates. Deriving duality attributes for software architectures.

Unit III: Design patterns: Pattern Systems, Patterns and Software architecture. Software architecture and maintenance management; Design Patterns: history, principles and expectations. Study of representative patterns like Singleton, Factory, Adaptor, Facade, Proxy, Iterator, Observer, Mediator, Composite, chain of ways of using patterns.

Unit IV: Architectural styles: Conventional Architectural styles, Applied Architectures and Styles: Distributed and Networked, Architectures for Network-Based Applications Architectures, Decentralized Architectures, Service-Oriented Architectures and Web Services.

Unit V: Introduction to Middleware: Middleware components, programming models, implementation, systems qualities Moving from qualities to architecture and views ,Components and COTS, Economics- Driven Architecture, Software product line, Software architecture future.

Unit VI: Web Architecture: Introduction to Web Architectures, Client side technologies, Need of Client side technology in multi-tier architectures, Need of server side technology in multi-tier architectures, Server side technologies.

Text Book:

1. Software Architecture: Foundations, Theory, and Practice, Richard N. Taylor, Nenad Medvidovic and Eric Dashofy, Wiley, 2008.
2. Software Architecture - Perspectives on an Emerging Discipline, M. Shaw, Prentice Hall, 1996.
3. Software Architecture in Practice, Len Bass, Paul Clements and Rick Kazman, Pearson Education, 3rd Edition, 2012.

Reference Books:

1. Beginning J2EE 1.4: From Novice to Professional, James L. Weaver, Kevin Mukhar, Apress, 2004.
2. Design and Use of Software Architectures, Jan Bosch, Addison-Wesley, 2000.
3. Software Architecture: Organizational Principles and Pattern, Dikel D. M, et Al, Pearson, 2001.

BECSE404T: Mainframe Technologies

Load	Credit	Total marks	Sessional marks	University marks	Total
4 hrs (Theory) 1 hr (Tutorial)	5	100	20	80	100

Unit I: Evolution of Mainframe computer, key features , benefits ,Basic IBM Mainframe Architecture, Input/output Devices, Virtual/Real/Auxiliary Storage Concepts, MVS Storage & Control Blocks , Mainframe Operating System.

Unit II: Z/OS Operating System, concepts of Address space, Buffer management, Dataset organization, Virtual Storage Access Method, VSAM overview, VSAM Advantage and Disadvantage, CLUSTER, Data organization of VSAM, Internal Organization of VSAM, Accessing VSAM Data Set, Introduction to CICS , Execution of CICS Application.

Unit III: Job Control language, Basic concept of JCL, Job Processing, JCL Statements and procedures, Data Definition Statements, JOB Statement, EXEC Parameter Coding Data Sets and I/O on DD statement, In-Stream and Catalog Procedures , Generation Data Group (GDG) ,IBM utility programs. SORT/MERGE Utilities.

Unit IV: COBOL Programming Introduction, Evolution & features, COBOL divisions & sections COBOL statements, Redefines Rename & Usage clause, COBOL program structure, data types, COBOL verbs, conditional & sequence control verbs.

Unit V: COBOL File processing, File concepts, Physical & logical records, File Organization, File handling verbs, Sorting & merging of files, Table handling, Character handling, , COBOL subroutines.

Unit VI: Introduction to DB2 , DB2 Objects & Data Types, Structured Query Language, DB2 Interfaces, DB2 application development overview, Embedded SQL Programming, Cursor programming, SQL execution validation, Locking and Concurrency.

Text Book:

1. Introduction to the New Mainframe: z/OS Basics, Mike Ebbers, John Kettner, Wayne O' Brien and Bill Ogden, IBM Redbooks, 2011.
2. Information Systems through COBOL, Andreas Philippakis and Leonard Kazmier, McGraw-Hill, 1978.
3. DB2: The Complete Reference, Paul C. Zikopoulos and Roman B. Melnyk, Tata McGraw Hill, 2002.

Reference Books:

1. A Complete Guide to DB2 Universal Database, Don Chamberlin, Morgan Kauffman, 1998.
2. Structured COBOL Programming, 8th Edition, Stern, Wiley and Sons, 2007.

VIII SEMESTER CSE

BECSE406T: Distributed Operating System

Load	Credit	Total marks	Sessional marks	University marks	Total
4 hrs (Theory) 1 hr (Tutorial)	5	100	20	80	100

Unit I: Fundamentals: Introduction, Models and Features, Concept of Distributed Operating system, Issues in Design of a Distributed Operating System.

Foundations of Distributed System: Limitations of Distributed Systems, Lamport's logical clocks, Vector clocks, Causal ordering of messages, Global state recording, Cuts of a Distributed Computation, Termination Detection.

Unit II: Distributed Mutual Exclusion: Requirement of Mutual Exclusion Algorithm, Non Token Based Algorithms: Lamport's Algorithm, Ricard-Agrawala Algorithm, Maekawa's Algorithm, Token Based Algorithms: Suzuki-Kasami's Broadcast Algorithm, Singhal's Heuristic Algorithm, Raymond's Tree-Based Algorithm, Comparative Performance Analysis.

Unit III: Distributed Deadlock Detection: Introduction, Deadlock Handling strategies in Distributed System, Centralized and Distributed Deadlock Detection Algorithms.

Agreement protocols: Introduction, System Model, Classification of Agreement Problems, Solutions to the Byzantine Agreement Problem.

Unit IV: Distributed File system: Introduction to Distributed File System, Architecture, and Mechanism for Building Distributed File System.

Distributed Shared Memory: General Architecture of DSM systems, Algorithm for Implementing DSM, Memory coherence and Coherence Protocols.

Unit V: Distributed Scheduling: Introduction, Issues in Load Distributing, Components of a Load Distributing Algorithm, Load Distributing Algorithms: Sender-Initiated Algorithm, Receiver-Intiated algorithm, Symmetrically Initiated

Algorithm, Adaptive Algorithm, Requirements for Load Distributing Task Migration, Issues in Task Migration.

Unit VI: Failure Recovery: Recovery in concurrent systems, Consistent set of Checkpoints, Synchronous check pointing and Recovery, Asynchronous check pointing and Recovery.

Fault Tolerance: Introduction, Commit Protocols, Static Voting Protocol, Dynamic Voting Protocol.

Text Books:

1. Advanced Concepts in Operating Systems, Mukesh Singhal and Niranjan Shivaratri, Tata McGraw Hill, 2001.
2. Distributed Systems - Concepts and Design, Coulouris, Dollimore and Kindberg, 5th Edition, Addison-Wesley, 2012.

Reference Books:

1. Distributed Operating System, Andrew S. Tanenbaum, Pearson Education, 2003.

BECSE406P: Distributed Operating System Lab

Load	Credit	Total marks	Sessional marks	University marks	Total
2 hrs (Practical)	1	50	25	25	50

Practical based on the syllabus for the course **BECSE406T.**

BECSE407T: Information & Cyber Security

Load	Credit	Total marks	Sessional marks	University marks	Total
4 hrs (Theory) 1 hr (Tutorial)	5	100	20	80	100

Unit I: Need of Information Security: Legal, Ethical and Professional Issues Attributes of security- authentication, access control, confidentiality, authorization, integrity, non-reproduction.

OSI Security Architecture: attacks, services and mechanisms. Security Attacks, Security services, A model of Internetwork Security.

Conventional Encryption: Classical Encryption Techniques and Problems on classical ciphers, Security architecture.

Unit II: Introduction to Secret key and cryptography, Encrypt given messages using DES, AES, IDEA, Problems on cryptography algorithms, Principles, finite fields, stream cipher, block cipher modes of operation, DES, Triple DES, AES, IDEA, RC5, key distribution.

Unit III: Introduction to Public key and Cryptography, Encrypt given messages using ECC, Problems on key generation, cryptography algorithms Principles, Introduction to number theory, RSA- algorithm, security of RSA, Key management- Diffie-Hellman key exchange, man-in-the-middle attack, Elliptical curve cryptography

Unit IV: Message Authentication and Hash Functions: Authentication Requirements and Functions, Hash Functions and their Security, MD5 Message Digest Algorithm, Kerberos.

Key Management: Digital Certificates-Certificate types, X.509 Digital Certificate format, Digital Certificate in action, Public Key Infrastructure-Functions, PKI Architecture, Certificate Authentication.

Unit V: Introduction to Network, Transport and Periphery Security, Study of IPSEC, TLS, and SSL. Firewalls - design principles, trusted systems, Intrusion Detection System, Intrusion Prevention System. Implementation and analysis of IPSEC, TLS and SSL, Introduction to cryptography - Classical cryptography.

Unit VI: Software Vulnerability: Phishing, Buffer Overflow, Cross-site Scripting (XSS), SQL Injection.

Electronic Payment: Payment Types, Enabling Technologies-Smart Cards and Smart Phones, Cardholder Present E-Transaction-Attacks, Chip Card Transactions, Payment over Internet-Issues and Concerns, Secure Electronic Transaction, Online Rail Ticket Booking.

Electronic Mail Security: Pretty Good Privacy, S/MIME

Text Book:

1. Cryptography and network security - principles and practices, William Stallings, Pearson Education, 2002.

Reference Books:

1. Network Security and Cryptography, Bernard Menezes, Cengage Learning.
2. Information System Security, Nina Godbole, Wiley India, 2008.
3. Network security, private communication in a public world, Charlie Kaufman, Radia Perlman and Mike Speciner, Prentice Hall, 2002.
4. Security architecture, design deployment and operations, Christopher M. King and Curtis Patton, RSA press, 2001.
5. Network Security - The Complete Reference, Robert Bragg and Mark Rhodes, Tata McGraw Hill, 2004.

BECSE407P: Information & Cyber Security Lab

Load	Credit	Total marks	Sessional marks	University marks	Total
2 hrs (Practical)	1	50	25	25	50

Practical based on the syllabus for the course **BECSE407T.**

BECSE408T: Elective-III: Pattern Recognition

Load	Credit	Total marks	Sessional marks	University marks	Total
4 hrs (Theory) 1 hr (Tutorial)	5	100	20	80	100

Unit I: Introduction: Pattern Recognition Systems, Design Cycle, Applications of pattern recognition, Learning and Adaption-Supervised, Unsupervised and Reinforcement Learning.

Unit II: Probability: Introduction to Probability, Probability of events, Random variables, Probability Distributions, Joint Distribution and Densities, Moments of Random Variables, Estimation of Parameters from samples, Minimum Risk Estimators.

Unit III: Statistical Decision Making: Bayes' Decision Theory, Multiple Features, Conditionally Independent Features, Decision Boundaries, Unequal costs of Error, Estimation of Error Rates, Leaving-one-out Technique, Confusion Matrix, Characteristic Curves.

Unit IV: Classifiers: Hidden Markov Model, Support Vector Machine, Artificial Neural network-back Propagation Algorithm and Fuzzy based classifiers.

Unit V: Non Parametric Decision Making: Introduction**,** Histograms, Kernel and window Estimators, Nearest Neighbor classification Technique, Adaptive Decision Boundaries, Adaptive Discriminate Functions, Minimum Squared Error Discriminate Functions.

Unit VI: Clustering: Introduction, Hierarchical clustering, Partitional Clustering.

Text Book:

1. Pattern Recognition and Image Analysis, Earl Gose, Richard Johnsonbaugh and Steve Jost, PHI, 1996.

Reference Book:

1. Pattern Classification, Richard O Duda, Peter E. Hart and David G. Stork, John Wiley, 2000.

BECSE408T: Elective III: Soft Computing Techniques

Load	Credit	Total marks	Sessional marks	University marks	Total
4 hrs (Theory) 1 hr (Tutorial)	5	100	20	80	100

Unit I: Introduction to Neuro: Fuzzy and Soft Computing**:** Soft Computing Constituents and Conventional AI; Neuro-Fuzzy and Soft Computing Characteristics.

Fuzzy Sets: Introduction Set Theoretic Operations, MF Formulation and Parameterization, Fuzzy Union, Intersection and Complement.

Fuzzy Rules and Fuzzy Reasoning: Extension Principles and Fuzzy Relations, Fuzzy If-Then Rules; Fuzzy Reasoning.

Unit II: Fuzzy Inference Systems: Mamdani Fuzzy Models; Sugeno Fuzzy Models, Tsukamoto Fuzzy Models, Other Considerations.

Derivative-Free Optimization: Introduction, Genetic Algorithms; Simulated Annealing; Random Search, Downhill Simplex Search.

Unit III: Adaptive Networks: Introduction, Architecture; Feed-forward Network; Extended Back-propagation for Recurrent Networks; Hybrid Learning Rule. Supervised Learning Neural Networks, Perceptrons, Back-propagation Multi-layer Perceptrons, Radial Basis Function Networks.

Unit IV: Unsupervised Learning and Other Neural Networks: Competitive Learning Networks, Kohonen Self-Organizing Networks; Learning Vector Quantization; Hebbian Learning, Principal Component Networks, Hopfield Networks.

Unit V: Adaptive Neuro-Fuzzy Inference System**:** ANFIS Architecture, Hybrid Learning Algorithm, ANFIS as Universal Approximator.

Data Clustering Algorithms: K-Means Clustering; Fuzzy C-Means Clustering, Mountain Clustering Method; Subtractive Clustering.

Unit VI: Rulebase Structure Identification: Input Selection, Input Space partitioning, Rulebase Organization, Focus Set-based Rule Combination.

Applications: Printer Character Recognition, Hand-written Numeral Recognition, GA-based Fuzzy Filters.

Text Books:

1. Neuro-Fuzzy and Soft Computing – A Computational Approach to Learning and Machine Intelligence; Jyh-Shing Roger Jang, Chuen-Tsai Sun and Eiji Mizutani; Prentice Hall, 2004.
2. Artifical Intelligence and Soft Computing, Anindita Das, Shroff Publication.

Reference Books:

1. Fuzzy Logic with Engineering Applications; Timothy J. Ross; McGraw-Hill; 1997.
2. Genetic Algorithms: Search, Optimization and Machine Learning; Davis E. Goldberg; Addison Wesley; 1989.
3. Neural Networks, Fuzzy Logic and Genetic Algorithms; S. Rajasekaran and G. A. V. Pai; Prentice Hall of India; 2003.

BECSE408T: Elective III: Optimization Techniques

Load	Credit	Total marks	Sessional marks	University marks	Total
4 hrs (Theory) 1 hr (Tutorial)	5	100	20	80	100

Unit I: Introduction: Engineering applications of optimization. Design variables. Constraints, objectives function, variable bounds, statement and formulation of an optimization problem, Example of Optimization problems, classification of optimization problems, different optimization algorithms.

Unit II: Optimal Point: Local optimal point, global optimal point and inflection point.

Unit III: Single Variable Optimization Techniques: Optimality criterion, Bracketing method (Bounding phase method), Region elimination methods (Internal halving method, Golden section search method), Point estimation method (successive quadratic estimation methods), Gradient-based methods (Newton-Raphson method, Bisection method, secant, Cubic search method.), Root finding using optimization techniques.

Unit IV: Multivariable Optimization Techniques: Optimality criterion, Unidirectional search method, Direct Search method (Hooke-Jeeves Pattern Search method, Powell’s conjugate direction method), Gradient-based methods (Steepest descent method, Newton’s method, and Marquardt’s methods)

Unit V: Constrained Optimization Algorithms**:** Kuhn-Tucker conditions, Transformation method (Penalty function method), direct search for constrained minimization (variable elimination method, complex search method)

Unit VI: Linear Programming: Linear programming problems, Simplex method of linear programming techniques.

Text Book:

1. Optimization for Engineering Design: Algorithms and Examples, Kalyanmoy Deb, PHI Learning, 2004.

Reference Books:

1. Engineering Optimization: Theory and Practice, Singiresu S. Rao, John Wiley 2009.
2. Optimization of Chemical Processes, T.I. Edgar & D.M. Himmelblau, McGraw Hill.
3. Optimization: Theory and Practice, Beveridge and Schecter, McGraw Hill.

BECSE408T: Elective III: Clustering & Cloud Computing

Load	Credit	Total marks	Sessional marks	University marks	Total
4 hrs (Theory) 1 hr (Tutorial)	5	100	20	80	100

Unit I: Introduction to Cloud Computing: Introduction to Cloud Computing, History of Cloud Computing, Cloud service providers, Properties, Characteristics & Disadvantages of Cloud Computing, Pros and Cons of Cloud Computing, Benefits of Cloud Computing, Cloud computing vs. Cluster computing vs. Grid computing. Legal issues when using cloud models, challenges in cloud computing, Overview of Mobile Cloud.

Unit II: Cloud Computing Architecture: Cloud computing stack, Comparison with traditional computing architecture (client/server), Services provided at various levels, How Cloud Computing Works, Role of Networks in Cloud computing, protocols used, Role of Web services, Service Models (XaaS), Infrastructure as a Service (IaaS), Platform as a Service(PaaS), Software as a Service(SaaS), Virtualization Technology: Virtual machine technology, virtualization applications in enterprises, Pitfalls of virtualization, Infrastructure as a Service (Iaas)using OpenStack/OwnCloud.

Unit III: Big Data Analysis, Hadoop and Map Reduce: Introduction, Clustering Big Data, Classification of Big Data, Hadoop MapReduce Job Execution, Hadoop scheduling, Hadoop cluster setup, configuration of Hadoop, starting and stopping Hadoop cluster.

Unit IV: Security in Cloud: Cloud Security Challenges, Infrastructure Security, Network level security, Host level security, Application level security, data privacy, data security, application security, virtual machine security, Identity Access Management, Authentication in cloud computing, Client access in cloud, Cloud contracting Model, Commercial and business considerations.

Unit V: Application Development using C#: Understand object oriented concepts in C#.NET, Creation of UI and event handling, web page creation using ASP.NET, ADO.NET architecture, implementation of data seta, using ADO.NET in console application, using ADO.NET in web application.

Unit VI: Creating Cloud Application using Azure: Creating simple cloud application, configuring an application, creating virtual machine, deployment of application to Windows Azure Cloud, using Azure Storage Services, using Azure Table Service, deployment of application to the production environment.

Text Books:

1. Google Compute Engine, Mark Cohen and K. Hurley, O'Reilly, 2014.
2. Cloud Computing: Principles and Paradigms, Rajkumar Buyya, James Broberg and Andrzej M. Goscinski, Wiley, 2011
3. Cloud Computing, A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2014.
4. Microsoft Azure: Enterprise Application Development, R. J. Dudley and N. A. Duchene, SPD Publication.

Reference Books:

1. Cloud Computing using Windows Azure, B. M. Harwani, SPD Publication.
2. Cloud Computing, Implementation, Management and Security, J. W. Rittinghouse and J. F. Ransome, CRC Press.

BECSE409T: Elective IV: Advanced Wireless Sensor Networks

Load	Credit	Total marks	Sessional marks	University marks	Total
4 hrs (Theory) 1 hr (Tutorial)	5	100	20	80	100

Unit I: Introduction to Sensor networks: application Examples of available sensor nodes, Challenges for WSN's, Mobile ad hoc networks and wireless sensor networks, single node architecture. Sensor node hardware overview, Sensors and actuators, Energy consumption of sensor nodes

Unit II: Operating systems and execution environments: Programming paradigms and application programming interfaces, Structures of operating system and protocol stack. Dynamic energy and power management, TinyOS and neSc examples

Unit III: Network Architecture: Sensor network scenarios, Design principles for WSNs, Services interfaces of WSNs, Gateway concepts, Mac protocols: Fundamentals, Low duty cycle and Wakeup concepts, contention and schedule based protocols, IEEE 802.15.4 MAC Protocol.

Unit IV: Naming and Addressing: Fundamentals Address and Name management in WSN, assignment in MAC Addresses, content based and geographical addressing. Hierarchical networks by clustering, Adaptive node activity: geographic adaptive Fidelity (GAF).

Unit V: Routing protocols and content based networking: Broadcast and multicast protocols Geographic Routing, Mobile nodes, Data centric Routing, Distribution versus gathering of data-In-network processing, Data Aggregation, data centric storage.

Unit VI: **Application specific support:** Advanced in-network processing, security, Target detection and tracking, contour/edge detection.

Text Books:

1. Protocols and Architectures for Wireless Sensor Networks, Holger Karl, and Andreas Willig, Wiley, 2005.
2. Wireless Sensor Networks, Cauligi S. Raghavendra, Krishna Sivalingam and Taieb M. Znati, Springer, 2005.
3. Introduction to Wireless and Mobile Systems, Third edition, Dharma Prakash Agrawal and Qing-An Zeng, Thomson/Cengage Learning, 2010.

Reference Books:

1. Wireless and Personal Communications Systems, Vijay K. Grag and Joseph E. Wilkes, Prentice Hall, 1995.
2. Routing in the Internet, Christian Huitema, Prentice Hall, 1995.

BECSE409T: Elective IV: Digital Image Processing

Load	Credit	Total marks	Sessional marks	University marks	Total
4 hrs (Theory) 1 hr (Tutorial)	5	100	20	80	100

Unit I: Introduction: What is Digital Image Processing, Applications of Digital Image Processing, Fundamental Steps in Digital Image Processing, Components of Image Processing System.

Digital Image Fundamentals: Elements of Visual Perception, Image Sampling and Quantization, Basic Relationships between Pixels.

Intensity Transformations: Basic Intensity Transformation Functions, Piecewise-Linear Transformations.

Unit II: Spatial Filtering: Histogram Processing – Histogram Equalization, Histogram Specification, Using Histogram Statistics for Image Enhancement, Fundamental of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters.

Color Image Processing: Color Fundamentals, Color Models – RGB Model, CMY and CMYK Model, HSI Model, Pseudo-color Image Processing – Intensity Slicing, Intensity-to-Color Transformations.

Unit III: Filtering in Frequency Domain: Preliminary Concepts, Discrete Fourier Transform of One Variable, Extensions to Functions of Two Variables, Properties of 2-D DFT, Basics of Filtering in Frequency Domain, Image Smoothing using Frequency Domain Filters, Image Sharpening using Frequency Domain Filters; Selective Filtering.

Unit IV: Image Restoration and Reconstruction: Model of Image Degradation/Restoration Process, Noise Model, Restoration in the Presence of Noise only – Spatial Filtering, Periodic Noise Reduction by Frequency Domain Filtering, Linear Position Invariant Degradations, Inverse Filtering, Wiener Filtering; Constrained Least Squares Filtering, Geometric Mean Filter.

Unit V: Image Compression: Fundamentals – Coding Redundancy, Spatial-Temporal Redundancy, Measuring Image Information, Fidelity Criteria, Image

Compression Models, Basic Compression Methods – Huffman Coding, Arithmetic Coding, Run-length Coding, LZW Coding; Digital Image Watermarking.

Unit VI: Image Segmentation: Point, Line and Edge Detection – Detection of Isolated Points, Line Detection, Edge Models, Basic Edge Detection, The Marr-Hildreth Edge Detector, The Canny Edge Detector, Edge Linking and Boundary Detection; Thresholding – Basic Global Thresholding, Otsu's Method; Region-Based Segmentation – Region Growing, Region Splitting and Merging.

Representation and Description: Boundary Following; Chain Codes; Polygonal Approximations using MPP; Signatures; Skeletons; Shape Numbers; Topological Descriptors.

Text Books:

1. Digital Image Processing; Rafael C. Gonzalez and Richard E. Woods; Third Edition; Pearson Education (India); 2014.
2. Digital Image Processing and Analysis; B. Chanda and D. Dutta Majumdar; Prentice Hall of India, 2001.
3. Digital Image Processing; S. Jayaraman, S. Essakkirajan and T. Veerakumar; Tata McGraw Hill; 2009.

Reference Books:

1. Digital Image Processing and Computer Vision; Milan Sonka, Vaclav Hlavac and Roger Boyle; Cengage Learning; 2008.
2. Digital Image Processing; Kenneth R. Castleman; Pearson Education (India); 1996.
3. Fundamentals of Digital Image Processing; Anil K. Jain; PHI Learning; 2013.

BECSE409T: Elective IV: Natural Language Processing

Load	Credit	Total marks	Sessional marks	University marks	Total
4 hrs (Theory) 1 hr (Tutorial)	5	100	20	80	100

Unit I: Introduction: NLP tasks in syntax, semantics, and pragmatics, Key issues &Applications such as information extraction, question answering, and machine translation, the problem of ambiguity, the role of machine learning, brief history of the field.

Unit II: N-gram Language Models : Role of language models, Simple N-gram models, Estimating parameters and smoothing, Evaluating language models, Part Of Speech Tagging and Sequence Labeling Lexical syntax, Hidden Markov Models, Maximum Entropy models.

Unit III: Syntactic parsing: Grammar formalisms and tree banks, Efficient parsing for context-free grammars (CFGs), Statistical parsing and probabilistic CFGs (PCFGs), Lexicalized PCFGs.

Unit IV: Semantic Analysis: Lexical semantics and word-sense disambiguation, Compositional semantics, Semantic Role labeling and Semantic Parsing.

Unit V: Information Extraction (IE): Named entity recognition and relation extraction, IE using sequence labeling, automatic summarization Subjectivity and sentiment analysis.

Unit VI: Machine Translation (MT): Basic issues in MT, Statistical translation, word alignment, phrase-based translation, and synchronous grammars.

Text Books:

1. Speech and Language Processing, D. Jurafsky and R. Martin, 2nd edition, Pearson Education, 2009.
2. Language Implementation Patterns, Terence Parr, Pragmatic Programmers, 2010.

Reference Books:

1. Natural Language Understanding, Allen James, Second Edition, Benjamin/Cumming, 1995.
2. NLP: A Paninian Perspective, Akshar Bharati, Vineet Chaitanya, and Rajeev Sangal, Prentice Hall, New Delhi, 1994.

BECSE409T: Elective IV: Digital Forensics

Load	Credit	Total marks	Sessional marks	University marks	Total
4 hrs (Theory) 1 hr (Tutorial)	5	100	20	80	100

Unit I: Introduction & evidential potential of digital devices – Key developments, Digital devices in society, Technology and culture, Comment, Closed vs. open systems, evaluating digital evidence potential. Device Handling & Examination Principles: Seizure issues, Device identification, Networked devices, Contamination, Previewing, Imaging, Continuity and hashing, Evidence locations.

Unit II: A seven element security model, A developmental model of digital systems, Knowing, Unknowing, Audit and logs, Data content, Data context. Internet & Mobile Devices, The ISO / OSI model, the internet protocol suite, DNS, Internet applications, Mobile phone PDAs, GPS, Other personal technology.

Unit III: Introduction to Computer Forensics, Use of Computer Forensics in Law Enforcement, Computer Forensics Assistance to Human Resources / Employment Proceedings, Computer Forensics Services, Benefits of Professional Forensics Methodology, Steps Taken by Computer Forensics Specialists, Who Can Use Computer Forensic Evidence?, Case Histories, Case Studies.

Unit IV: Types of Military Computer Forensic Technology, Types of Law Enforcement: Computer Forensic Technology, Types of Business Computer Forensic Technology, Specialized Forensics Techniques, Hidden Data and How to Find It, Spyware and Adware, Encryption Methods and Vulnerabilities, Protecting Data from Being Compromised, Internet Tracing Methods.

Unit V: Homeland Security Systems, Occurrence of Cyber Crime, Cyber Detectives, Fighting Cyber Crime with Risk Management Techniques, Computer Forensics Investigative Services, Forensic Process Improvement, Case Histories.

Unit VI: The violation of privacy during information words. The individual exposed. Advanced computer Forensics systems and future directions-advanced, encryption, hacking, advanced trackers, case studies.

Text Books:

1. Digital Forensics, Angus M. Marshall, 2nd Edition, Wiley-Blackwell, John Wiley and Sons, 2008.
2. Computer forensics: Computer Crime Scene Investigation, John R. Vacca, 2nd Edition, Charles River Media, 2002.

Reference Books:

1. Recovering and examining computer forensic evidence, Michael G. Noblett; Mark M. Pollitt and Lawrence A. Presley, 2000.
2. A Formalization of Digital Forensics, R Leigland, 2004.
3. Evaluating Commercial Counter-Forensic Tools, M. Geiger, DFRWS-2005.
4. Cyber Forensics: A Field Manual for Collecting, Examining, and Preserving Evidence of Computer Crimes, Albert J. Marcella and Robert S. Greenfield, Auerbach Publications, 2007.
5. Handbook of Computer Crime Investigation: Forensic Tools and Technology, Eoghan Casey, Academic Press, 2001.
6. Privacy Protection and Computer Forensics, Second Edition, Michael Caloyannides, Artech House, 2004.
7. Computer Forensics: Incident Response Essentials, Warren G. Kruse and Jay G. Heiser, Addison Wesley, 2001.

Rashtrasant Tukadoji Maharaj Nagpur University

Formerly Known as Nagpur University

SCHEME OF EXAMINATION FOR

B.E. SEVENTH SEMESTER (ELECTRONICS ENGINEERING)

Sub. Code	Board	SUBJECT	Work Load				Credit				Marks				
											Theory		Practical		Total Marks
			L	P	T	Total	L	P	T	Total	Internal	University	Internal	University	
BEENE701T	Electronics	DSP Processor & Architecture	4	0	1	5	4	0	1	5	20	80	0	0	100
BEENE701P	Electronics	DSP Processor & Architecture	0	2	0	2	0	1	0	1	0	0	25	25	50
BEENE702T	Electronics	Embedded system	4	0	1	5	4	0	1	5	20	80	0	0	100
BEENE702P	Electronics	Embedded system	0	2	0	2	0	1	0	1	0	0	25	25	50
BEENE703T	Electronics	Optical Communication	4	0	0	4	4	0	0	4	20	80	0	0	100
BEENE704T	Electronics	Advanced Digital System Design	4	0	1	5	4	0	1	5	20	80	0	0	100
BEENE704P	Electronics	Advanced Digital System Design	0	2	0	2	0	1	0	1	0	0	25	25	50
BEENE705T	Electronics	Elective-I	3	0	1	4	3	0	1	4	20	80	0	0	100
BEENE706P	Electronics	Project Seminar	0	2	0	2	0	2	0	2	0	0	50	0	50
Total			**19**	**8**	**4**	**31**	**19**	**5**	**4**	**28**	**100**	**400**	**125**	**75**	**700**

Elective-I – 1. Digital Image Processing 2. .Mobile Communication 3. Biomedical Instrumentation 4.Random Signal Theory

SCHEME OF EXAMINATION FOR

B.E. EIGHTH SEMESTER (ELECTRONICS ENGINEERING)

Sub. Code	Board	SUBJECT	Work Load				Credit				Marks				
											Theory		Practical		Total Marks
			L	P	T	Total	L	P	T	Total	Internal	University	Internal	University	
BEENE801T	Electronics	Microelectromechanical System & System on Chip	4	0	0	4	4	0	0	4	20	80	0	0	100
BEENE802T	Electronics	Computer Communication Network	4	0	1	5	4	0	1	5	20	80	0	0	100
BEENE802P	Electronics	Computer communication Network	0	2	0	2	0	1	0	1	0	0	25	25	50
BEENE803T	Electronics	CMOS VLSI Design	4	0	0	4	4	0	0	4	20	80	0	0	100
BEENE803P	Electronics	CMOS VLSI Design	0	2	0	2	0	1	0	1	0	0	25	25	50
BEENE804T	Electronics	Elective-II	3	0	1	4	3	0	1	4	20	80	0	0	100
BEENE805T	Electronics	Elective-III	3	0	1	4	3	0	1	4	20	80	0	0	100
BEENE806P	Electronics	Project	0	6	0	6	0	6	0	6	0	0	75	75	150
Total			18	10	3	31	18	8	3	29	100	400	125	125	750

Elective-II – 1. Wireless Sensor Network 2. Nanotechnology 3. Fuzzy Logic and Neural Networks 4. Satellite Communication

Elective-III – 1.Artificial Intelligence 2. Robotics & Automation 3.Speech Processing 4.Data Compression & Encryption

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SCHEME OF EXAMINATION FOR

B.E. SEVENTH SEMESTER (ELECTRONICS & COMMUNICATION / ELECTRONICS & TELECOMMUNICATION ENGINEERING)

Sub Code	Board	SUBJECT	Work Load				Credit				Marks				
											Theory		Practical		Total Marks
			L	P	T	Total	L	P	T	Total	Internal	University	Internal	University	
BEECE701T/ BEETE701T	Electronics	DSP Processor & Architecture	4	0	1	5	4	0	1	5	20	80	0	0	100
BEECE701P/ BEETE701P	Electronics	DSP Processor & Architecture	0	2	0	2	0	1	0	1	0	0	25	25	50
BEECE702T/ BEETE702T	Electronics	Television & Video Engineering	4	0	1	5	4	0	1	5	20	80	0	0	100
BEECE702P/ BEETE702P	Electronics	Television & Video Engineering	0	2	0	2	0	1	0	1	0	0	25	25	50
BEECE703T/ BEETE703T	Electronics	Optical Communication	4	0	0	4	4	0	0	4	20	80	0	0	100
BEECE704T/ BEETE704T	Electronics	Advanced Digital System Design	4	0	1	5	4	0	1	5	20	80	0	0	100
BEECE704P/ BEETE704P	Electronics	Advanced Digital System Design	0	2	0	2	0	1	0	1	0	0	25	25	50
BEECE705T/ BEETE705T	Electronics	Elective-I	3	0	1	4	3	0	1	4	20	80	0	0	100
BEECE706P/ BEETE706P	Electronics	Project Seminar	0	2	0	2	0	2	0	2	0	0	50	0	50
		Total	**19**	**8**	**4**	**31**	**19**	**5**	**4**	**28**	**100**	**400**	**125**	**75**	**700**

Elective-I – 1. Fuzzy Logic & Neural Network 2. Microelectromechanical Systems and System On Chip 3. Data Compression & Encryption 4. VLSI Signnal Processing

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SCHEME OF EXAMINATION FOR

B.E. EIGHTH SEMESTER (ELECTRONICS & COMMUNICATION / ELECTRONICS & TELECOMMUNICATION ENGINEERING)

Sub Code	Board	SUBJECT	Work Load				Credit				Marks				
											Theory		Practical		Total Marks
			L	P	T	Total	L	P	T	Total	Internal	University	Internal	University	
BEECE801T/ BEETE801T	Electronics	Microwave & Radar Engineering	4	0	0	4	4	0	0	4	20	80	0	0	100
BEECE801P/ BEETE801P	Electronics	Microwave & Radar Engineering	0	2	0	2	0	1	0	1	0	0	25	25	50
BEECE802T/ BEETE802T	Electronics	Computer Communication Network	4	0	1	5	4	0	1	5	20	80	0	0	100
BEECE802P/ BEETE802P	Electronics	Computer Communication Network	0	2	0	2	0	1	0	1	0	0	25	25	50
BEECE803T/ BEETE803T	Electronics	Wireless & Mobile Communication	4	0	0	4	4	0	0	4	20	80	0	0	100
BEECE804T/ BEETE804T	Electronics	Elective-II	3	0	1	4	3	0	1	4	20	80	0	0	100
BEECE805T/ BEETE805T	Electronics	Elective-III	3	0	1	4	3	0	1	4	20	80	0	0	100
BEECE806P/ BEETE806P	Electronics	Project	0	6	0	6	0	6	0	6	0	0	75	75	150
Total			**18**	**10**	**3**	**31**	**18**	**8**	**3**	**29**	**100**	**400**	**125**	**125**	**750**

Elective-II – 1. Wireless Sensor Network 2. Embedded System 3.Digital Image Processing 4. Artificial Intelligence

Elective-III – 1.Random Signal Theory 2.Robotics & Automation 3. Satellite Communication 4.CMOS VLSI Design

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY LONERE.

ELECTRICAL ENGINEERING DEPARTMENT

Second Year B. Tech. Electrical Engineering / Electrical Engineering (Electronics and Power)/ Electrical & Electronics Engg / Electrical & Power Engineering

With effect from November 2018

Teaching & Evaluation scheme of second year B. Tech. Electrical Engineering / Electrical Engineering (Electronics and Power)/ Electrical & Electronics Engg / Electrical & Power Engg .

III SEMESTER.									
S.No	Course Code	Course Title	Teaching Scheme			Evaluation Scheme			Credits
			L	T	P	MSE	CA	ESE	
1	BTBSC301	Engineering Mathematics-III	3	1	0	20	20	60	4
2	BTEEC302	Network Analysis and Synthesis	2	1	0	20	20	60	3
3	BTEEC303	Fluid Mechanics and Thermal Engineering	2	1	0	20	20	60	3
4	BTEEC304	Measurement and Instrumentation	2	1	0	20	20	60	3
5	BTEEE305A BTEEE305B BTEEE305C	Elective –I (A) Electrical Engineering Materials (B) Applied Physics (C) Signals and Systems	3	0	0	20	20	60	3
6	BTHM3401	Basic Human Rights	2	0	0	-	20	-	Audit
7	BTHM306	Engineering Economics	2	0	0	20	20	60	2
8	BTEEL307	Network Analysis and Synthesis Lab	0	0	2	-	60	40	1
9	BTEEL308	Measurement and Instrumentation Lab	-	0	4	-	60	40	2
10	BTEEM309	Electrical workshop/ Mini project	-	-	2	-	60	40	1
11	BTEEF310	Field Training/ Internship/ Industrial Training Evaluation						50	1
		TOTAL	16	04	08	120	320	530	23
IV SEMESTER.									
1	BTEEC401	Electrical Machine-I	3	1	0	20	20	60	4
2	BTEEC402	Power System-I	2	1	0	20	20	60	3
3	BTEEC403	Electrical Installation and Estimation	2	1	0	20	20	60	3
4	BTEEC404	Numerical Methods and Programming	2	1	0	20	20	60	3
5	BTID405	Product Design Engineering	1	0	2	30	30	40	2
6	BTEEE-406A BTEEE-406B BTEEE-406C	Elective –II (A) Solid State Devices (B) Analog and Digital electronics (C) Electromagnetic Theory	2	0	0	20	20	60	2
7	BTEEOE407-A BTEEOE407-B BTEEOE407-C	Elective –III (A) Industrial safety (B) Introduction to Non-Conventional energy sources (C) Software Techniques.	2	0	0	20	20	60	2
8	BTEEL408	Electrical Machine-I Lab	0	0	2	-	60	40	1
9	BTEEL409	Power System lab-I	0	0	2	-	60	40	1
10	BTEEL410	Numerical Methods and Programming Lab	-	0	2	-	60	40	1
11	BTEEEL411	Elective-II Lab	0	0	2	-	60	40	1
12		Field Training / Internship/ Industrial Training (minimum 4 weeks which can be completed partially in Third semester and Fourth Semester or in at one time.)							Credits to be evaluated in V Sem
	TOTAL		15	04	10	140	380	580	23

Semester III

BTBSC301. Engineering Mathematics III

Teaching Scheme	**Examination Scheme**
Theory : 03 Hrs/Week	Mid-term Test : 20 Marks
Tutorial : 01 Hr/Week	Internal Assessment: 20 Marks
	End Semester Exam: 60 Marks
	Duration: 03 Hrs.

Course Contents:

Unit 1: Laplace Transform

Definition – conditions for existence ; Transforms of elementary functions ; Properties of Laplace transforms - Linearity property, first shifting property, second shifting property, transforms of functions multiplied by t^n, scale change property, transforms of functions divided by t, transforms of integral of functions, transforms of derivatives ; Evaluation of integrals by using Laplace transform ; Transforms of some special functions- periodic function, Heaviside-unit step function, Dirac delta function.

[07 Hours]

Unit 2: Inverse Laplace Transform

Introductory remarks ; Inverse transforms of some elementary functions ; General methods of finding inverse transforms ; Partial fraction method and Convolution Theorem for finding inverse Laplace transforms ; Applications to find the solutions of linear differential equations and simultaneous linear differential equations with constant coefficients.

[07 Hours]

Unit 3: Fourier Transform

Definitions – integral transforms ; Fourier integral theorem (without proof) ; Fourier sine and cosine integrals ; Complex form of Fourier integrals ; Fourier sine and cosine transforms ; Properties of Fourier transforms ; Parseval's identity for Fourier Transforms.

[07 Hours]

Unit 4: Partial Differential Equations and Their Applications

Formation of Partial differential equations by eliminating arbitrary constants and functions; Equations solvable by direct integration; Linear equations of first order (Lagrange's linear equations); Method of separation of variables – applications to find solutions of one dimensional heat flow equation $\left(\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}\right)$, and two dimensional heat flow equation (i.e. Laplace equation : $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$).

[07 Hours]

Unit 5: Functions of Complex Variables (Differential calculus)

Limit and continuity of f(z); Derivative of f(z) ; Analytic functions; Cauchy- Riemann equations in Cartesian and polar forms; Harmonic functions in Cartesian form; Mapping: Translation, magnification and rotation, inversion and reflection , bilinear transformation; Conformal mapping.

[07 Hours]

Unit 6: Functions of Complex Variables (Integral calculus)

Cauchy's integral theorem; Cauchy's integral formula; Residues; Cauchy's residue theorem (All theorems without roofs).

[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 III) by Dr. B. B. Singh, Synergy Knowledge ware, Mumbai.
4. A Text Book of Applied Mathematics (Vol I & II) by P. N. Wartikar and J. N. Wartikar, Pune Vidyarthi Griha Prakashan, Pune.
5. Higher Engineering Mathematics by H. K. Das and Er. Rajnish Verma, S. Chand & CO. Pvt. Ltd., New Delhi.

Reference Books

1. Higher Engineering Mathematics by B. V. Ramana, Tata McGraw-Hill Publications, New Delhi.
2. A Text Book of Engineering Mathematics by Peter O' Neil, Thomson Asia Pte Ltd., Singapore.
3. Advanced Engineering Mathematics by C. R. Wylie & L. C. Barrett, Tata Mcgraw-Hill Publishing Company Ltd., New Delhi.
4. Integral Transforms and Their Engineering Applications by Dr. B. B. Singh, Synergy . Knowledge ware, Mumbai.
5. Integral Transforms by I. N. Sneddon, Tata McGraw-Hill, New York.

General Instructions:

1. The tutorial classes in Engineering Mathematics-III 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.

BTEEC 302. NETWORK ANALYSIS AND SYNTHESIS.

Teaching scheme:	**Examination Scheme:**
Theory: 2 hrs	Mid-term test: 20 Marks
Tutorial: 1 hr	Internal Assessment: 20 Marks
Total credit: 3	End semester exam: 60 Marks

Pre requisite	Basic electrical engineering	
Course Outcome	To review basic components of electric network. To design and develop network equations and their solutions. To apply Laplace theorem for electric network analyses To analyze AC circuit.	
Unit	Contents	Contact Hrs
1	Active & Passive Circuit Element: Independent & dependent voltage & current sources, R, L, C & mutual inductance circuit parameters, Their mathematical modes, Voltage current power relations. Classification of element: Lumped distributed, Linear & non-linear, Unilateral, Bilateral, Time invariant & variant, Pace invariant & variant, Super position, Thevenin's, Norton's Reciprocity, Maximum power transfer, Substitution, Tellegen's theorem.	6
2	Network Equations: Network topology, Graph, Tree, Branches, Chords, Equilibrium equation on loop basis & node basis Number of network equation required, Choice between nodal & loop analysis, Source transformation, Network mutual inductance, Dot conventions, Concept of super mesh, Super node Concept of duality & dual networks.	6
3	Solution of Network Equations: Classification solution of first, Second order differential equations of series & parallel R-L, R-C, R-L-C circuits, General & particular solutions, Particular integral & complimentary functions, Time constant, Mathematical analysis of circuit transients, initial conditions in network, Procedure of evaluality, Conditions in network problems, Solution of D.C. resistive network & A. C. sinusoidal steady state networks, Writing loop equations, Node equations directly in matrices form. Numericals	6
4	Application of Laplace's Transform: Solution of differential equation using Laplace transform, Unit step, Impulse & ramp functions, Laplace transform of singular & shifted function, Convolution integral, Concept of complex frequency, Transform impedance & transform admittance, Series & parallel combination of these transform networks.	6
5	Two port network: Terminals& terminal pairs, Driving points & transfer admittance, Transfer functions, Concept of poles & zeroes, Two port networks, Z, Y & the transmission parameters relationship between parameter sets.	6
6	Sinusoidal Steady State A. C. Circuit: R-L-C series circuits, Series resonance Variation of Z with frequency, maximum value of VC & VL, Magnification, Bandwidth, Q factor. Parallel Resonance: Resonance frequency for tank circuit frequency, Locus diagram of series R-L, R-C with variable R & X. Filter: Introduction classification, Low pass, High pass, Band pass & band reject filter, active & passive filters. Application of Fourier series, Expansion for periodic & non-sinusoidal waveforms.	6
	Ref Books: 1. Mac.E Van Valkenburg, "Network Analysis", 2. Franklin Fa-Kun. Kuo, "Network Analysis & Synthesis", John Wiley & Sons. 3. M. L. Soni, J. C. Gupta, "A Course in Electrical Circuits and Analysis", 4. Mac.E Van Valkenburg, "Network Synthesiss", 5. Joseph A. Edminister, Mahmood Maqvi, "Theory and Problems of Electric Circuits", Schaum's Outline Series,	

BTEEC 303. FLUID MECHANICS AND THERMAL ENGINEERING.

Teaching scheme:	**Examination Scheme:**
Theory: 2 hrs	Mid-term test: 20 Marks
Tutorial: 1hr	Internal Assessment: 20 Marks
Total credit: 3	End semester exam: 60 Marks

Pre requisite	Basic Mechanical engineering	
Course Outcome	To introduce properties of fluid and hydraulic measurement To understand dynamics of fluid flow To understand basic concepts of IC engines To understand concept of refrigeration and air conditioning	
Unit	Contents	Contact Hrs
1	Introduction to properties of fluids & hydraulic measurements (pressure at plane & curved surfaces, criteria of pressure), Fluid kinematics and dynamics & simple numerical.	6
2	Flow through pipe Laminar flow, Haugen Poisellie's equation Turbulent flow, Darcy Weisbach formula, Friction factor, use of Moddys Diagram only, Pipes in series & parallel, minor losses. Introduction to reciprocating and centrifugal pumps, their characteristics and applications	6
3	Internal Combustion Engines: Introduction to First Law & second Law of Thermodynamics, Concept of Entropy & Enthalpy Classification Otto, Diesel & air-fuel cycles, Constructional details of two stroke, four stroke engines, study of various systems such as fuel supply, ignition cycle, over heating, cooling, lubrication, calculation of IP, BP, MEP, efficiencies, heat balance, engine trial, performance, gas turbine, classification, cycles, performance improvement .	6
4	Air compressors: Classification, principle of operation of reciprocating & rotary compressors, Constructional details of single & multi stage compressor, work input, P-V diagram, efficiencies, improving compressor performance, reciprocating type only, use of compressed air	6
5	Refrigeration & Air conditioning: Refrigeration: Different systems, principle of cycles of operations of vapour compression & vapour absorption systems, COP calculations of vapour compression refrigeration system, refrigerants, desirable & undesirable properties, application of refrigeration.	6
6	Air conditioning: Psychrometry, DBT, WBT, RH, Psychometric chart, air conditioning processes such as heating, cooling, humidification, dehumidification, study of central air conditioning plant & its control, application of air conditioning.	6
	Ref Books: 1. Joel Reyner, "Engineering Thermodynamics",(Longman Publications) 2. Nag P. K., "Engineering Thermodynamics", (Tata McGraw Hill Publications) 3. Arora C.P, "Refrigeration & Air Conditioning", (Tata McGraw Hill Publications) 4. Eastop T. D. & Mcconkey A., "Applied Thermodynamics For Engineering Technologists" (Longman Publications) 5. Modi P.N & Seth S.M, "Hydraulic Fluid Mechanics",(Standard Book House Publications) 6. Lewitt W., "Hydraulic & Fluid Mechanics",(Sir Issac Pitman Publications),10th Edition	

BTEEC 304 MEASUREMENT AND INSTRUMENTATION

Teaching scheme:
Theory: 2 hrs
Tutorial: 1 hr
Total credit: 3

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Pre requisite	Basic electrical engineering	
Course Outcome	To understand philosophy of measurement. To understand different methods analog and digital measurement. To study principle of construction and operation of different transducer and dismay methods.	
Unit	Contents	Contact Hrs
1	Philosophy Of Measurement- Methods of Measurement, Measurement System, Classification of instrument system, Characteristics of instruments & measurement system, Errors in measurement & its analysis, Standards.	6
2	Analog Measurement of Electrical Quantities – Electro dynamic, Thermocouple, Electrostatic & Rectifier type Ammeters & Voltmeters, Electro dynamic Wattmeter, Three Phase Wattmeter, Power in three phase system, errors & remedies in wattmeter and energymeter. Instrument Transformer and their applications in the extension of instrument range, Introduction to measurement of speed, frequency and power factor	6
3	Measurement of Parameters - Different methods of measuring low, medium and high resistances, measurement of inductance & capacitance with the help of AC Bridges, Q Meter	6
4	Digital Measurement of Electrical Quantities-Concept of digital measurement, block diagram Study of digital voltmeter, frequency meter Power Analyzer and Harmonics Analyzer; Electronic Multimeter.	6
5	Transducers: Definition - different types of transducers – criteria for selection –general characteristics–dynamic characteristics – transducers for measurement of displacement (RVDT &LVDT), speed, angular rotation, altitude, force, torque, humidity and moisture, pressure, strain and temperature (Thermocouple and RTD method), Hall Effect transducer and applications Instrumentation amplifiers – differential amplifiers) Data transmission and telemetry – methods of data transmission, General telemetry systems – Digital methods of frequency, phase, time and period measurements.	6
6	Display methods, recorders: Display methods and devices – different types of recorders – galvanometric recorders – pen driving system– magnetic recorders – digital recorders, digital storage oscilloscope (Block Diagram, theory and applications only)	6
	Reference Books: 1. A.K.Sawhney, A course in Elect. & Electronic Measurement and Instrumentation, Dhapat Rai & Co. 2. Golding & Widis, Electrical Measurement and Measurement instrument, Wheelar Books H.S. Kalsi, Electronic Instruments, Tata Mc-Graw hill 3.Carr, Elements of Electronic Instrumentation and Measurement, Pearson Education. 4. D. Patranabis, Sensors & Transducers, PHI. 5. A.J. Bouwens, Digital Instrumentation, Tata Mc-Graw hill. 6. A.D. Heltric & W.C. Copper, Modern Electronic instrumentation & Measuring instruments, Wheeler Publication. 7. H.K.P. Neubert, Instrument transducers, Oxford University press.	

BTHM3401 - Basic Human Rights

Teaching scheme: Examination Scheme:
Theory: 2 hrs
Total credit: Audit Continuous Assessment: 50 Marks

Pre requisite		
Course Objective		
Course Outcome	To study concept of time value of money To study about demand in detail To understand Meaning of Production and factors of production, To understand dif. Concept about market	
Unit	Contents	Contact Hrs
1	The Basic Concepts: Individual, Group, Civil Society, State, Equality, Justice, Human Values: - Humanity, Virtues, Compassion.	6
2	Human Rights and Human Duties: Origin, Civil and Political Rights, Contribution of American Bill of Rights, French Revolution, Declaration of Independence, Rights of Citizen, Rights of working and Exploited people, Fundamental Rights and Economic program, India's Charter of freedom	6
3	Society, Religion, Culture, and their Inter-Relationship: Impact of Social Structure on Human behaviour, Roll of Socialization in Human Values, Science and Technology, Modernization, Globalization, and Dehumanization.	6
4	Social Structure and Social Problems: Social and Communal Conflicts and Social Harmony, Rural Poverty, Unemployment, Bonded Labour, Migrant workers and Human Rights Violations, Human Rights of mentally and physically challenged.	6
5	State, Individual Liberty, Freedom and Democracy: The changing of state with special reference to developing countries, Concept of development under development and Social action, need for Collective action in developing societies and methods of Social action, NGOs and Human Rights in India: - Land, Water, Forest issues.	6
6	Human Rights in Indian Constitution and Law: The constitution of India: (i) Preamble (ii) Fundamental Rights (iii) Directive principles of state policy (iv) Fundamental Duties (v) Some other provisions Universal declaration of Human Rights and Provisions of India, Constitution and Law, National Human Rights Commission and State Human Rights Commission	6
	Reference Books: 1. Shastry, T. S. N., India and Human rights: Reflections, Concept Publishing Company India (P Ltd.), 2005. 2. Nirmal, C.J., Human Rights in India: Historical, Social and Political Perspectives (Law in India), Oxford India.	

BTHM306. ENGINEERING ECONOMICS

Teaching scheme:
Theory: 2 hrs
Total credit: 2

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Pre requisite		
Course Outcome	To study concept of time value of money To study about demand in detail To understand Meaning of Production and factors of production, To understand dif. Concept about market	
Unit	Contents	Contact Hrs
1	Introduction to the subject: Micro and Macro Economics, Relationship between Science, Engineering, Technology and Economic Development. Production Possibility Curve, Nature of Economic Laws.	4
2	Time Value of Money: concepts and application. Capital budgeting; Traditional and modern methods, Payback period method, IRR, ARR, NPV, PI (with the help of case studies)	4
3	Meaning of Demand, Law of Demand, Elasticity of Demand; meaning, factors effecting it and its practical application and importance. Demand forecasting (a brief explanation)	4
4	Meaning of Production and factors of production, Law of variable proportions and returns to scale. Internal and external economies and diseconomies of scale. Concepts of cost of production, different types of costs; accounting cost, sunk cost, marginal cost, Opportunity cost. Break even analysis, Make or Buy decision (case study). Relevance of Depreciation towards industry.	5
5	Meaning of market, types of market, perfect competition, Monopoly, Monopolistic, Oligopoly. (Main features). Supply and law of supply, Role of demand and supply in price determination.	4
6	Indian Economy, nature and characteristics. Basic concepts; fiscal and monetary policy, LPG, Inflation, Sensex, GATT, WTO and IMF. Difference between Central bank and Commercial banks	2
	Reference Books: 1. Chopra P. N., Principle of Economics, Kalyani Publishers 2. Dewett K. K., Modern economic theory, S. Chand 3. H. L. Ahuja., Modern economic theory, S. Chand 4. Dutt Rudar & Sundhram K. P. M., Indian Economy 5. Mishra S. K., Modern Micro Economics, Pragati Publications	

BTEEE 305A . ELECTRICAL ENGINEERING MATERIALS.

Teaching scheme:
Theory: 3 hrs
Total credit: 3

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Pre requisite	Basic electrical engineering, Physics, Chemistry	
Course Outcome	To study about crystal structure To understand magnetic material structure To study about conducting and superconducting materials To study dielectric and nano materials.	
Unit	Contents	Contact Hrs
1	Crystallography Crystal directions and planes, Diatomic Crystal (CsCl, NaCl, Diamond, BaTiO3) Crystal imperfection, Point defects, Line defects, Surface and Volume defects, Structure properties relationship, structure determination by X-ray diffraction.	6
2	Magnetic Materials Origin of magnetization using atomic theory, classification of magnetic materials and properties, Langevin's theory of Dia, Para and ferromagnetism, Soft and Hard magnetic materials and their uses, Domain theory of ferromagnetism, Hysteresis loss, Antiferromagnetic and Ferrimagnetic materials, Ferrites and Garnets, magnetic bubbles, magnetic recording.	7
3	Conducting and Superconducting Materials Band theory of solids, Classical free electron theory of metals, Quantum free electron theory, Density of energy states and carrier concentration, Fermi energy, Temperature and Fermi energy distribution, Superconductivity, Factor affecting Superconductivity, Meissner effect, Type-I and Type-II superconductors, BCS theory, Josephson effect, High temperature superconductors, Application of superconductors (Cryotron, magnetic levitation)	7
4	Semiconducting Materials Band structure of semiconductor, Charge carrier concentration, Fermi level and temperature, Electrical conductivity, Hall effect in semiconductors, P-N junction diode, Preparation of single crystals, LED, Photovoltaic Cell	6
5	Dielectric Materials Dielectric constant and polarizability, types of polarization, temperature and frequency dependences of Dielectric parameter, internal fields in solids, Clausius-Mosotti equation, dielectric loss, dielectric breakdown, ferroelectric, pyroelectric and piezoelectric materials, applications of dielectric materials	7
6	Nano Materials Nanomaterials : Introduction and properties, synthesis of nanomaterials, Carbon Nano Tubes, Characterization techniques of nanomaterials- SEM, TEM, EDAX, FMR, XRD. Applications of nanomaterials.	7
	Reference Books : 1. Material Science and Engineering – V. Raghavan 2. Electrical Engineering Materials – A.J. Dekker 3. Solid State Physics – A.J. Dekker 4. Science of Engineering Materials and Carbon Nanotubes - C.M. Srivastava and C. Srinivasan	

BTEEE305B. APPLIED PHYSICS

Teaching scheme:	**Examination Scheme:**
Theory: 3hrs	Mid-term test: 20 Marks
Total credit: 3	Internal Assessment: 20 Marks
	End semester exam: 60 Marks

Pre requisite	Physics-II	
Course Outcome	1.Understand concept of Electromagnetic theory and Magnetism 2. Understand concept od Dielectric and Super conductivity 3. Understand concept of nanomaterial	
Unit	Contents	Contact Hrs
1	Electromagnetic Theory covering, Coulomb"s law for distribution of charges, Polarization Gauss"s law, Electric current and equation of continuity, Magnetic induction and Lorentz force, Steady current and Biot-Savert law, Ampere"s law, Magnetization and magnetic intensity, Faradays law of induction, Generalization of Ampere"s law, Maxwell"s equations	4
2	Dielectrics: Introduction to dielectrics, Concept of Polarization; Dipole and dipole moment, Electric field due to dipole (without derivation); Depolarization field, depolarization factors, Local electric field at an atom, Lorentz field, Lorentz relation; Dielectric constant and polarizability – ClausiusMossotti equation (with derivation); Types of polarization – electronic, ionic, dipolar, space charge; Temperature and frequency dependence of dielectric constant	5
3	Magnetism : Magnetic field and Magnetization; Magnetic susceptibility, Paramagnetism - Paramagnetism due to partially filled shells, transition elements (3d), rare earths (4f) and actinides, Magnetization and total angular momentum (definition and relationship); Concept of magnetic moment, gyromagnetic ratio, Lande"s g-factor, Bohr Magneton, Curie"s Law – derivation for „spin only" system (L = 0), expression for non-zero orbital angular momentum system (J = L + S); Ferromagnetism, antiferromagnetism, and ferrimagnetism; Exchange interaction between magnetic ions; Molecular field, Expression for Curie-Weiss law, concept of θP ;Ferromagnetism and Ferrimagnetism – Curie temperature, hysteresis, Hard ferromagnets, permanent magnets – SmCo5, Nd2Fe14B, Sintered Alnico, Sintered Ferrite – 3 etc. – Comparison and applications; Soft ferromagnets –Permalloys, Ferrites etc. – Comparison and applications; Neel temperature, Curie-Weiss law; Magnetic resonance, NMR and MRI, MASER;	5
4	Superconductivity :Zero resistance, Critical temperature Tc ,Perfect diamagnetism, Meissner effect, Critical field Hc, Type I and Type II superconductors, Cooper pairs and formation of superconducting gap at Fermi level, Electron-Phonon interaction and BCS theory, Isotope effect, Applications – Superconducting magnets, Transmission lines, Josephson effect (DC & AC, qualitative), SQUID; (7 Lectures)	4
5	Physics of Nanomaterials : Nanoscale; Properties of nanomaterials- Optical (SPR, luminescence, tuning band gap of semiconductor nanoparticles), Electrical (SET), Magnetic, Structural, Mechanical; Brief description of different methods of synthesis of nanomaterials (physical - laser ablation, ball milling; chemical - vapor deposition, sol gel); Reduction of dimensionality, Quantum wells (two dimensional), Quantum wires (one dimensional), Quantum dots (zero dimensional); Density of states and energy spectrum for Zero dimensional solid, One dimensional quantum wire, Two dimensional potential well, Particle in a three dimensional box; Some special nanomaterials like, Aerogels – properties and applications, Carbon nanotubes - properties and applications, Core shell nanoparticles - properties and applications; Applications of nanomaterials: Electronics, Energy, Automobiles, Space, Medical, Textile, Cosmetics; Nanotechnology and Environment;	7
6	Quantum Computation and Communication covering, the idea of „qubit" and examples of single qubit logic gates- Classical bits, Qubit as a two level system; Bloch vector representation of state of qubit; Polarization states of photon and measurements; Pauli gates, Hadamard gate, Phase shift gate, Quantum gates as rotations in Bloch sphere; EPR paradox, concept of entanglement and Bell"s inequality- The paradox, joint state of entangled particles; Proof of Bell"s inequality; Two-qubit controlled gates; entanglement generation and the Bell basis- Generic twoqubit state, Controlled-NOT gate; Quantum circuit for transforming computational basis to Bell basis; Qualitative discussion on the „circuit" model of „quantum computation; An overview of classical cryptography: Vernam cypher; Public key cryptosystem; The „Rivest-Shamir-Adleman" or „RSA" protocol; Comments on No-cloning theorem and impossibility of faster-than-light transfer of information; The	8

	BB84 protocol in quantum cryptography- The protocol; its validity on the basis of Heisenberg‟s uncertainty principle; Quantum Teleportation- Basic idea; measurement using Bell operator, need for classical communication channel; quantum circuit describing teleportation protocol;	

	Ref Books: 1. Kittel C., Introduction to Solid State Physics, Wiley Eastern 2. Callister W.C. Jr., Material Science and Engineering: An Introduction, 6th Edn., John Wiley & Sons 3. Kulkarni Sulabha K., Nanotechnology: Principles & Practices, Capitol Publishing Co. **4.** Charles P. Poole, Jr., Frank J. Owens, Introduction to Nanotechnology, Wiley Eastern **5.** Nielsen M. A., I. L. Chuang, Quantum Computation & Quantum Information, Cambridge Univ. Press

BTEEE305C. SIGNALS AND SYSTEMS

Teaching scheme:
Theory: 3 hrs
Total credit: 3

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Pre requisite	Basic electrical engineering	
Course Outcome	To study classification of signals and system To analyze diff. types of time signal	
Unit	Contents	Contact Hrs
1	CLASSIFICATION OF SIGNALS Continuous time signals (CT signals), discrete time signals (DT signals) - Step, Ramp, Pulse, Impulse, Exponential, Classification of CT and DT signals - periodic and periodic, random singals,	5
	CLASSIFICATION OF SYSTEMS CT systems and DT systems, Basic properties of systems - Linear Time invariant Systems and properties.	5
2	ANALYSIS OF CONTINUOUS TIME SIGNALS Fourier series analysis, Spectrum of C.T. singals, Fourier Transform and Laplace Transform in Signal Analysi	7
3	LINEAR TIME INVARIANT –CONTINUOUS TIME SYSTEMS Differential equation, Block diagram representation, Impulse response, Convolution integral, frequency response , Fourier and Laplace transforms in analysis, State variable equations and matrix representation of systems	7
4	ANALYSIS OF DISCRETE TIME SIGNALS Sampling of CT signals and aliasing, DTFT and properties, Z-transform and properties of Z-transform.	7
5	LINEAR TIME INVARIANT - DISCRETE TIME SYSTEMS Difference equations, Block diagram representation, Impulse response, Convolution sum, LTI systems analysis using DTFT and Z-transforms , State variable equations and matrix representation of systems.	7
	REFERENCES: 1. Allan V.Oppenheim, S.Wilsky and S.H.Nawab, Signals and Systems, Pearson Education, 2007. 2. Edward W Kamen & Bonnie's Heck, "Fundamentals of Signals and Systems", Pearson Education, 2007 3. H P Hsu, Rakesh Ranjan" Signals and Systems", Schaum's Outlines, Tata McGraw Hill, Indian Reprint, 2007 4. S.Salivahanan, A. Vallavaraj, C. Gnanapriya, Digital Signal Processing, McGraw Hill International/TMH, 2007. 5. Simon Haykins and Barry Van Veen, Signals and Systems John Wiley & sons , Inc, 2004. 6. Robert A. Gabel and Richard A.Roberts, Signals & Linear Systems, John Wiley	

BTEEL307. NETWORK ANALYSIS AND SYNTHESIS LABORATORY

Teaching scheme:
Lab work : 2 hrs
Total credit: 1

Examination Scheme:
Continuous Assessment (T/W): 30 Marks
Pr/oral: 20 Marks

Pre requisite	Basic electrical engineering	
Course Objective	To understand principles of various network theorems and network principles	
Course Outcome	Verifies principles of network	
Expt No	Title of Expt	
1	Verification of Superpostion theorem	
2	Verification of Thevinion's theorem	
3	Verification of Norton's theorem	
4	Verification of maximum power transfer theorem	
5	Verification of reciprocating theorem	
6	Determination of transient response of current in RL & RC circuits with step voltage input	
7	Analysis of RL/ RC and RLC circuits	
8	Determination of transient response of current in RLC circuit with step voltage input for under damped, critically damped and over damped cases	
9	Determination of frequency response of current in RLC circuit with sinusoidal ac input	
10	Determination of driving point and transfer functions of a two port ladder network and verify with theoretical values	
11	Determine characters tics of filter	

BTEEL308. MEASUREMENTS AND INSTRUMENTATION LABORATORY

Teaching scheme:
Lab work : 4 hrs
Total credit: 2

Examination Scheme:
Continuous Assessment (T/W): 60 Marks
Pr/oral: 40 Marks

Pre requisite	Basic electrical engineering	
Course Objective		
Course Outcome		
Expt No	Title of Expt	
1	Study of Reyleigh's current balance method	
2	To study AC bridges	
3	Study of different types of ohm meter	
4	Study of megger	
5	Study of instrument T/F and it's types	
6	Study of wattmeter	
7	Construction of ammeter and voltmeter	
8	To study different types of transdusers	
9	Study digital frequency meter and digital voltmeter	
10	To study linear variable differential transformer	
11	Study of digital torque measurement	

BTEEM309. ELECTRICAL WORKSHOP/ MINI PROJECT

Teaching scheme:
Lab work : 2 hrs
Total credit: 1

Examination Scheme:
Continuous Assessment (T/W): 30 Marks
Pr/oral: 20 Marks

Pre requisite	Basic electrical engineering	
Course Objective	To provide hands on experience towards building of prototype	
Course Outcome	Build and verifies basic scientific principles.	
Expt No	Title of Expt	
1	Study various resources and components in electrical engineering projects	
2	Study datasheet of basic circuit components of a project	
3-5	Study various software in building of project like: Electric Circuit, X-Circuit, Electrician app, Electronic Tutorials, Logisim, Circuit simulator, Free PCB Ki CAD EDA softwer suit, SYC labs, Tina-TI etc	
6	Preparation of PCB for a given project	
7	Verification and analysis of project	
8	Report writing	

Semester IV

BTEEC 401. ELECTRICAL MACHINES – I

Teaching scheme:	**Examination Scheme:**
Theory: 3 hrs	Mid-term test: 20 Marks
Tutorial: 1 hr	Internal Assessment: 20 Marks
Total credit: 4	End semester exam: 60 Marks

Pre requisite	Basic electrical technology,	
Course Outcome	To study diff. types, construction and operating principle of diff. types of electrical machines	
Unit	Contents	Contact Hrs
1	Single Phase Transformer: Transformer construction, Ideal and practical transformer, exact and approximate equivalent circuits, no load and on load operation, phasor diagrams, power and energy efficiency, voltage regulation, parallel operation, effect of load on power factor, Per Unit system, excitation phenomenon in transformers, switching transients, Auto transformers, Variable frequency transformer, voltage and current transformers, welding transformers, Pulse transformer and applications.	7
2	Three Phase Transformers: Constructional features of three phase transformers, Cooling methodology, Standard and special transformer connections, Phase conversion, Parallel operation of three phase transformers, three winding transformers and its equivalent circuit, On load tap changing of transformers, Modern trends in transformers, Type and routine tests, Standards.	8
3	Electromechanical Energy Conversion Principles: Energy in a magnetic systems, field energy and mechanical force, energy in singly and multiply excited magnetic systems, determination of magnetic force and torque from energy and coenergy, Forces and torques in magnetic field systems, dynamic equations of electromechanical systems and analytical techniques	6
4	DC Generators: Construction of armature and field systems, Working, types, emf equation, Armature windings, Characteristics and applications, Building of emf, Armature reaction - Demagnetizing and Cross magnetizing mmfs and their estimation; Remedies to overcome the armature reaction; Commutation process, Causes of bad commutation and remedies	9
5	D.C. Motors: Principles of working, Significance of back emf, Torque Equation, Types, Characteristics and Selection of DC Motors, Starting of DC Motors, Speed Control, Losses and Efficiency, Condition for Maximum Efficiency, Braking of DC Motors, Effect of saturation and armature reaction on losses; Applications, Permanent Magnet DC Motors, Type and Routine tests.	9
6	Special Machines: Constructional details of reluctance machine, variable-reluctance machines, basic VRM analysis, practical VRM analysis, stepper motors and their analysis, Brushless DC motors.	6
	REFERENCES: 1. Bhattacharya S. K, “Electrical Machines”,(Tata McGraw Hill Publications) 2. Kothari Nagrath, “Electrical Machines”, (Tata McGraw Hill Publications) 3. M. N. Bandopadhyay, “Electrical Machines”, (Tata McGraw Hill Publications) 4. Fitzaralda, “Electrical Machines”, (Tata McGraw Hill Publications)	

BTEEC402 : POWER SYSTEM-I:

Teaching scheme:	**Examination Scheme:**
Theory: 2 hrs	Mid-term test: 20 Marks
Tutorial: 1 hr	Internal Assessment: 20 Marks
Total credit: 3	End semester exam: 60 Marks

Pre requisite	Basic electrical engineering	
Course Outcome	To Understand basic operation of power system, power system components and their characteristics.	
Unit	Contents	Contact Hrs
1	**Load and Energy survey**: load duration curve, plant factor and plant economics. Introduction to different sources of energy. Construction, principle and working of different thermal power plants with neat block diagram of main parts, fuel economisation, for thermal power plants based on Coal, Oil and nuclear energy. Hydroelectric Power Plant: Advantages and limitations, selection of site, hydrological cycles and hydrographs, storage and pondage, essential elements of hydroelectric plant, classification, different types of turbines and their selection, layout of hydro-station, simple numerical.	7
2	**Major Electric Equipments**: Descriptive treatment of alternator exciter & excitation systems, Transformers, Control panels, Metering & other control room equipments. 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.	5
3	**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 & with out symmetrical spacing for solid & composite conductors.	6
4	**Transmission:** Types of conductors, Choice of conductor materials, Stranded copper & ACSR conductor, Insulation consideration, Different types of insulator, supports, distribution of voltage across the insulator string, String efficiency, skin effect, Ferranty effect, proximity effect	6
5	**Current and Voltage relation:** Representation of short, medium & long transmission lines, P. U. quantities, evaluation of ABCD parameters and surge impedance loading, power flow through transmission line, circle diagram, evaluation of relation between sending and receiving end current & voltage, Interpretation of transmission line equation, Numericals, Line current, % regulation, Transmission efficiency, numericals based on above	7
6	**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.	5
	REFERENCES: 1. Gupta B. R. " Power Plant Engineering".(Eurasia publications) 2. Nag P. K. " Power Plant Engineering",(Tata McGraw Hill Publications) 3. Kothari Nagrath, "Electric Power System", (Tata McGraw Hill Publications) 4. Wadhva S. L.,"Electric Power System",(Tata McGraw Hill Publications) 5. Stevension W. B., "Power System", (English Language Book Society publications)	

BTEEC 403 ELECTRICAL INSTALLATION AND ESTIMATION

Teaching scheme:	**Examination Scheme:**
Theory: 2 hrs	Mid-term test: 20 Marks
Tutorial-1hr	Internal Assessment: 20 Marks
Total credit: 3	End semester exam: 60 Marks

Pre requisite	Basic electrical engineering, electrical measurement and instrumentation.	
Course Outcome	To prepare estimates and costing of electrical installations of power system, To understand procedures of contracting and purchase.	
Unit	Contents	Contact Hrs
1	Estimating and Determination of conductor size for internal wiring, HT and LT Overhead Lines and Underground Cables: Various steps to form an estimate, Price catalogue, Schedule of labour rates, Schedule of rates and estimating data, Conductor size, calculations for internal domestic wiring, Permissible voltage drops for lighting and industrial load, simple numericals, Conductor size calculation for underground cables: General considerations, Simple numericals, Conductor size calculations for overhead lines with A.C.S.R. conductors, simple numericals.	7
2	Preparation of estimate of quantity of material required for wiring of a house (typical plan of house including electric layout is to be given). Drawing of electrical circuit for such electrification. Specification for accessories like AC energy meter, main switch, Tumbler switch, Electric heater, Fluorescent tube, Chokes for tubes, starters, bulbs, and Insulation tapes.	5
3	**Principles of Contracting**: Purchasing techniques, Spot quotations, Floating limited enquiry, Typical example of quotation form, preparation of comparative statement, Analysis of comparative statement, Tenders types (Single tender, Open tender), Earnest money, Security deposit, Various steps involved in complete purchase, Typical order formats, various criteria for selecting the supplier, General considerations in order form, Procedures to be followed for submitting the tenders & quotations. Purchase Department, Objective, activities, duties and functions, purchase organization, Centralized and decentralized purchasing, relative advantages and disadvantages, Applications	6
4	**Study of different types of components in electrical distribution system:** Cables: Classification, general construction, types of cables, jointing of cables, measurement of insulation resistance, Insulators: Requirements, materials used, types (Pin, Suspension, Strain, Stay) Substation: Different types, classification, design consideration, various symbols, complete arrangement of substation (Single and double bus bar), key diagrams for typical substations. Review of Insulated Wires: Types: Rubber covered taped and compounded or VIR, Lead alloy sheathed, Tough rubber sheathed, Weather proof, Flexible wire splicing, Termination (Twist splicing, Married joint, Tap joint, Pig tail joint) Different Types of Switches: Tumbler, flush, pull, grid, architrave, rotary snap, Push button, Iron clad water proof, Quick break knife switch. Ceiling roses, Mounting blocks, Socket outlets plugs, Main switches, Distribution fuse boards, MCB (Miniature Circuit Breakers)	7
5	**Different Tools Used**: Screwdriver, Pliers of various types, wrench, and blowlamp, Precaution for using tools	4
6	**Wiring System**: Selection of types of wiring. Methods of wiring (Cleat, Casing capping, Metal sheathed and Conduit) Calculation and Estimation of power rating of different AC and DC machines, schematic and wiring diagrams for motor control and protection circuit	6
	REFERENCES: 1. Uppal .S. L – Electrical Wiring, Estimation & Costing(Khanna Publication). 2. Raina & Bhattacharaya – Electrical Design Estimating & Costing (Willy Estern).	

BTEEC404. NUMERICAL METHODS AND PROGRAMMING.

Teaching scheme:
Theory: 2 hrs
Tutorial-1hr
Total credit: 3

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Pre requisite	Mathematics 1, mathematics 2, mathematics 3, C programming	
Course Outcome	To study and understand MATLAB programming. To review mathematical concepts . To develop computer program for linear and nonlinear equations.	
Unit	Contents	Contact Hrs
1	Introduction to MATLAB Programming: Array operations , Loops and execution control Lecture . Working with files: Scripts and Functions , Plotting and program output	5
2	Approximations and Errors: Defining errors and precision in numerical methods Taylor's / Maclaurin series, Truncation and round-off errors, Error propagation, Global and local truncation errors.	6
3	Numerical Differentiation and Integration: Methods of numerical differentiation and integration, trade-off between truncation and round-off errors, error propagation and MATLAB functions for integration	6
4	Linear and Nonlinear Equations: numerical methods in linear algebra, and use of MATLAB to solve practical problems. Gauss Elimination ,LU decomposition and partial pivoting, Iterative methods: Gauss Siedel and Special Matrices: Tri-diagonal matrix algorithm, Nonlinear equations: NewtonRaphson method and MATLAB routines fzero and fsolve., Nonlinear equations in single variable , MATLAB function fzero in single variable, Fixed-point iteration in single variable , Newton-Raphson in single variable , MATLAB function fsolve in single and multiple variables, Newton-Raphson in multiple variab	6
5	Regression and Interpolation: Linear least squares regression(including lsqcurvefit function) , Functional and nonlinear regression (including lsqnonlin function), Interpolation in MATLAB using spline and p chip	5
6	Ordinary Differential Equations (ODE) – 1 Explicit ODE solving techniques in single variable, Introduction to ODEs; Implicit and explicit Euler's methods, Second-Order Runge-Kutta Methods, Higher order Runge-Kutta methods, Error analysis of Runge-Kutta method. Stiff ODEs and MATLAB ode15s algorithm ,Practical example for ODE-IVP ,Solving transient PDE using Method of Lines	7
	Reference Books: 1. Fausett L.V. (2007) Applied Numerical Analysis Using MATLAB, 2nd Ed., and Pearson Education. 2. Chapra S.C. and Canale R.P. (2006) Numerical Methods for Engineers, 5th Ed., and McGraw Hill. 3. NPTEL notes. http://nptel.ac.in/courses/122106033/	

Product Design Engineering

Teaching Scheme:	Examination Scheme:
Lecture-cum-demonstration: 1 hr/week Design Studio: 2 hr/week	Continuous Assessment 1: 30 Marks Continuous Assessment 2: 30 Marks Final Assessment: 40 Marks

- Pre-requisites: Knowledge of Basic Sciences, Mathematics and Engineering Drawing
- Design Studio : 2 hr/week to develop design sketching and practical skills, learning digital tools
- Continuous Assessment: Progress through a product design and documentation of steps in the selected product design
- Final Assessment: Product Design in Studio with final product specifications

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

1. Create simple mechanical or other designs
2. Create design documents for knowledge sharing
3. Manage own work to meet design requirements
4. Work effectively with colleagues

Course Contents:

Unit 1. Introduction to Engineering Product Design:

Trigger for Product/ Process/ System, Problem solving approach for Product Design, Disassembling existing Product(s) and understanding relationship of components with each other, Sketching of components, identifying materials and their processing for final product, fitting of components, understanding manufacturing as scale of the components, Reverse engineering concept, case studies of products in markets, (or in each discipline), underlying principles, Case studies of product failures, revival of failed products, Public/Society's perception of products, and its input into product design.

Unit 2. Ideation:

Generation of ideas, Funnelling of ideas, Short-listing of ideas for product(s) as an individual or group of individuals, Sketching of products, Market research for need, competitions, scale and cost, Initial specifications of products

Unit 3. Conceptualisation:

Computer operation principles and image editing through a graphical Composition; Computer aided 2D drafting and 3D Modeling through simple exercises.

Designing of components, Drawings of parts and synthesis of a product from its component parts, Rendering the designs for 3-D visualization and to create a photo realistic image, Parametric modelling of product, 3-D Visualization of mechanical products, Detail Engineering drawings of components

BTEEE406A. SOLID STATE DEVICES.

Teaching scheme:
Theory: 2 hrs
Total credit: 2

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Pre requisite	basic electrical engineering,	
Course Outcome	1. To study construction and characteristics of solid state devices. 2. To apply operational amplifier models in circuits employing negative feedback. 3. To design electronics circuit using Timer IC and voltage regulators. 4. To perform analysis of amplifiers using small signal models for the circuit elements. 5. To calculate the frequency response of circuits containing BJT, Op-Amp etc	
Unit	Contents	Contact Hrs
1	Semiconductor Devices and their applications: Applications of diodes - clippers, clampers, multipliers, Types of diodes - Zener diode, Tunnel diode, schottky diode, LED, PIN diode, Photodiode etc, BJT- CB, CE, CC configurations, biasing, FET biasing, MOSFET biasing, NMOS, PMOS, CMOS, Device modeling.	4
2	Signal and Power Amplifiers: Analysis of CB, CC, CE and FET amplifiers. Low and high frequency response of transistor and FET amplifier, Feedback in amplifiers, Oscillators. Transistor power amplifiers.	4
3	Operational Amplifiers: The ideal Op-Amp, equivalent circuit of Op-Amp, ideal voltage transfer curve, open loop Op-Amp configurations, Op-Amp parameters, block diagram representation of feedback configurations, frequency response, high frequency Op-Amp.	4
4	Active Filters and Oscillators: Active filters: low pass filter, high pass filter, band-pass filters, band reject filters, all pass filters, comparators and oscillators.	4
5	Generalized Linear Applications: DC and AC amplifiers, instrumentation amplifier, logarithmic amplifier, voltage to current converter, current to voltage converter, the integrator, the differentiator.	4
6	Specialized IC Applications: The 555 Timer as monostable, astable multivibrator, phase locked loops operating principles, 565 PLL applications, voltage regulators- fixed, adjustable, switching, special. Analog switch and analog multiplier.	4
	Ref Books: 1. Millman, Halkias and Satyabrata Jit, " Electronic Devices and Circuits", 4th edition, McGraw Hill Education (India) Private Limited, 2015. 2. Robert L. Boylestad and Louis Nashelsky, "Electronic devices and circuit theory", 11th edition, Prentice Hall India Ltd, 2015. 3. Ramakant A. Gayakwad, "Op-Amps and linear integrated Circuits" 4th edition, Pearson Education, 2015.	

BTEEE405B. ANALOG AND DIGITAL ELECTRONICS

Teaching scheme:	**Examination Scheme:**
Theory: 2 hrs	Mid-term test: 20 Marks
Total credit: 2	Internal Assessment: 20 Marks
	End semester exam: 60 Marks

Pre requisite	basic electrical engineering,	
Course Outcome	To review basic number system. To understand deign and characteristics of digital logic gates. To study different techniques in use of digital circuits. To design digital systems.	
Unit	Contents	Contact Hrs
1	Transistor as an Amplifier, load line, Small signal low frequency analysis of single stage amplifier in different configuration, High frequency equivalent circuit of transistor (hybrid pi), Cascade amplifier, High input resistance circuits-C coupled amplifier Frequency response, Definition of 3 db bandwidth, Effect of cascading on gain & BW, Classification of amplifiers	4
2	Block diagram of operational amplifier, Properties of ideal operational amplifier, Explanation of different terms appearing in OP-Amp application (offset, bias, quantities, PSRR, CMRR, Ad, AC, Slew rate etc.), Operation of circuit diagram of OP-Amp using discrete components & I.C. diagram, Different types of current of current sources in I.C. technology, frequency response of OP-Amp, OP-Amp parameters & minimization technique of temperature effect, Inverting & Non-inverting operation of Op-Amp & analysis for AG, RI, RO, Linear & non-linear circuit application of OP-Amp	4
3	Number Systems, Basic Logic Gates & Boolean Algebra: Binary Arithmetic & Radix representation of different numbers. Sign & magnitude representation, fixed point representation, complement notation, various codes & arithmetic in different codes & their inter conversion. Features of logic algebra, postulates of Boolean algebra. Theorems of Boolean algebra. Boolean function. Derived logic gates: Exclusive-OR, NAND, NOR gates, their block diagrams and truth tables. Logic diagrams from Boolean expressions and Vica-versa. Converting logic diagrams to universal logic. Positive, negative and mixed logic. Logic gate conversion	4
4	Digital Logic Gate Characteristics: TTL logic gate characteristics: Theory & operation of TTL NAND gate circuitry. Open collector TTL. Three state output logic. TTL subfamilies. MOS & CMOS logic families. Realization of logic gates in RTL, DTL, ECL, and C-MOS & MOSFET. Interfacing logic families to one another. Sequential Systems: Latches, flip-flops, R-S, D, J-K, Master Slave flip flops. Conversions of flip-flops Counters: Synchronous & asynchronous ripple and decade counters, Modulus counter, skipping state counter, counter design, state diagrams and state reduction techniques. Ring counter. Counter applications. Registers: buffer register, shift register	4
5	Minimization Techniques: Minterm, Maxterm, Karnaugh Map, K map upto 4 variables. Simplification of logiConversion of truth tables in POS and SOP form. Incomplete specified functions.Variable mapping.Quinn-McKlusky minimization techniques. c functions with K-map	4
6	Combinational Systems: Combinational logic circuit design, half and full adder, subtractor. Binary serial and parallel adders.BCD adder. Binary multiplier. Decoder: Binary to Graydecoder, BCD to decimal, BCD to 7-segment decoder' Multiplexer, DE multiplexer, encoder. Octal to binary, BCD to excess-3 encoder. Diode Switching matrix. Design of logic circuits by multiplexers, encoders, decoders and DE multiplexers.	4
	Ref Books: 1. Mandal, Digital Electronics: Principles and Applications, TMH 2009 2. Leach, Digital Principles and Applications, ed. 7, TMH 2008 3. M. Morris Mano, Digital Logic and Computer Design, Pearson Edu. 2014	

BTEEE 405C. ELECTRO MAGNETIC THEORY

Teaching scheme:
Theory: 2 hrs
Total credit: 2

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Pre requisite	Basic electrical engineering, machine 1, physics	
Course Outcome	To understand vector relations in diff. forms To analyze diff. laws and their solution To study about magneto static To understand time varying field and effect of magnetism in transmission line	
Unit	Contents	Contact Hrs
1	Introduction: Vector Relation in rectangular, cylindrical, spherical and general curvilinear coordinate system. Concept and physical interpretation of gradient, Divergence and curl, Green's Stoke's and Helmholz theorems	4
2	Electrostatics: Electric field vectors-electric field intensity, flux density & polarization. Electric field due to various charge configurations. The potential functions and displacement vector.	4
3	Gauss's law, Poisson's and Laplace's equation and their solution. Uniqueness theorem. Continuity equation. Capacitance and electrostatics energy. Field determination by method of images. Boundary conditions. Field mappings and concept of field cells	5
4	Magnetostatics: Magnetic field vector: Magnetic field intensity, flux density & magnetization, Bio-Savart's law, Ampere's law, Magnetic scalar and vector poten Energy stored in magnetic field, Boundary conditions, Analogy between electric and magnetic field, Field mapping and concept of field cellstial, self & mutual inductance.	5
5	Time Varying Fields: Faraday's law, Displacement currents and equation of continuity. Maxwell's equations, Uniform plane wave in free space, dielectrics and conductors, skin effect sinusoidal time variations, reflections, refraction & polarization of UPW, standing wave ratio. Pointing vector and power considerations.	4
6	Transmission Lines: The high-frequency circuit. LCR ladder model. The transmission Lin equation. Solution for loss-less lines. Wave velocity and wave impedance. Reflection and Transmission coefficients at junctions. VSWR	4
	Ref Books: 1. G. S. N. Raju: Electromagnetic Field Theory and Transmission Lines, Pearson. 2006 2. S. Baskaran and K. Malathi: Electromagnetic Field and Waves, Scitech Pub. 2013 3. R. S. Kshetrimayum, Electromagnetic Field Theory, Cengage Learning. 2012 4. J. D. Kraus: Electromagnetic. 5th edition, MGH. 1999	

BTEEOE 407A. INDUSTRIAL SAFETY.

Teaching scheme:
Theory: 2 hrs
Total credit: 2

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Pre requisite	Basic electrical engineering, electrical measurement and instrumentation, machine 1	
Course Outcome	To understand importance of safety in industrial environment. To understand different safety procedures in an industrial environment.	
Unit	Contents	Contact Hrs
1	SAFETY IN METAL WORKING MACHINERY AND WOOD WORKING MACHINES General safety rules, principles, maintenance, Inspections of turning machines, boring machines, milling machine, planning machine and grinding machines, CNC machines, Wood working machinery, types, safety principles, electrical guards, work area, material handling, inspection, standards and codes- saws, types, hazards	4
2	PRINCIPLES OF MACHINE GUARDING Guarding during maintenance, Zero Mechanical State (ZMS), Definition, Policy for ZMS – guarding of hazards - point of operation protective devices, machine guarding, types, fixed guard, interlock guard, automatic guard, trip guard, electron eye, positional control guard, fixed guard fencing- guard construction- guard openin Selection and suitability: lathe-drilling-boring-milling-grinding-shaping-sawingshearingpresses- forge hammer-flywheels-shafts-couplings-gears-sprockets wheels and chains-pulleys and belts-authorized entry to hazardous installations-benefits of good guarding systems.	5
3	SAFETY IN WELDING AND GAS CUTTING Gas welding and oxygen cutting, resistances welding, arc welding and cutting, common hazards, personal protective equipment, training, safety precautions in brazing, soldering and metalizing – explosive welding, selection, care and maintenance of the associated equipment and instruments – safety in generation, distribution and handling of industrial gases-colour coding – flashback arrestor – leak detection-pipe line safety-storage and handling of gas cylinders.	4
4	SAFETY IN COLD FORMING AND HOT WORKING OF METALS Cold working, power presses, point of operation safe guarding, auxiliary mechanisms, feeding and cutting mechanism, hand or foot-operated presses, power press electric controls, power press set up and die removal, inspection and maintenance-metal sheers-press brakes.	4
5	Hot working safety in forging, hot rolling mill operation, safe guards in hot rolling mills – hot bending of pipes, hazards and control measures. Safety in gas furnace operation, cupola, crucibles, ovens, foundry health hazards, work environment, material handling in foundries, foundry production cleaning and finishing foundry processes.	4
6	SAFETY IN FINISHING, INSPECTION AND TESTING Heat treatment operations, electro plating, paint shops, sand and shot blasting, safety in inspection and testing, dynamic balancing, hydro testing, valves, boiler drums and headers, pressure vessels, air leak test, steam testing, safety in radiography, personal monitoring devices, radiation hazards, engineering and administrative controls, Indian Boilers Regulation	4
	References: 1. “Accident Prevention Manual” – NSC, Chicago, 1982. 2. “Occupational safety Manual” BHEL, Trichy, 1988. 3. “Safety Management by John V. Grimaldi and Rollin H. Simonds, All India Travelers Book seller, New Delhi, 1989. 4. “Safety in Industry” N.V. Krishnan JaicoPublishery House, 1996. 5. Indian Boiler acts and Regulations, Government of India. 6. Safety in the use of wood working machines, HMSO, UK 1992. 7. Health and Safety in welding and Allied processes, welding Institute, UK, High Tech. Publishing Ltd., London, 1989	

BTEEOE 407B. INTRODUCTION TO NON-CONVENTIONAL ENERGY SOURCES,

Teaching scheme:	**Examination Scheme:**
Theory: 2 hrs	Mid-term test: 20 Marks
Total credit: 2	Internal Assessment: 20 Marks
	End semester exam: 60 Marks

Pre requisite	Energy and environmental engineering, basic electrical engineering	
Course Outcome	To review energy scenario. To understand basic concepts , construction and operational features of different non-conventional sources.	
Unit	Contents	Contact Hrs
1	Introduction: World energy situation, conventional and non-conventional energy sources, Indian energy scene.	2
2	Solar Energy: Solar radiation, solar radiation geometry, solar radiation on tilted surface. Solar energy collector. Flat- plate collector, concentrating collector - parabolidal and heliostat. Solar pond. Basic solar power plant. Solar cell, solar cell array, basic photo-voltaic power generating system	4
3	Wind Energy: Basic principle of wind energy conversion, efficiency of conversion, site selection. Electric power generation-basic components, horizontal axis and vertical axis wind turbines, towers, generators, control and monitoring components. Basic electric generation schemes- constant speed constant frequency, variable speed constant frequency and variable speed variable frequency schemes. Applications of wind energy	6
4	Geothermal Energy: Geothermal fields, estimates of geothermal power. Basic geothermal steam power plant, binary fluid geothermal power plant and geothermal preheat hybrid power plant. Advantages and disadvantages of geothermal energy. Applications of geothermal energy. Geothermal energy in India. Tidal Energy: Introduction to tidal power. Components of tidal power plants, double basin arrangement. Power generation. Advantages and limitations of tidal power generation. Prospects of tidal energy in India	5
5	Nuclear Fusion Energy: Introduction, nuclear fission and nuclear fusion. Requirements for nuclear fusion. Plasma confinement – magnetic confinement and inertial confinement. Basic Tokamak reactor, laser fusion reactor. Advantages of nuclear fusion. Fusion hybridand cold fusion	4
6	Biomass Energy: Introduction, biomass categories, bio-fuels. Introduction to biomass conversion technologies. Biogas generation, basic biogas plants-fixed dome type, floating gasholder type, Deen Bandhu biogas plant, Pragati design biogas plant. Utilization of bio gas. Energy plantation. Pyrolysis scheme. Alternative liquid fuels –ethanol and methanol. Ethanol production	4
	Ref Books: 1. A. N. Mathur: Non-Conventional Resources of Energy. 2010 2. V. V. N. Kishore: Renewable Energy Engineering and Technology, TERI. 2006	

BTEEOE 407C. SOFTWARE TECHNIQUES.

Teaching scheme:
Theory: 2 hrs
Total credit: 2

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Pre requisite	Basic C programming	
Course Outcome	To understand different techniques of software models. To understand verification and validation of software. To analyze software project management.	
Unit	Contents	Contact Hrs
1	Introduction- Notion of Software as a Product – characteristics of a good Software Product. Engineering aspects of Software production – necessity of automation. Job responsibilities of Programmers and Software Engineers as Software developers	3
2	Process Models and Program Design Techniques- Software Development Process Models – Code & Fix model, Waterfall model, Incremental model, Rapid Prototyping model, Spiral (Evolutionary) model.	3
3	Good Program Design Techniques – Structured Programming, Coupling and Cohesion, Abstraction and Information Hiding, Automated Programming, Defensive Programming, Redundant Programming, Aesthetics. Software Modelling Tools – Data flow Diagrams, UML and XML. Jackson System Development	7
4	Verification and Validation: Testing of Software Products – Black-Box Testing and White-Box Testing, Static Analysis, Symbolic Execution and Control Flow Graphs – Cyclomatic Complexity. Introduction to testing of Real-time Software Systems.	5
5	Software Project Management: Management Functions and Processes, Project Planning and Control, Organization and Intra-team Communication, Risk Management. Software Cost Estimation – underlying factors of critical concern. Metrics for estimating costs of software products – Function Points. Techniques for software cost estimation – Expert judgement, Delphi cost estimation, Work break-down structure and Process break-down structure, COCOMO and COCOMO-II.	6
6	Advanced Topics: Formal Methods in Software Engineering – Z notation, Hoare‟s notation. Formalization of Functional Specifications – SPEC. Support environment for Development of Software Products. Representative Tools for Editors, Linkers, Interpreters, Code Generators, Debuggers. Tools for Decision Support and Synthesis, Configuration control and Engineering Databases, Project Management. Petrinets. Introduction to Design Patterns, Aspectoriented Programming.	7
	Reference books: 1. Fundamentals of Software Engineering – Carlo Ghezzi et. al. 2. Software Engineering – Design, Reliability Management – Pressman. 2. Software Engineering – Ian Sommerville. 2. Software Engineering - Shoeman. 3. Software Engineering with Abstraction – Berzins and Luqi	

BTEEL408. ELECTRICAL MACHINE-I LABORATORY

Teaching scheme:	**Examination Scheme:**
Lab work : 2 hrs	Continuous Assessment (T/W): 60 Marks
Total credit: 1	Pr/oral: 40 Marks

8-10 experiments covering full content of the syllabus and at least one experiment from each unit.

Pre requisite	Basic electrical engineering	
Course Objective		
Course Outcome		
Expt No	Title of Expt	
1	To verify turn ratio of transformer	
2	To determine equivalent circuit diagram of transformer through OC and SC test	
3	To determine efficiency by direct load test on single phase transformer	
4	To verify V-I relation & to draw phasor diagram of i) star-star ii) star-delta iii) delta-star iv) delta-delta connection of 3 phase transformer	
5	To verify relation in i) scott connection ii) open delta connection	
6	To study the parallel operation of 3 phase transformer	
7	To study construction of stator and rotor of DC machine	
8	To determine magnetization, internal and external characteristics of a series generator	
9	To determine internal and external characteristics of dc machine	
10	To determine ST characteristics of DC motor	
11	To determine efficiency of DC motor	
12	To control the Speed of DC motor	
13	To conduct braking test on DC motor	

BTEEL409. POWER SYSTEM-I LABORATORY

Teaching scheme:
Lab work : 2 hrs
Total credit: 1

Examination Scheme:
Continuous Assessment (T/W): 60 Marks
Pr/oral: 40 Marks

8-10 experiments covering full content of the syllabus and at least one experiment from each unit.

Pre requisite	Basic electrical engineering	
Course Objective		
Course Outcome		
Expt No	Title of Expt	
1	Study of Thermal power plant layout and its components	
2	Study of Hydropower plant layout and its components	
3	Study of alternator exciter systems	
4	Study of control panel and metering equipment	
5	Study of different OHT System conductors	
6	Study of different OHT System insulator	
7	Determination of performance parameter of short transmission line	
8	Determination of performance parameter of medium transmission line	
9	Determination of performance parameter of long transmission line	
10	Determination of ABCD parameters of transmission line	
11		
12		

PS: A visit to nearby typical power plant which includes study of expt 1-6 is recommended.

BTEEL410. NUMERICAL METHODS AND PROGRAMMING LABORATORY

Teaching scheme: Examination Scheme:

Lab work : 2 hrs Continuous Assessment (T/W): 60 Marks

Total credit: 1 Pr/oral: 40 Marks

8-10 experiments covering full content of the syllabus and at least one experiment from each unit.

Pre requisite	Basic electrical engineering	
Course Objective		
Course Outcome		
Expt No	Title of Expt	
1	Program for scan conversion of a straight line	
2	Program for scan conversion of a circle	
3	Program for scan conversion of an ellipse	
4	Program for scan conversion of a rectangle	
5	Program for scan conversion of an arc	
6	Program for scan conversion of a sector	
7	Program for finding roots of f(x)=0 by newton raphsonm method	
8	Program for finding roots of f(x)=0 by bisection method	
9	Program for solving numerical integration by simpson’s 1/3 rule	
10	Program for solving ordinary differential equation by runge kutta method	

BTEEL411. ELECTIVE-II LABORATORY

Teaching scheme:
Lab work : 2 hrs
Total credit: 1

Examination Scheme:
Continuous Assessment (T/W): 60 Marks
Pr/oral: 40 Marks

8-10 experiments covering full content of the syllabus and at least one experiment from each unit.

Analog and digital Electronics Lab

Pre requisite	Basic electrical engineering	
Course Objective		
Course Outcome		
Expt No	Title of Expt	
1	Measurement of op Amp parameters	
2	Design and implementation of integrator, differentiator and comparator	
3	Design and implementation of phased locked loop and its applications	
4	Design and implementation of various signal generator	
5	Design and implementation of instrument amplifier	
6	Design and implementation of arithmetic circuits	
7	Design and implementation of various code converters and its applications.	
8	Design and implementation of multiplexer and demultiplexer and its applications.	
9	Design and implementation of encoders and decoders and its applications	
10	Design and implementation of synchronous and asynchronous counters and its applications	
11	Design and implementation of non-sequential counters.	
12	Design and implementation of shift registers and its applications.	
13	Implementation and verifications of Combinational circuits on programmable logic devices	

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY LONERE.

ELECTRICAL ENGINEERING DEPARTMENT

Structure and syllabus

Of

Third year B. Tech. Electrical Engineering / Electrical Engineering (Electronics and Power)/ Electrical & Electronics Engg / Electrical & Power Engineering

With effect from January 2019

Teaching & Evaluation scheme of Third year B. Tech. Electrical Engineering / Electrical Engineering (Electronics and Power)/ Electrical & Electronics Engg / Electrical & Power Engg .

V Semester

Course Code	Course Name	Teaching Scheme			Evaluation Scheme				
		L	P	T	Int	MSE	ESE	Total	Credits
BTEEC501	Electrical Machine-II	3	0	1	20	20	60	100	4
BTEEC502	Power System-II	3	0	1	20	20	60	100	4
BTEEL503	Microprocessor and micro Controller	3	0	0	20	20	60	100	3
BTHM504	Value Education, Human Rights and Legislative Procedures [MOOC/Swayam/NPTEL]	2	0	0	**-**	**-**	**-**	Audit course	0
BTEEE505	Elective-IV	3	0	0	20	20	60	100	**3**
BTEEOE506	Elective-V	3	0	0	20	20	60	100	**3**
BTEEL507	Electrical Machine-II Lab	0	4	0	**60**	**-**	**40**	100	**2**
BTEEL508	Power System-II Lab	0	2	0	**30**	**-**	**20**	50	**1**
BTEEL509	Microprocessor and micro Controller Lab	0	2	0	**30**	**-**	**20**	50	**1**
BTEEF510	Industrial Training	-	-	-	**50**	**-**	**-**	50	**1**
	Total	17	08	02	**270**	**100**	**380**	750	**22**

Elective- IV: 1.Illumination engineering 2. Advances in Renewable Energy Sources. 3. Testing and Maintenance of Electrical equipment.

Elective-V: 1.Electrical Mobility. 2 Power Plant Engineering. 3. Design and Analysis of Algorithms

VI semester

Course Code	Course Name	Teaching Scheme			Evaluation Scheme				
		L	P	T	Int	MSE	ESE	Total	Credits
BTEEC601	Control System	3	0	1	20	20	60	100	4
BTEEC602	Principles of Electrical Machine Design	3	0	0	20	20	60	100	3
BTEEC603	Power Electronics	3	0	1	20	20	60	100	4
BTEEE604	Elective-VI	3	0	0	20	20	60	100	3
BTEEC605	Elective-VII	3	0	0	20	20	60	100	**3**
BTEEOE606	Elective-VIII [MOOC/Swayam/NPTEL]	3	0	0	20	20	60	100	**3**
BTEEL607	Control System- Lab	0	2	0	30	-	20	50	**1**
BTEEL608	Principles of Electrical Machine Design Lab	0	2	0	30	-	20	50	**1**
BTEEL609	Power Electronics Lab	0	4	0	60	-	40	100	**2**
	Total	18	08	02	**240**	**120**	**440**	800	**24**

Elective-VI Industrial automation and Control 2. Design of Experiments 3. Artificial neural network.
Elective-VII 1. Switch Gear and Protection 2. Computer aided analysis and design 3. Mechatronics
Elective- VIII. 1. Rural Technology and Community Development. 2. Project Management 3. Knowledge Management

Semester: V

BTEEC501: ELECTRICAL MACHINE-II

Teaching scheme:	**Examination Scheme:**
Theory: 3 hrs	Mid-term test: 20 Marks
Tutorial: 1 hr	Internal Assessment: 20 Marks
Total credit: 4	End semester exam: 60 Marks

Prerequisite	Electrical machine I	
Course outcome	To study different methods of speed control of AC and DC motor To study importance and procedure of different performance test on AC and DC motor. To determine different operating characteristics of AC and DC machines	
Unit	Contents	Contact Hrs
1	Basic Concepts in A.C. Machines: Classification of A.C. Machines, principle of operation and constructional features of synchronous and induction machines, rotating mmf waves in A.C. Machines	8
2	Armature windings: Introduction, ac machine windings, winding factors, the emf equation, harmonics in generated emf, causes of harmonics and their suppressions.	6
3	Synchronous Machines : Construction, types, armature reaction, circuit model of synchronous machine, determination of synchronous reactance, phasor diagram, power angle characteristics, parallel operation of synchronous generators, synchronizing to infinite bus bars, two axis theory, synchronous motor operation, characteristic curves, synchronous condenser, dynamics.	10
4	Three phase Induction (Asynchronous) Motor: Types of induction motor, flux and mmf waves, development of circuit model, power across air gap, torque and power output, oc and sc tests, circle diagram, starting methods, cogging and crawling, speed control, deep bar/ double cage rotor, induction generator, induction machine dynamics, high efficiency induction motors	10
5	Fractional Kilowatt Motors: Introduction, single phase induction motors, double revolving field theory, circuit model of single phase induction motor, determination of circuit parameters.	5
6	Special A.C. Machines: Single phase synchronous motors, permanent magnet ac motors, ac servomotors	5
	Ref Books: 1.Say M. G., “Design & performance of A.C. Machines”, (Book Publications,3rd edition) 2..Bhimra P. S., “Electric Machines”, (South Ex Publications, New Delhi) 3. D. P. Kothari, I. J. Nagrath,”Electric Machines “, Tata McGraw Hill Publication, Fourth edition, reprint 2012. 4. A. F. Puchstein, T.C. Lloyd, A.G. Conrad, “Alternating current machines”, John Wiley and Sons, New York 1954. 5.• A.E. Fitzgerald, Charles Kingsley Jr., Stephen D. Umans ,”Electric Machinery “, Tata McGraw Hill Publication, sixth edition 2002	

BTEEC502: POWER SYSTEM-II

Teaching scheme:
Theory: 3 hrs
Tutorial: 1hr
Total credit: 4

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Prerequisite	Power system I	
Course outcome	To study different parameters of power system operation and control To study load flow and Diff. methods of reactive power control. To understand diff. methods of fault analysis and stability study	
Unit	Contents	Contact Hrs.
1	Economic Operation of Power Systems: Distribution of loads between units within a plant, Economic division of load between units in a plant, Transmission loss as a function of plant generation, Calculation of loss co-efficient, Distribution of load between plants, Introduction to unit commitment, Numerical examples	8
2	Load Flow Studies: Network model formulation, (Applications of iterative techniques like Gauss-Siedal method, and Newton-Rap son method, etc.) Numerical. Active Power Control Basic generator control, Load frequency control. Load, prime mover and governor model, Numerical examples	6
3	Reactive Power Control: System voltage and reactive power, Reactive power generation by synchronous machine, Excitation control, Automatic voltage regulator for alternator, Reactive power generation by turbo-generator, Synchronous compensators, Reactors, Capacitors, Static compensators. Introduction to power flow control, HVDC and Facts.	6
4	Symmetrical and unsymmetrical fault analysis: Symmetrical Components transformation analysis for, transformers, transmission lines and synchronous machines, Numerical examples. Fault analysis and evaluation of faults on loaded unloaded synchronous generator, Selection of circuit breakers, asymmetrical fault-evaluation of a) Line to ground b) Line to line c) Double line to ground d) single & double conductor open faults, Numerical examples	6
5	Stability: Dynamics of a synchronous machine, Power angle equation, Steady state stability, Equal area criterion, Numerical solution of swing equation, Factors affecting transient stability, Critical clearance angle, Numerical	6
6	Load dispatch center functions, Contingency analysis, preventive, emergency and restorative Control. power quality: def., causes, affects, slandered and mitigation methods	7
	Ref Books: 1. Stevension .W. D– Power System Analysis. (Tata Mcgraw Hill). 2. Ashfaq Hussian - Power System Analysis. (Tata Mcgraw Hill). 3. Nagrath & Kothari – Modern Power System Analysis.(Tata Mcgraw Hill). 4. Hadi Sadat- Power System Analysis (Tata Mcgraw Hill). 5. Prof A M Kulkarni IIT "Bombay Web Course on Power System Operation and Control"	

BTEEC503-.MICROPROCESSOR AND MICRO CONTROLLER

Teaching scheme:
Theory: 3 hrs
Tutorial: 0 hr
Total credit: 3

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Prerequisite	Digital electronics, electronics devices and circuits	
Course outcome	To know the architecture of 8085 and 8051. To understand interfacing and interrupt features of 8085 and 8051. To develop program for basic applications.	
Unit	Contents	Contact Hrs.
1	Architecture of 8085 Microprocessor and Programming: Functional Block Diagram, Registers, ALU, Bus systems, Timing and control signals, Machine cycles and timing diagrams. Instruction formats, Addressing modes, Instruction set, Need for Assembly language, Development of Assembly language programs.	7
2	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/O Scheme, I/O mapped I/O scheme, Input and Output cycles, Simple I/O ports, Programmable peripheral interface (8255). Data transfer schemes: Programmable data transfer, DMA data transfer, Synchronous, Asynchronous and interrupt driven data transfer schemes, Interfacing, Simple keyboards and LED displays.	5
3	Interrupts and DMA: Interrupt feature, Need for interrupts, Characteristics of Interrupts, Types of Interrupts, Interrupt structure, Methods of servicing interrupts, Development of Interrupt service subroutines, Multiple interrupt request and their handling, need for direct memory access, Devices for Handling DMA, Programmable DMA controller 8237.	5
4	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	5
5	Intel 8051 Microcontroller : Architecture of 8051, Memory Organization, Addressing modes, Instruction set, Boolean processing, Simple programs	6
6	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	6
	Ref 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. 3. Douglas, V.Hall. “Microprocessor and Interfacing Programming and Hardware”, 2ndEdition, McGraw Hill Inc., 1992. 4. Kenneth, L.Short., “Microprocessors and Programmed Logic”, Prentice Hall of India, 2nd Edition, 1987	

BTHM 504: VALUE EDUCATION, HUMAN RIGHTS AND LEGISLATIVE PROCEDURES

Teaching scheme:	**Examination Scheme:**
Theory: 2 hrs	Mid-term test: --
Total credit: 0 (Audit course)	Internal Assessment: --
	End semester exam:---

Prerequisite	Human Values and engg ethics	
Course outcome	To understand value of education and self-development To develop good values and character To know Human right and legislative procedure	
Unit	Contents	Contact Hrs.
1	Values and Self Development-Social values and individual attitudes, Work ethics, Indian vision of humanism, Moral and non-moral valuation, Standards and principles, Value judgments.	5
2	Importance of cultivation of values, Sense of duty, Devotion, Self-reliance, Confidence, Concentration, Truthfulness, Cleanliness, Honesty, Humanity, Power of faith, National unity, Patriotism, Love for nature, Discipline.	4
3	Personality and Behavior Development- Soul and scientific attitude, God and scientific attitude, Positive thinking, Integrity and discipline, Punctuality, Love and kindness, Avoiding fault finding, Free from anger, Dignity of labor, Universal brotherhood and religious tolerance, True friendship, Happiness vs. suffering love for truth, Aware of self-destructive habits, Association and cooperation, Doing best, Saving nature.	5
4	Character and Competence- Science vs. God, Holy books vs. blind faith, Self-management and good health, Science of reincarnation, Equality, Nonviolence, Humility, Role of women, All religions and same message, Mind your mind, Self-control, Honesty, Studying effectively.	5
5	Human Rights- Jurisprudence of human rights nature and definition, Universal protection of human rights, Regional protection of human rights, National level protection of human rights, Human rights and vulnerable groups.	5
6	Legislative Procedures- Indian constitution, Philosophy, fundamental rights and duties, Legislature, Executive and Judiciary, Constitution and function of parliament, Composition of council of states and house of people, Speaker, Passing of bills, Vigilance, Lokpal and functionaries	4
	Ref Books: 1. Chakraborty, S.K., Values and Ethics for Organizations Theory and Practice, Oxford University Press, New Delhi, 2001. 2. Kapoor, S.K., Human rights under International Law and Indian Law, Prentice Hall of India, New Delhi, 2002. 3. Basu, D.D., Indian Constitution, Oxford University Press, New Delhi, 2002. 4. Frankena, W.K., Ethics, Prentice Hall of India, New Delhi, 1990. 5. Meron Theodor, Human Rights and International Law Legal Policy Issues, Vol. 1 and 2, Oxford University Press, New Delhi, 2000.	

BTEEE 505: ELECTIVE- IV: 1. ILLUMINATION ENGINEERING

Teaching scheme:
Theory: 3 hrs
Total credit: 3

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Prerequisite	Basic electrical engineering , physics.	
Course outcome	To get the detailed information about modern lamps and their accessories. To get detailed insight of indoor and outdoor illumination system components, its controls and design aspects. To know the requirements of energy efficient lighting. To introduce the modern trends in the lighting	
Unit	Contents	Contact Hrs.
1	**Importance of Lighting in Human Life:**Optical systems of human eye ,Dependence of human activities on light, performance characteristics of human visual system, External factors of vision-visual acuity, contrast, sensitivity, time illuminance, colour, visual perception, optical radiation hazards, Good and bad effects of lighting & perfect level of illumination, Artificial lighting as substitute to natural light, Ability to control natural light, Production of light, physics of generation of light, Properties of light, Quantification & Measurement of Light.	8
2	**Light Sources:** Lamp materials: Filament, glass, ceramics, gases, phosphors and other metals and non-metals. Discharge Lamps: Theory of gas Discharge phenomena, lamp design considerations, characteristics of low and high mercury and Sodium vapour lamps, Low Vapour Pressure discharge lamps – Mercury Vapour lamp, Fluorescent Lamp, Compact Fluorescent Lamp (CFL) High Vapour Pressure discharge lamps - Mercury Vapour lamp, Sodium Vapour lamp, Metal halide Lamps, Solid Sodium Argon Neon lamps, SOX lamps, Electro luminescent lamps, Induction lamps.	6
3	**Electrical Control of Light Sources:** Ballast, igniters and dimmers for different types of lamps, **Photometric Control of Light Sources and their Quantification:** Types of Luminaries, factors to be considered for designing luminaries Types of lighting fixtures. Optical control schemes, design procedure of reflecting and refracting type of luminaries. Lighting Fixture types, use of reflectors and refractors, physical protection of lighting fixtures, types of lighting fixtures according to installation type, types of lighting fixtures according to photometric usages, luminaries standard (IEC-598-Part I).	6
4	Zonal cavity method for general lighting design, determination for zonal cavities and different shaped ceilings using COU (coefficient of utilization), beam angles and polar diagrams. Factors to be considered for design of indoor illumination scheme **Indoor illumination design for following installations:** Residential (Numerical)**,**Educational institute**,** Commercial installation**,** Hospitals**,** Industrial lighting**, Special purpose lighting schemes** Decorative lighting**,** Theatre lighting**,** Aquarium, swimming pool lighting	6
5	Factors to be considered for design of outdoor illumination scheme, **Outdoor Lighting Design:** Road classifications according to BIS, pole arrangement, terminology, lamp and luminaire selection, different design procedures, beam lumen method, point by point method, isolux diagram, problems on point by point method. **Outdoor illumination design for following installations**; Road lighting (Numerical), Flood lighting (Numerical), Stadium and sports complex, Lighting for advertisement/hoardings	6
6	**Modern trends in illumination;** LED luminary designs**,** Intelligent LED fixtures**,** Natural light conduiting**,** Organic lighting system**,** LASERS, characteristics, features and applications, non-lighting lamps**,** Optical fiber, its construction as a light guide, features and applications	7
	Ref Books: 1 H. S. Mamak, "Book on Lighting", Publisher International lighting Academy 2. Joseph B. Murdoch, "Illumination Engineering from Edison's Lamp to Lasers" Publisher - York, PA: Visions Communications 3. M. A. Cayless, A. M. Marsden, "Lamps and Lighting", Publisher-Butterworth-Heinemann(ISBN978-0-415-50308-2) 4. Designing with light: Lighting Handbook., Anil Valia; Lighting System 2002	

BTEEE 505 ELECTIVE- IV: 2. ADVANCES IN RENEWABLE ENERGY SYSTEMS

Teaching scheme:	**Examination Scheme:**
Theory: 3 hrs	Mid-term test: 20 Marks
Total credit: 3	Internal Assessment: 20 Marks
	End semester exam: 60 Marks

Prerequisite	Introduction to Non-Conventional energy sources	
Course outcome	To know the principle of energy conversion technique from biomass, geothermal and hybrid energy systems. To understand effects of air pollution and ecosystems	
Unit	Contents	Contact Hrs.
1	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.	8
2	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	6
3	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.	6
4	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.	6
5	Environment impact assessment policies and auditing, conflicting worldviews 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.	6
6	Ecosystem definition, concepts, structure, realm of ecology, lithosphere, hydrosphere, biosphere, atmosphere-troposphere-stratosphere; Nonrandom high quality solar energy flow/ balance to earth, greenhouse effect, matter and nutrient recycling in ecosystems; nitrogen, oxygen, carbon and water cycles, food producers, consumers and decomposers, food chains; biodiversity, threat and conservation of biodiversity.	7
	Ref Books: 1. NPTEL courses	

BTEEOE 506: ELECTIVE-V. 1. ELECTRICAL MOBILITY

Teaching scheme:	**Examination Scheme:**
Theory: 3 hrs	Mid-term test: 20 Marks
Total credit: 3	Internal Assessment: 20 Marks
	End semester exam: 60 Marks

Prerequisite	Digital electronics, network analysis and synthesis	
Course outcome		
Unit	Contents	Contact Hrs
1	**Electric mobility introduction:** Introduction to electrical mobility, classification, need of electrical mobility, operating principle.	8
2	**Energy sources and storage systems:** Conventional energy sources and non-conventional energy sources, different types of energy storage schemes and energy storage devices	7
3	**Electric machines in electric mobility:** Diff. types of electrical machines used in electric mobility: induction machine , dc machine, synchronous machine,	8
4	**Power converters:** Introduction to power converters, different types of power converters, construction, working, applications, advantages, disadvantages.	7
5	**Applications, Modeling:**	8
6	**Electric vehicles and the environment;**	7
	Ref Books: 1. Nptel 2. Larminie, J.; Lowry, J. Electric vehicle technology explained [on line]. Chichester, West Sussex: J. Wiley, cop. 2003Available 3. on: <http://onlinelibrary.wiley.com/book/10.1002/0470090707>. ISBN 0470851635. 4. Miller, J. M. Propulsion systems for hybrid vehicles. 2nd ed. The Institution of Engineering and Technology, 2010. ISBN 978- 5. 1-84919-147-0. 6. Husain, I. Electric and hybrid vehicles : design fundamentals [on line]. 2nd ed. Boca Raton: CRC Press, cop. 2011 7. [Consultation: 07/03/2012]. Available on: <http://www.sciencedirect.com/science/book/9780444535658>. ISBN 8. 9781439811757. 9. Ehsani, M.; Gao, Y.; Emadi, A. Modern electric, hybrid electric, and fuel cell vehicles : fundamentals, theory and design. 2nd	

BTEEOE 506: ELECTIVE-V 2 POWER PLANT ENGINEERING.

Teaching scheme:
Theory: 3 hrs
Total credit: 3

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Prerequisite	Power system I, power system II, machine I and II	
Course outcome	To review basic components of power system, energy sources. To understand principle of construction and operation of different conventional power plants.	
Unit	Contents	Contact Hrs
1	Load and Energy survey, load duration curve, plant factor and plant economics, Introduction to conventional energy sources, different sources of non-conventional energy like solar, wind, tidal, geothermal biomass, MHD plants, their applications and site selection, Indian energy scenario	8
2	Thermal Power Station: Introduction, selection of sites, main parts of thermal power station and their working, simple numerical examples. Nuclear Power Plant: Review of atomic physics (atomic number, mass number, isotopes, atomic mass, unit rate of radioactivity, mass equivalent number, binding energy and mass defects), main parts of nuclear power station, types of reactors (pressurized water reactor (PWR), boiling water reactor, gas cooled reactor, liquid metal tank feeder reactor, heavy water reactor, plant layout and working, simple numerical, India's nuclear power program.	6
3	Hydroelectric Power Plant: Advantages and limitations, selection of site, hydrological cycles and hydrographs, storage and pondage, essential elements of hydroelectric plant, classification, different types of turbines and their selection, governing of hydraulic turbines, surge tanks, draft tube, layout of hydro-station, simple numerical.	6
4	Diesel Engine & Gas Power Plant: Advantage and limitations, types of diesel plants, general layout, IC engines and their performance characteristics, layout of diesel engine power plant and applications. Components of gas power plant, gas turbine fuels, turbine fuels, turbine materials, working, improvement of thermal efficiency of gas power plant and applications, simple numerical examples.	6
5	Combined working of power plants: Economics of combined working power plants, base load and peak load stations, pumped storage plants, inter- connections of power stations. Tariff: Fixed cost, running cost and their interrelation for all types of conventional power plants, depreciable cost, different types of tariffs, numerical example based on above, effect of deregulation on pricing.	6
6	Grid interface of different power plants: Concept of parallel operation of various generating sources and load sharing, need of interconnection between different power plants, concept of Grid, importance of grid, requirement of grid, types of grid (in transmission and distribution system), conditions to interface different power plants to grid.	7
	Ref Books: 1.Gupta B. R. " Power Plant Engineering".(Eurasia publications) 2.Nag P. K. " Power Plant Engineering",(Tata McGraw Hill Publications) 3.Deshpande M. V. " Elements of Electrical Power Station Design" (Wheeler publications) 4.Arora and Domkundwar, "A course in Power Plant Engineering" (Dhanpat Rai & co., 5/e) 5.R. K. Rajput, "Power Plant Engineering" 6.V. K. Mehta, "Power System", S. Chand Pub. 7.J. B. Gupta, "A course in Power System Engineering",	

BTEEOE 506: ELECTIVE-V. 3. DESIGN AND ANALYSIS OF ALGORITHMS

Teaching scheme:	**Examination Scheme:**
Theory: 3 hrs	Mid-term test: 20 Marks
Total credit: 3	Internal Assessment: 20 Marks
	End semester exam: 60 Marks

Prerequisite	Numerical methods and C programming, control system I,	
Course outcome	To know fundamental characteristic of an algorithm. To understand strategy of algorithm formation, To develop different algorithm.	
Unit	Contents	Contact Hrs
1	Introduction- Fundamental characteristics of an algorithm. Basic algorithm analysis – Asymptotic analysis of complexity bounds – best, average and worst-case behaviour, standard notations for expressing algorithmic complexity. Empirical measurements of performance, time and space trade-offs in algorithms. Using recurrence relations to analyze recursive algorithms – illustrations using recursive algorithms.	8
2	Fundamental Algorithmic Strategies: Brute-Force, Greedy, Branch-and-Bound, Backtracking and Dynamic Programming methodologies as techniques for design of algorithms – Illustrations of these techniques for Problem-Solving. Heuristics – characteristics and their domains of applicability. Design of algorithms for String/ Texmatching problems, Huffman Code and Data compression problems, Subset-sum and Knapsack problems.	6
3	Graph and Tree Algorithms: Depth- and Breadth- First traversals. Shortest path algorithms, Transitive closure, Minimum Spanning Tree, Topological sort, Network Flow problems	6
4	Tractable and Intractable Problems: Computability.The Halting problem. Computability classes – P, NP, NP-complete and NP-hard. Cook‟s theorem. Standard NP-complete problems Reduction techniques.	6
5	Advanced Topics: Approximation algorithms, Randomized algorithms, Class of problems beyond NP – PSPACE.	6
6		7
	References: 1. Algorithm Design – Jon Kleinberg and Eva Tardos 2. Introduction to Algorithms – T.H. Corman et. al. 3. Fundamentals of Algorithms – E. Horowitz et al. 4. Combinatorial Optimization: Algorithms and Complexity – C.H. Papadimitriou et al	

BTEEL507. Electrical Machine-II **Lab**

Teaching scheme:
Lab work : 4 hrs
Total credit: 2

Examination Scheme:
Continuous Assessment (T/W): 60 Marks
Pr/oral: 40 Marks

Pre requisite	Basic electrical engineering, electrical machine I	
Course Objective		
Course Outcome		
Expt No	Title of Expt	
1	Determination of sequence impedances of salient pole synchronous machine	
2	Determination of Xd and Xq of a salient pole synchronous machine from slip test.	
3	V and inverted V curves of a3-phasesynchronous motor	
4	Regulation of alternator by synchronous impedance method and MMF method.	
5	Parallel operation of Synchronous generator	
6	To study different types of starters for three phase Squirrel cage induction motor	
7	Rotor resistance starter for slip ring induction motor.	
8	To conduct no load and blocked rotor test and to determine performance characteristics of three phase induction motor from circle diagram	
9	Load and block rotor tests on squirrel cage induction motor	
10	Brake test on slip ring induction motor	
11	To control speed of wound rotor induction motor by rotor resistance control method	
12	To control speed of induction motor by V/F	
13	To control speed of induction motor by i) star-delta ii) autotransformer	
14		
15		

BTEEL508. Power System-II Lab

Teaching scheme:
Lab work : 2 hrs
Total credit: 1

Examination Scheme:
Continuous Assessment (T/W): 30 Marks
Pr/oral: 20 Marks

Pre requisite	Basic electrical engineering, Power system I	
Course Objective		
Course Outcome		
Expt No	Title of Expt	
1	Measurement of sequence reactance of salient pole synchronous machine	
2	Measurement of sub transient reactance of salient pole synchronous machine	
3	Steady state stability of synchronous motor	
4	Steady sate power limit of transmission line	
5	Study of AC network analyzer	
6	Load flow study on AC network analyzer	
7	Fault study on AC network analyzer	
8	Use of computers for load flow study	
9	Use of computers for stability study	

BTEEL509. Microprocessor Lab

Teaching scheme:	Examination Scheme:
Lab work : 2 hrs	Continuous Assessment (T/W): 30 Marks
Total credit: 1	Pr/oral: 20 Marks

Pre requisite	Basic electrical engineering, analog and digital electronics	
Course Objective		
Course Outcome		
Expt No	Title of Expt	
1	Study of architecture of 8085	
2	Assembly language programmes for determination of smaller and larger no	
3	Assembly language programmes for ascending and descending order	
4	Assembly language programmes for rolling/flash display	
5	Assembly language programmes for led flashing	
6	Programming for speed and direction control of dc motor	
7	Programming for speed and direction of stepper motor	
8	Assembly language programming base on lockup table concept	
9	Study of hexadecimal, modulo-9, BCD counter	
10	Assembly language programme for real time clock	
11	Multiplication/division of numbers	

Semester: VI

BTEEC 601. CONTROL SYSTEM

Teaching scheme:	**Examination Scheme:**
Theory: 3 hrs	Mid-term test: 20 Marks
Tutorial: 1 hr	Internal Assessment: 20 Marks
Total credit: 4	End semester exam: 60 Marks

Prerequisite	Control system I	
Course outcome	To understand the behavior of nonlinear control system. To design and analyze PID controller. To understand and analyze state variable technique. To design and analyze suitable control system for engineering application.	
Unit	Contents	Contact Hrs
1	Non-linear Control Systems: Peculiar behavior of non-linear systems such as sub harmonics, jump resonance, limit cycle, Different types of non-linearities, Phase plane method, Singular Points, Methods of isoclines, Limit Lines & dividing lines on phase plane, Construction of phase plane, Obtaining time domain response from phase plane plots, merits & demerits. Describing function (DF) method, definition & assumptions, Derivation for describing function for different non- linearities, Stability analysis using DF method.	8
2	PID controllers: Introduction to Proportional (P), Integral (I) & Derivative (D) controller, individual effect on overall system performance, P-PI & PID control and effect on overall system performance, Numerical examples.	6
3	State Variable Technique: Concept of state & state variable, General form of state equations, formulation of state equations for the physical system, (RLC network, Armature controlled & Field controlled DC servo motor, mechanical systems).	6
4	State Variable Analysis: Different forms of state variable representations (Phase, physical & canonical form), Concept of diagonalization, Obtaining state equations from transfer function representation and vice versa, solution of state equations, State transition matrix (STM), Methods of finding STM, Power series method, Laplace transform method, Calay Hamilton method, Controllability & observability of linear system, Kalman's test.	6
5	Discrete Data Control System: Methods of representation, Z-transform, Inverse Z-transforms, Pulse transfer function of closed loop system, Response between sampling instants, Concept of stability of discrete time systems, Stability by Jury's test.	6
6	Introduction to control system design, Compensation technique-Cascade & Feedback, Compensation network (lag, lead & lag-lead), Design by reshaping of Bode plots & Root locus technique.	7
	References: 1.Ogata K., 'Modem control Engineering', Prentice Hall 2.Kuo B. C., 'Automatic Control System' Prentice Hall 3. Nagarath I. J., Gopal M., 'Control System Engineering' Willey Eastern.	

BTEEC602 PRINCIPLES OF ELECTRICAL MACHINE DESIGN

Teaching scheme:	**Examination Scheme:**
Theory: 3 hrs	Mid-term test: 20 Marks
Tutorial: 0 hr	Internal Assessment: 20 Marks
Total credit: 3	End semester exam: 60 Marks

Prerequisite	Machine I and II,	
Course outcome	To understand principles of electric machine design. To design different components of electric machine. To design Transformer To understand CAD and use it for transformer design	
Unit	Contents	Contact Hrs
1	Principles and design of Electrical machines: Design of Electrical machines along with their parts and special features, rating, Specifications, Standards, Performance and other criteria to be considered, Brief study of magnetic, electric, dielectric and other materials, Introduction to machine design.	6
2	Design of Electrical Apparatus: Detailed design of heating coils, starters and regulators. Design of Electrical Devices Field coils, Chokes and lifting magnets.	6
3	AC and DC Winding: Types of dc windings, Pitches, Choice and design of simple/ duplex lap and wave winding, Concept of multiplex windings and reasons for choosing them, Single and double layer single phase AC winding with integral and fractional slots, Single and double layer integral and fractional slot windings of three phase. AC winding factors, Tests for fault finding in windings, Numerical examples.	6
4	Heating, Cooling and Ventilation: Study of different modes of heat generation, Temperature rise and heat dissipation, Heating and Cooling cycles, heating and cooling time constants, their estimation, dependence and applications, Methods of cooling / ventilation of electrical apparatus, Thermal resistance, radiated heat quantity of cooling medium (Coolant) Numerical.	6
5	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 to counteract them, Testing of transformers as per I.S.S., Numerical examples.	6
6	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.	6
	References: 1. Siskind – Electrical Machine Design (Mcgraw Hill). 2. Sawhaney. A. K– A Course in Electrical Machine Design (Dhanpat Rai). 3. Deshpande. M. V- A Course in Electrical Machine Design (Prentice Hall Of India).(Design And Testing Of Electrical Machines). 4. Sen .S. K– Computer aided design of Electrical Machines	

BTEEC603 POWER ELECTRONICS

Teaching scheme:
Theory: 3 hrs
Tutorial: 1 hr
Total credit: 4

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Prerequisite	Electronic Devices And Circuits	
Course outcome	To review principle of construction, operation and characteristics of basic semiconductor devices. To understand and analyze performance of controlled and uncontrolled converters. To understand and analyze performance of DC to DC converters. Dc to AC converters. To understand and analyze performance of AC voltage controllers.	
Unit	Contents	Contact Hrs
1	Power semiconductor devices & their characteristics : Characteristics and operation of power diodes, Thyristors, power transistors (BJTs, MOSFETs, IGBTs, SITs), Ratings of power semiconductor devices, typical applications of power semiconductor devices, Introduction to types of power electronic circuits: diode rectifiers, AC-DC converters, AC-AC converters, DC-DC converters, DC-AC converters	8
2	Turn on and Turn off circuits for power semiconductor devices; BJT base drive requirements and drive circuit, MOSFET & IGBT gate drive circuits, Isolation of gate/base drives: Pulse transformers, optocouplers Thyristor firing schemes, Gate drive ICs	7
3	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, Effect of source inductance 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.	7
4	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.	6
5	DC-DC converters : Classification of DC-DC converters, Buck converter, Boost converter, Buck-Boost converter, Cuk converter	6
6	DC-AC converters : Principle of operation and performance parameters, single phase bridge inverter, Three phase inverters: 180 degree and 120 degree conduction modes of operation	7
	References: 1.RashidM. H – Power Electronics circuits, devices and applications-(New Delhi Pearson Education). 2.Murthi.V. R- Power Electonics Devices, circuits and Industrial Applications.(Oxford). 3. Bimbhra.P. S- Power Electronics.(Khanna Publication).	

BTEEE604 : Elective-VI: 1. INDUSTRIAL AUTOMATION AND CONTROL

Teaching scheme:
Theory: 3 hrs
Total credit: 3

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Prerequisite	Control system I, industrial automation	
Course outcome	To understand construction and working principle of different industrial measurement systems. To understand new trends in industrial process control.	
Unit	Contents	Contact Hrs
1	Introduction to Industrial Automation and Control: Architecture of Industrial Automation Systems. Introduction to sensors and measurement systems.	8
2	measurement: Temperature measurement, Pressure and Force measurements, Displacement and speed measurement, Flow measurement techniques, Measurement of level, humidity, pH etc, Signal Conditioning and Processing, Estimation of errors and Calibration	6
3	Process Control: Introduction to Process Control P I D Control, Controller Tuning. Implementation of PID Controllers. Special Control Structures: Feed forward and Ratio Control. Predictive Control, Control of Systems with Inverse Response, Cascade Control, Overriding Control, Selective Control, Split Range Control.	6
4	Sequence Control: Introduction to Sequence Control PLCs and Relay Ladder Logic Sequence Control, Scan Cycle, RLL Syntax Sequence Control, Structured Design Approach Sequence Control, Advanced RLL Programming Sequence Control : The Hardware environment	6
5	Control of Machine tools: Introduction to CNC Machines Control of Machine Tools, Analysis of a control loop, Introduction to Actuators, Flow Control Valves. Hydraulic Actuator Systems,: Principles, Components and Symbols, Hydraulic Actuator Systems: Pumps and Motors, Proportional and Servo Valves.	6
6	Pneumatic Control Systems: System Components Pneumatic Control Systems, Controllers and Integrated Control Systems. Networking of Sensors, Actuators and Controllers: The Fieldbus, The Fieldbus Communication Protocol, Introduction to Production Control Systems	7
	References NPTEL course	

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BTEEE604 : Elective-VI: 2. DESIGN OF EXPERIMENTS

Teaching scheme:
Theory: 3 hrs
Total credit: 3

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Prerequisite		
Course outcome	To understand experimental design principles. To understand different experimental design used in industry. To deign computer experiments to use with engineering problems.	
Unit	Contents	Contact Hrs
1	Introduction to experimental design principles, simple comparative experiments, introduction to R language and its applications in DOE problems	8
2	Single factor experiments, randomized blocks, Latin square designs and extensions, introduction to R language Introduction to factorial designs, two levels, 2k factorial designs, confounding and blocking in factorial designs, applications to manufacturing problems.	6
3	Fractional factorial designs, two-level, three-level and mixed-level factorials and fractional factorials, applications to quality control problems. Regression models including multiple regression models and its application to transportation scheduling problems	6
4	Response surface methodology, parameter optimization, robust parameter design and its application to control of processes with high variability	6
5	Random and mixed effects models, nested and split plot and strip plot designs and its application to semiconductor manufacturing problem. Repeated measures design, analysis of covariance and its applications in comparing alternatives	6
6	Design of computer experiments and the applications in industrial engineering problems	7
	References NPTEL course	

BTEEE604 : ELECTIVE-VI: 3. ARTIFICIAL NEURAL NETWORK.

Teaching scheme:
Theory: 3 hrs
Total credit: 3

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Prerequisite		
Course outcome	To review basic principles of neuron structure. To understand building blocks artificial neural network. To understand different networks of ANN To develop different algorithm for learning. To study and understand Fuzzy neural networks.	
Unit	Contents	Contact Hrs
1	Introduction and ANN Structure : Biological neurons and artificial neurons. Model of an ANN. Activation functions used in ANNs. Typical classes of network architectures. Mathematical Foundations and Learning mechanisms : Re-visiting vector and matrix algebra. State-space concepts. Concepts of optimization. Error-correction learning. Memory-based learning. Hebbian learning. Competitive learning.	8
2	Single layer perceptrons : Structure and learning of perceptrons. Pattern classifier - introduction and Bayes' classifiers. Perceptron as a pattern classifier. Perceptron convergence. Limitations of a perceptrons.	6
3	Feedforward ANN : Structures of Multi-layer feedforward networks. Back propagation algorithm. Back propagation - training and convergence. Functional approximation with back propagation. Practical and design issues of back propagation learning.	6
4	Radial Basis Function Networks : Pattern separability and interpolation. Regularization Theory.Regularization and RBF networks.RBF network design and training. Approximation properties of RBF	6
5	Competitive Learning and Self organizing ANN : General clustering procedures. Learning Vector Quantization (LVQ). Competitive learning algorithms and architectures. Self organizing feature maps. Properties of feature maps.	6
6	Fuzzy Neural Networks : Neuro-fuzzy systems. Background of fuzzy sets and logic. Design of fuzzy stems. Design of fuzzy ANNs	7
	References NPTEL course	

BTEEE605 ELECTIVE-VII 1. SWITCH GEAR AND PROTECTION

Teaching scheme:	**Examination Scheme:**
Theory: 3 hrs	Mid-term test: 20 Marks
Total credit: 3	Internal Assessment: 20 Marks
	End semester exam: 60 Marks

Prerequisite	Power system I and II, control system I and II, machine I and II	
Course outcome	To understand principles of protective relaying. To understand principle of construction, operation and selection of different type of circuit breaker used in power system. To understand different protection schemes used in power system operation	
Unit	Contents	Contact Hrs
1	Switchgear and protection: Different types of switchgear, modes of classification, ratings and specifications. Protective Relaying: Need of protective relaying in power system, General idea about protective zone, Primary and backup protection, Desirable qualities of protective relaying, Classification of relays, Principle of working and characteristics of attracted armature, balanced beam, induction, disc and cup type relays, induction relays, Setting characteristics of over current; directional, differential, percentage differential and distance (impedance, reactance, mho) relays, introduction to static relays, advantages & disadvantages.	8
2	Circuit interruption: Principles of circuit interruption, arc phenomenon, A.C. and D. C. circuit breaker, Restricting and recovery voltage. Arc quenching methods. Capacitive, inductive current breaking, resistance switching, Auto reclosing Circuit Breakers: Construction, working and application of Air blast, Bulk oil, Minimum oil, SF6 and vacuum circuit breakers, Circuit breaker ratings, Rewritable and H. R. C. fuses, their characteristics and applications..	6
3	Digital And Numerical Protection: Introduction, working principle , Diff. methods of Digital and Numerical protection,	6
4	Bus bar: Feeder and Transmission line protection. Bus bar protection, Frame leakage protection circulating current protection and Transmission line protection using over current relays. Principles of distance relaying, choice between impedance, reactance and mho types, pilot wire and carrier pilot protection.	6
5	Protection of Alternators and Transformers: Alternators – Stator fault, stator inter turn protection. Unbalanced load, protection (Negative phase sequence [NPS] protection) Transformer – Use of Buccholz relay, differential protection, connection of C. T. and calculation of C.T. ratio needed for differential relaying, balanced and unbalanced restricted earth fault protection, frame leakage protection. Generator-Transformer unit protection	6
6	Insulation co-ordination and over current protection: Definitions (Dry flashover voltage FOV), WEF FOV, Impulse FOV, insulation, coordinating insulation and protective devices. Basic impulse insulation (BIL), Determination of line insulation. Insulation levels of substation equipment. Lightning arrester selection and location. Modern surge diverters and Necessity of power system earthing, Method of earthing the neutral, Peterson coil, earthing of transformer.	7
	References: 1. Patara Basu & Chaudhary – Power System Protection.(New Delhi Oxford And IBH). 2. Sunil S. Rao – Switchgear & Protection.(Tata Mcgraw Hill). 3. Madhavrao .T. S– Static relay.	

BTEEE605 ELECTIVE-VII 2. COMPUTER AIDED ANALYSIS AND DESIGN

Teaching scheme:
Theory: 3 hrs
Total credit: 3

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Prerequisite	Numerical methods and C programming, control system I and II	
Course outcome	To study different computer aided tools in engineering application. To understand the functionality of different engineering software. To apply different software in engineering design.	
Unit	Contents	Contact Hrs
1	Introduction to computer aided tools for analysis and design- software and hardware	8
2	PSPICE /PSIM / MATLAB-SIMULINK/ (description as per choice/ availability)	6
3	MATHEMATICA/ PSIM / LABVIEW / DSPACE(description as per choice/ availability)	6
4	Modelling of Electrical/Electronic components and systems, Time and Frequency domain analysis, parameter variations, response representation storage/import/export.	6
5	Optimization methods: parametric optimization and functional optimization. Design issues of Electrical/Electronic components and systems.	6
6	Applications for control systems, power systems and electrical machines	7
	Text/Reference Books: 1. L.P.Singh, „Advanced Power System Analysis and Dynamics", New Age International. 2. M.Gopal, „Control Systems: Principles and Design", TMH 3. Vlado Ostovic „Computer-Aided Analysis of Electric Machines: A Mathematical Approach", Prentice Hall. 4. Singiresu S. Rao, „ Engineering optimization: theory and practice", John Wiley & Sons. 5. Paul W. Tuinenga, "SPICE: A guide to circuit Simulation and Analysis Using PSPICE", Prentice Hall, 1992. 6. M.H. Rashid, "SPICE for Circuits and Electronics Using PSPICE" Prentice Hall of India, 2000	

BTEEE605 ELECTIVE-VII 3. MECHATRONICS

Teaching scheme:	**Examination Scheme:**
Theory: 3 hrs	Mid-term test: 20 Marks
Total credit: 3	Internal Assessment: 20 Marks
	End semester exam: 60 Marks

Prerequisite	Digital electronics, basic mechanical engineering	
Course outcome	To understand concept of mechatronics. To understand sensor and transducer construction and operation. To understand microprocessor architecture and operation. To understand principle of construction and operation of PLC To design a robo for engineering application.	
Unit	Contents	Contact Hrs
1	Introduction to Mechatronics and its Systems; Evolution, Scope, Measurement Systems, Control Systems, open and close loop systems, sequential controllers, microprocessor based controllers, mechatronics approach. Basics of Digital Technology Number System, Boolean algebra, Logic Functions, Karnaugh Maps, Timing Diagrams, Flip-Flops, Applications	8
2	Sensors and transducers -Introduction, performance terminology-Displacement, Position and Proximity, Velocity and motion, force, Fluid Pressure-Temperature sensors Light Sensors-Selection of Sensors-Signal Processing Pneumatic and Hydraulic actuation systems: actuation systems, Pneumatic and hydraulic systems, directional control valves, pressure control valves, cylinders, process control valves, rotary actuators.	6
3	Mechanical actuation systems -Mechanical systems, types of motion, kinematics chains, cams, gear trains, ratchet and pawl, belt and chain drives, bearings, mechanical aspects of motor selection.	6
4	Microprocessors-Introduction, Architecture, Pin Configuration, Instruction set, Programming of Microprocessors using 8085 instructions-Interfacing input and output devices-Interfacing D/A converters and A/D converters, Applications, Temperature control, Stepper motor control, Traffic light controller	6
5	Programmable Logic Controller- Introduction, Basic structure, Input/ Output Processing, Programming, Mnemonics, Timers, Internal relays and counters, Data handling, Analog Input/Output, Selection of a PLC.	6
6	Robotics- Introduction, types of robots, Robotic control, Robot drive systems Robot end effectors, selection parameters of a robot, applications.	7
	Text/Reference Books: 1. Bolton W., “Mechatronics”, Longman, Second Edition, 2004. 2. Histand Michael B.& Alciatore David G., “Introduction to Mechatronics & Measurement Systems”, McGraw Hill, 2003. 3. HMT Ltd., “Mechatronics”, Tata McGraw Hill Publishing Co. Ltd., 1998. 4. Nitaigour Premchand Mahalik, “Mechatronics Principles, Concepts * Applications”, TMH 2003	

BTEEOE606 ELECTIVE- VIII. 1. RURAL TECHNOLOGY AND COMMUNITY DEVELOPMENT.

Teaching scheme:
Theory: 3 hrs
Total credit: 3

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Prerequisite	Communication skills	
Course outcome	To analysis data, information and knowledge. To understand concepts of marketing. To identify projects and work for community development To understand and analyze business model.	
Unit	Contents	Contact Hrs
1	Data Analysis and Measures of Central Tendency- Meaning, nature, scope and limitations of statistics, collection of statistical data, classification, tabulation and diagrammatic representation of data, Measures of central tendency : Statistical averages Mean, Median, Mode.	8
2	Data, Information and Knowledge; concept of information, need of information (professional, educational, research), qualities of information, value of information, difference between data and information, properties of the needed information. Information and Management; planning, organizing, co-ordinating and controlling,	6
3	Concepts of marketing; difference between marketing selling and retailing; marketing mix, market-segmentation, marketing planning. Strategy and Approaches; modern concept of marketing.	6
4	Community development; concept, definition, meaning, need, history, principles, objectives and scope. Community Building: Coming of Age, Regenerating Community, Community Model	6
5	Consensus Organizing Model, What's Behind Building Healthy Communities? Participatory Democracy, The Role of various NGOs in Community Development.	6
6	The Role of Business and Government in Community Development Initiatives How to Form a Non-profit Corporation Fund Raising and Grant Writing.	7
	References; NPTEL	

BTEEOE606 ELECTIVE- VIII. 2. PROJECT MANAGEMENT

Teaching scheme:
Theory: 3 hrs
Total credit: 3

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Prerequisite	Communication skills.	
Course outcome	To understand concepts of project management. To develop a project plan. To understand the project implementation strategy. To analyze post project affects.	
Unit	Contents	Contact Hrs
1	Introduction to Project management: Characteristics of projects, Definition and objectives of Project Management, Stages of Project Management, Project Planning Process, Establishing Project organization.	8
2	Work definition: Defining work content, Time Estimation Method, Project Cost Estimation and budgeting, Project Risk Management,	6
3	Project scheduling and Planning Tools: Work Breakdown structure, LRC, Gantt charts, CPM/PERT Networks	6
4	Developing Project Plan (Baseline), Project cash flow analysis, Project scheduling with resource constraints: Resource Levelling and Resource Allocation. Time Cost Trade off: Crashing Heuristic.	6
5	Project Implementation: Project Monitoring and Control with PERT/Cost, Computers applications in Project Management, Contract Management, Project Procurement Management	6
6	Post-Project Analysis	7
	Text/Reference Books: 1. Shtub, Bard and Globerson, Project Management: Engineering, Technology, and Implementation, Prentice Hall, India 2. Lock, Gower, Project Management Handbook. 3. Cleland and King, VNR Project Management Handbook. 4. Wiest and Levy, Management guide to PERT/CPM, Prentice Hall. Ibdia 5. Horald Kerzner, Project Management: A Systemic Approach to Planning, Scheduling and Controlling, CBS Publishers, 2002. 6. S. Choudhury, Project Scheduling and Monitoring in Practice. 7. P. K. Joy, Total Project Management: The Indian Context, Macmillan India Ltd.	

BTEEOE606 ELECTIVE- VIII. 3. KNOWLEDGE MANAGEMENT

Teaching scheme:	**Examination Scheme:**
Theory: 3 hrs	Mid-term test: 20 Marks
Total credit: 3	Internal Assessment: 20 Marks
	End semester exam: 60 Marks

Prerequisite	Communication skills	
Course outcome	To understand different components knowledge management. To conduct knowledge audit and knowledge management practices in organization.	
Unit	Contents	Contact Hrs
1	Introduction: Definition, evolution, need, drivers, scope, approaches in Organizations, strategies in organizations, components and functions, understanding knowledge; Learning organization: five components of learning organization, knowledge sources, and documentation	8
2	Essentials of Knowledge Management; knowledge creation process, knowledge management techniques, systems and tools	6
3	Organizational knowledge management; architecture and implementation strategies, building the knowledge corporation and implementing knowledge management in organization	6
4	Knowledge management system life cycle, managing knowledge workers,	6
5	knowledge audit, and knowledge management practices in organizations, few case studies.	6
6	Futuristic KM: Knowledge Engineering, Theory of Computation, Data Structure	7
	Reference Books : 1. Knowledge Management – a resource book – A Thohothathri Raman, Excel, 2004. 2. Knowledge Management- Elias M. Awad Hasan M. Ghazri, Pearson Education 3. The KM Toolkit – Orchestrating IT, Strategy & Knowledge Platforms, Amrit Tiwana, Pearson, PHI, II Edn. 4. The Fifth Discipline Field Book – Strategies & Tools For Building A learning Organization – PeterSenge et al. Nicholas Brealey 1994 5. Knowledge Management – Sudhir Warier, Vikas publications 6. Leading with Knowledge, Madanmohan Rao, Tata Mc-Graw Hill	

BTEEL607. Control System Lab

Teaching scheme:
Lab work : 2 hrs
Total credit: 1

Examination Scheme:
Continuous Assessment (T/W): 30 Marks
Pr/oral: 20 Marks

Pre requisite	Basic electrical engineering, control system I	
Course Objective		
Course Outcome		
Expt No	Title of Expt	
1	Study of analog computer components	
2	Simulation of first order differential equation on the analog computer	
3	Simulation of second order differential equations and sine waveform	
4	Simulation of non linear equations	
5	Non linear system analysis by DF method	
6	Non linear system analysis by phase method	
7	Finding transfer function from frequency response plots	
8	Analysis of control system using digital computer matlab and basic command	
9	MATLAB programming	
10	MATLAB simulation program	
11	MATLAB and its basic command	
12	Solution of state space equation using MATLAB	

BTEEL608. Principles of Electrical Machine Design Lab

Teaching scheme:	Examination Scheme:
Lab work : 2 hrs	Continuous Assessment (T/W): 25 Marks
Total credit: 1	Pr/oral: 25 Marks

Pre requisite	Basic electrical engineering, electrical machine I and II	
Course Objective		
Course Outcome		
Expt No	Title of Expt	
1	To study General electrical symbol	
2	To study Electrical installation for residential building	
3	To study Design of Dc shunt motor starter	
4	To study Design of simplex lap winding	
5	To study Design of wave winding	
6	To study Design of ac lap winding	
7	To study Design of transformer	

BTEEL609. Power Electronics Lab

Teaching scheme: Examination Scheme:
Lab work : 4 hrs Continuous Assessment (T/W): 60 Marks
Total credit: 2 Pr/oral: 40 Marks

Pre requisite	Basic electrical engineering , basic electronics engineering	
Course Objective		
Course Outcome		
Expt No	Title of Expt	
1	To study Gate drive circuit	
2	To study Reverse recovery time of diode	
3	To study Single phase half wave controlled converter	
4	To study Characteristics of junction gate fet	
5	To study Unsymmetrical half wave bridge rectifier	
6	To study SCR parallel inverter	
7	To study Lamp dimmer using DIAC and TRIAC	
8	To study Simulation of 3 phase full wave controlled rectifier	
9	To study Simulation of 3 phase inverter	
10	To study Simulation of buck converter	

JAIDEV EDUCATION SOCIETY'S
J D COLLEGE OF ENGINEERING AND MANAGEMENT
KATOL ROAD, NAGPUR
SESSION 2019-20

Teaching scheme

Branch: Mechanical Engineering	Branch Code: ME

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	HU1T001	Communication Skills	2	0	0	60	0	40	100	2
2	BSC	MA1T001	Engineering Mathematics- I	3	1	0	20	20	60	100	4
3	BSC	ME1T002	Engineering Chemistry	3	1	0	20	20	60	100	4
4	ESC	ME1T003	Engineering Graphics	1	0	0	20	20	60	100	1
5	HSMC	HU1L001	Communication Skills Lab.	0	0	4	60	0	40	100	2
6	BSC	ME1L002	Engineering Chemistry Lab	0	0	2	60	0	40	100	1
7	ESC	ME1L003	Engineering Graphics Lab	0	0	4	60	0	40	100	2
8			Induction Programme	3 Weeks							
9	ESC	ME1T004	Basic Civil and Mechanical Engineering	2	0	0	10	15	25	50	Audit
				11	2	10					16

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	HU2T002	Introduction to Computer programming	2	0	0	20	20	60	100	2
2	BSC	MA2T001	Engineering Mathematics- II	3	1	0	20	20	60	100	4
3	BSC	ME2T005	Engineering Physics	3	1	0	20	20	60	100	4
4	ESC	ME2T006	Energy and Environment Engineering	3	0	0	20	20	60	100	3
5	ESC	WS2L001	Workshop Practices	0	0	4	60	0	40	100	2
6	HSMC	HU2L002	Introduction to Computer programming Lab	0	0	4	60	0	40	100	2
7	BSC	ME2L005	Engineering Physics Lab	0	0	2	60	0	40	100	1
8			Societal Internship/ Field Training	Credit to be given in III Sem.							
9	ESC	ME2T007	Basic Electrical and Electronics Engineering	2	0	0	10	15	25	50	Audit
				13	2	10					18
				25							

DBATU-3RD-SEMSETER-SCHEME

B. Tech. Mechanical Engineering

Course Structure for Semester III [Second Year] w.e.f. 2018-2019

Course Code	Type of Course	Course Title	Weekly Teaching Scheme			Evaluation Scheme				Credits
			L	T	P	CA	MSE	ESE	Total	
BTBSC301	BSC 7	Engineering Mathematics-III	3	1	--	20	20	60	100	4
BTMEC302	ESC 11	Materials Science and Metallurgy	3	1	--	20	20	60	100	4
BTMEC303	PCC 1	Fluid Mechanics	3	1	--	20	20	60	100	4
BTMEC304	PCC 2	Machine Drawing and CAD	2	--	--	20	20	60	100	2
BTMEC305	ESC 12	Thermodynamics	3	1	--	20	20	60	100	4
BTHM3401	HSMC 3	Basic Human Rights	2	--	--	50	--	--	50	Audit (AU/ NP)
BTMEL307	ESC 13	Materials Science and Metallurgy Lab	--	--	2	60	--	40	100	1
BTMEL308	PCC 3	Fluid Mechanics Lab	--	--	2	60	--	40	100	1
BTMEL309	PCC 4	Machine Drawing and CAD Lab	--	--	4	60	--	40	100	2
BTMEF310	Project 1	Field Training /Internship/Industrial Training I	--	--	--	--	--	50	50	1
		Total	16	4	8	330	100	470	900	23

DBATU-4TH -SEMSETER-SCHEME

B. Tech. Mechanical Engineering

Course Structure for Semester IV [Second Year] w.e.f. 2018-2019

Course Code	Type of Course	Course Title	Weekly Teaching Scheme			Evaluation Scheme				Credits
			L	T	P	CA	MSE	ESE	Total	
BTMEC401	PCC 5	Manufacturing Processes - I	2	1	--	20	20	60	100	3
BTMEC402	PCC 6	Theory of Machines-I	3	1	--	20	20	60	100	4
BTMEC403	PCC 7	Strength of Materials	3	1	--	20	20	60	100	4
BTMEC404	BSC 8	Numerical Methods in Mechanical Engineering	2	1	--	20	20	60	100	3
BTID405	PCC 8	Product Design Engineering – I	1	--	2	60	--	40	100	2
BTBSE406A	OEC 1	Physics of Engineering Materials	3	--	--	20	20	60	100	3
BTBSE3405A		Advanced Engineering Chemistry								
BTHM3402		Interpersonal Communication Skill& Self Development								
BTMEL407	PCC 9	Manufacturing Processes Lab – I	--	--	2	60	--	40	100	1
BTMEL408	PCC 10	Theory of Machines Lab- I	--	--	2	60	--	40	100	1
BTMEL409	PCC 11	Strength of Materials Lab	--	--	2	60	--	40	100	1
BTMEL410	BSC 9	Numerical Methods Lab	--	--	2	60	--	40	100	1
		Total	14	4	10	400	100	500	1000	23
Minimum 4 weeks training which can be completed partially in third and fourth semester or in at one time.										

DBATU-5TH -SEMSETER-SCHEME

B. Tech. Mechanical Engineering

Course Structure for Semester V [Third Year] w.e.f. 2019-2020

Course Code	Type of Course	Course Title	Weekly Teaching Scheme			Evaluation Scheme				Credits
			L	T	P	CA	MSE	ESE	Total	
BTMEC501	PCC 12	Heat Transfer	3	1	--	20	20	60	100	4
BTMEC502	PCC 13	Applied Thermodynamics – I	2	1	--	20	20	60	100	3
BTMEC503	PCC 14	Machine Design – I	2	1	--	20	20	60	100	3
BTMEC504	PCC 15	Theory of Machines-II	3	1	--	20	20	60	100	4
BTMEC505	PCC 16	Metrology and Quality Control	2	1	--	20	20	60	100	3
BTID506	PCC 17	Product Design Engineering - II	1	--	2	60	--	40	100	2
BTMEC506A	OEC 2	Automobile Engineering	3	--	--	--	--	--	--	Audit (AU/NP)
BTMEC506B		Nanotechnology								
BTMEC506C		Energy Conservation and Management								
BTMEL507	PCC 18	Heat Transfer Lab	--	--	2	30	--	20	50	1
BTMEL508	PCC 19	Applied Thermodynamics Lab	--	--	2	30	--	20	50	1
BTMEL509	PCC 20	Machine Design Practice- I	--	--	2	30	--	20	50	1
BTMEL510	PCC 21	Theory of Machines Lab- II	--	--	2	30	--	20	50	1
BTMEF511	Project 2	Field Training /Internship/Industrial Training II	--	--	--	--	--	50	50	1
		Total	16	5	10	280	100	470	850	24

DBATU-6TH -SEMSETER-SCHEME

B. Tech. Mechanical Engineering

Course Structure for Semester VI [Third Year] w.e.f. 2019-2020

Course Code	Type of Course	Course Title	Weekly Teaching Scheme			Evaluation Scheme				Credits
			L	T	P	CA	MSE	ESE	Total	
BTMEC601	PCC 22	Manufacturing Processes- II	2	1	--	20	20	60	100	3
BTMEC602	PCC 23	Machine Design-II	3	1	--	20	20	60	100	4
BTMEC603	PCC 24	Applied Thermodynamics- II	2	1	--	20	20	60	100	3
BTMEC604A	PEC 1	Engineering Tribology	2	1	--	20	20	60	100	3
BTMEC604B		IC Engines								
BTMEC604C		Additive Manufacturing								
BTMEC604D		Mechanical Measurements								
BTMEC605A	OEC 3	Quantitative Techniques in Project Management	3	--	--	20	20	60	100	3
BTMEC605B		Sustainable Development								
BTMEC605C		Renewable Energy Sources								
BTMEC606A	OEC 4	Biology for Engineers	3	--	--	--	--	--	--	Audit (AU/ NP)
BTMEC606B		Solar Energy								
BTMEC606C		Human Resource Management								
BTMEL607	PCC 25	Metrology and Quality Control Lab	--	--	2	30	--	20	50	1
BTMEL608	PCC 26	Machine Design Practice-II	--	--	2	30	--	20	50	1
BTMEL609	PCC 27	IC Engine Lab	--	--	2	30	--	20	50	1
BTMEL610	PCC 28	Refrigeration and Air Conditioning Lab	--	--	2	30	--	20	50	1
BTMEM611	Project 3	Technical Project for Community Services	--	--	4	30	--	20	50	2
		Total	15	4	12	250	100	400	750	22

RTMNU-7TH -SEMSETER-SCHEME

Annexure - B

Rashtrasant Tukdoji Maharaj Nagpur University, Nagpur
Faculty of Engineering & Technology
Course and Examination Scheme of Bachelor of Engineering (Mechanical Engineering)

VII Semester B.E. (Mechanical Engineering)

Subject Code	Subject	Teaching Scheme: Hours per week L	T	P	No. of Credits	Examination Scheme: Theory: Duration of Paper (Hrs.)	Max. Marks University Assessment	Max. Marks College Assessment	Total Marks	Min. Passing Marks	Practical: Max. Marks University Assessment	Max. Marks College Assesment	Total Marks	Min. Passing Marks
BEME701T	Industrial Engineering	03	01	-	04	03	80	20	100	40	-	-	-	-
BEME702T	Elective-I	03	01	-	04	03	80	20	100	40	-	-	-	-
BEME703T	Computer Aided Design	03	01	-	04	03	80	20	100	40	-	-	-	-
BEME703P	Computer Aided Design	-	-	02	01	-	-	-	-	-	25	25	50	25
BEME704T	Energy Conversion - II	03	01	-	04	03	80	20	100	40	-	-	-	-
BEME704P	Energy Conversion - II	-	-	02	01	-	-	-	-	-	25	25	50	25
BEME705T	Design of Mechanical Drives	03	01	-	04	03	80	20	100	40	-	-	-	-
BEME705P	Design of Mechanical Drives	-	-	02	01	-	-	-	-	-	25	25	50	25
BEME706P	Project Seminar	-	-	03	03	-	-	-	-	-	-	50	50	25
Total		**15**	**05**	**09**	-	-	**400**	**100**	**500**	-	**75**	**125**	**200**	-
Semester Total		**29**			**26**	**700 Marks**								

Elective – I (BEME702T):

BEME702T1: Industrial Robotics
BEME702T2: Tool Design
BEME702T3: Automobile Engineering
BEME702T4: Power Plant Engineering
BEME702T5: Synthesis of Mechanisms
BEME702T6: Material Handling System

All subjects pertains to Board of Studies in Mechanical Engineering.

RTMNU-8TH -SEMSETER-SCHEME

Rashtrasant Tukdoji Maharaj Nagpur University, Nagpur
Faculty of Engineering & Technology
Course and Examination Scheme of Bachelor of Engineering (Mechanical Engineering)

VIII Semester B.E. (Mechanical Engineering)

Subject Code	Subject	Teaching Scheme				Examination Scheme								
		Hours per week			No. of Credits	Theory					Practical			
		L	T	P		Duration of Paper (Hrs.)	Max. Marks University Assessment	Max. Marks College Assessment	Total Marks	Min. Passing Marks	Max. Marks University Assessment	Max. Marks College Assesment	Total Marks	Min. Passing Marks
BEME801T	Industrial Management	03	01	-	04	03	80	20	100	40	-	-	-	-
BEME802T	Elective – II	03	01	-	04	03	80	20	100	40	-	-	-	-
BEME802P	Elective – II	-	-	02	01	-	-	-	-	-	25	25	50	25
BEME803T	Elective – III	03	01	-	04	03	80	20	100	40	-	-	-	-
BEME804T	Automation in Production	03	01	-	04	03	80	20	100	40	-	-	-	-
BEME804P	Automation in Production	-	-	02	01	-	-	-	-	-	25	25	50	25
BEME805T	Energy Conversion - III	03	01	-	04	03	80	20	100	40	-	-	-	-
BEME805P	Energy Conversion - III	-	-	02	01	-	-	-	-	-	25	25	50	25
BEME806P	Project	-	-	06	06	-	-	-	-	-	75	75	150	75
Total		**15**	**05**	**12**		-	**400**	**100**	**500**	-	**150**	**150**	**300**	-
Semester Total		**32**			**29**	**800 Marks**								

Elective – II (BEME802T, BEME802P):

BEME802T1/P1: Finite Element Method
BEME802T2/P2: Computer Integrated Manufacturing
BEME802T3/P3: Industrial Fluid Power
BEME802T4/P4: Management Information Systems
BEME802T5/P5: Refrigeration & Air-Conditioning
BEME802T6/P6: Stress Analysis

Elective – III (BEME803T):

BEME803T1: Advanced Manufacturing Techniques
BEME803T2: Machine Tool Design
BEME803T3: Renewable Energy Systems
BEME803T4: Mechanical Vibrations
BEME803T5: Advance I.C. Engine
BEME803T6: Tribology

All subjects pertains to Board of Studies in Mechanical Engineering.

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
Second Year, Third Year and Final Year
B. Tech. Programme in Information Technology

Effective from
Academic Year 2018-19
Approved in the 11th meeting of Academic Council dated 8th June, 2018

Teaching and Evaluation Scheme Second Year B. Tech. (Information Technology)

Sr. No.	Code	Course title	Weekly Teaching hours			Evaluation Scheme			Credit	Total Hours
			L	T	P	MSE	CA	ESE		
		Semester III								
1	BTBSC301	Engineering Mathematics III	3	1	-	20	20	60	4	4
2	BTESC302	Switching Theory and Logic Design	2	1	-	20	20	60	3	3
3	BTITC303	Object Oriented Paradigm with C++	2	1	-	20	20	60	3	3
4	BTCOC304	Computer Architecture and Organization	2	1	-	20	20	60	3	3
5	BTBSCOE305A BTHSMCOE305B BTITOE305C BTITOE305D	**Elective I** A) Advanced Engineering Chemistry B) Interpersonal Communication Skills and Self Development for Engineers C) Programming in Java D) Introduction to Web Technology	1	1	-	20	20	60	2	2
6	BTHM306	Basic Human Rights	2	-	-	-	50	-	Audit	2
7	BTESCL307	Switching Theory and Logic Design Lab	-	-	2	-	60	40	1	2
8	BTITL308	Object Oriented Paradigm with C++ Lab	-	-	4	-	60	40	2	4
9	BTITL309	Programming Lab (Python)	-	-	4	-	60	40	2	4
10	BTITOEL310	**Elective I Lab** A) Advanced Engineering Chemistry Lab B) Interpersonal Communication Skills and Self Development for Engineers Lab C) Programming in Java Lab D) Introduction to Web Technology Lab	-	-	2	-	60	40	1	2
11	BTITF311	Field Training / Internship/Industrial Training Evaluation	-	-	-	-	-	100	1	-
		Total	**12**	**5**	**12**	**100**	**390**	**560**	**22**	**29**
		Semester IV								
1	BTITC401	Microprocessors and Microcontrollers	2	1	-	20	20	60	3	3
2	BTITC402	Data Structures and Applications	3	1	-	20	20	60	4	4
3	BTITC403	Discrete Structures and Applications	2	1	-	20	20	60	3	3
4	BTITC404	Internetworking Protocols	2	1	-	20	20	60	3	3
5	BTBSCOE405A BTHMOE405B BTXXOE405C	**Elective II** A) Physics of Engineering Materials B) Organizational Behavior C) Development Engineering	2	1	-	20	20	60	3	3
6	BTXX406	Product Design Engineering	2	-	-	20	20	60	2	2
7	BTITL407	Microprocessors and Micro-controllers Lab	-	-	2	-	60	40	1	2
8	BTITL408	Data Structures and Applications Lab	-	-	4	-	60	40	2	4
9	BTITL409	Internetworking Protocols Lab	-	-	2	-	60	40	1	2
10	BTITF410	Field Training / Internship/Industrial Training (minimum 4 weeks which can be completed partially in third semester and fourth semester or at one time.)						100	To be evaluated in V Semester	-
		Total	**13**	**5**	**8**	**120**	**300**	**580**	**22**	**26**

Programme Objectives:

The program educational objectives for the B. Tech. programme in Information Technology describes accomplishments that graduates are expected to attain within the four years of graduation. Graduates will be able to apply their expertise to contemporary problem solving, be engaged professionally, and have continued to learn and adapt, and have contributed to their organizations through leadership and teamwork. More specifically, the objectives are:

1. PEO1: To enable graduates gain strong skills for employment in multidisciplinary domains driven by IT
2. PEO2: To enable graduates to pursue higher education and research
3. PEO3: To enable graduates to develop entrepreneurship and leadership skills
4. PEO4: To enable graduates to contribute to the society in accordance with highest standards of ethics
5. PEO5: To develop breakthrough solutions enabling transformations in a rapidly changing IT world

Programme Outcomes:

The graduates of this programme will be able to demonstrate:

1. PO1: An Understanding of IT architecture, software and hardware concepts, functionalities and applications
2. PO2: An Ability to design, develop and test computer programs involving various algorithms, methodology and programming languages
3. PO3: Competency of business domains and functional processes that employ IT systems and applications
4. PO4: Practical use of communication protocols and their applications in the field of Internet and World Wide Web
5. PO5: Sound understanding of fundamentals of computer as the central enabling platform for information management in 21st century
6. PO6: An Ability to develop, integrate, maintain and innovate software applications deployed in various multi-disciplinary domains
7. PO7: Thought leadership to design and implement practical solutions for global industry needs.
8. PO8: Acumen to embrace and adopt futuristic IT technological developments
9. PO9: Sound knowledge of entrepreneurship traits to succeed
10. PO10: Adoption of practices that are ethical ensuring transparency and accountability
11. PO11: Capability to provide solutions that are socially empowering and environment friendly
12. PO12: Effective communication and collaboration techniques with stakeholders to achieve best results

Course Title:	**Engineering Mathematics – III**	**Semester III**	
Course Code	**BTBSC301**	**Course Type**	**Compulsory**
Prerequisite	**MATH201**	**L – T – P**	**3 – 1 – 0**
Stream	**Basic Science**	**Credits**	**4**

Course Objectives:

1. To provide in depth knowledge of complex numbers
2. To find the solution of differential equations
3. To find an in-depth knowledge of Fourier series analysis of periodic function

Course Outcomes:

After learning the course the students should be able:

1. To develop an ability to use characteristics of complex numbers in problem pertaining to electric circuits
2. To develop an acquaintance with the method of finding solution of differential equations
3. To develop an in depth knowledge of vector differentiation and vector integration
4. To develop Fourier series expansion of different periodic functions

Course Content:

UNIT I

Laplace Transform

Definition – conditions for existence ; Transforms of elementary functions ; Properties of Laplace transforms - Linearity property, first shifting property, second shifting property, transforms of functions multiplied by t^n, scale change property, transforms of functions divided by t, transforms of integral of functions, transforms of derivatives ; Evaluation of integrals by using Laplace transform ; Transforms of some special functions- periodic function, Heaviside-unit step function, Dirac delta function.

UNIT II

Inverse Laplace Transform

Introductory remarks ; Inverse transforms of some elementary functions ; General methods of finding inverse transforms ; Partial fraction method and Convolution Theorem for finding inverse Laplace transforms ; Applications to find the solutions of linear differential equations and simultaneous linear differential equations with constant coefficients.

UNIT III

Fourier Transform

Definitions – integral transforms ; Fourier integral theorem (without proof) ; Fourier sine and cosine integrals ; Complex form of Fourier integrals ; Fourier sine and cosine transforms ; Properties of Fourier transforms ; Parseval's identity for Fourier Transforms.

UNIT IV

Partial Differential Equations and Their Applications

Formation of Partial differential equations by eliminating arbitrary constants and functions; Equations solvable by direct integration; Linear equations of first order (Lagrange's linear equations); Method of separation of variables – applications to find solutions of one dimensional heat flow equation $\left(\frac{\partial u}{\partial t}=c^2\frac{\partial^2 u}{\partial x^2}\right)$, and two dimensional heat flow equation (i.e. Laplace equation : $\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial y^2}=0$).

UNIT V

Functions of Complex Variables (Differential calculus)

Limit and continuity of f(z); Derivative of f(z) ; Analytic functions; Cauchy- Riemann equations in Cartesian and polar forms; Harmonic functions in Cartesian form; Mapping: Translation, magnification and rotation, inversion and reflection , bilinear transformation; Conformal mapping.

UNIT VI

Functions of Complex Variables (Integral calculus)

Cauchy's integral theorem; Cauchy's integral formula; Residues; Cauchy's residue theorem (All theorems without proofs).

Text Books:

1. B. S. Grewal, ***"Higher Engineering Mathematics"***, Khanna Publishers, New Delhi.
2. H. K. Das, Er. RajnishVerma, ***"Higher Engineering Mathematics"***, S. Chand & CO. Pvt. Ltd., New Delhi.
3. Dr. B. B. Singh, **"A course in Engineering Mathematics (Volume-III)"**, Synergy Knowledge ware, Mumbai.
4. B. V. Ramana, ***"Higher Engineering Mathematics"***, Tata McGraw-Hill Publications, New Delhi.

Reference Books:

1. Erwin Kreyszig, ***"Advanced Engineering Mathematics"***, John Wiley & Sons, New York.
2. Peter O' Neil, ***"A Text Book of Engineering Mathematics"***, Thomson Asia Pvt. Ltd., Singapore.
3. C. R. Wylie, L. C. Barrett, ***"Advanced Engineering Mathematics"***, Tata McGraw-Hill Publishing Company Ltd., New Delhi.
4. C. R. Wylie & L. C. Barrett, ***"Integral Transforms and their Engineering Applications"***, Synergy Knowledge ware, Mumbai.
5. I. N. Sneddon, ***"Integral Transforms"***, Tata McGraw-Hill, New York.

General Instructions:

1. The tutorial classes in Engineering Mathematics-III are to be conducted batch wise. 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.

Course Title:	**Switching Theory and Logic Design**	**Semester III**	
Course Code	**BTESC302**	**Course Type**	**Compulsory**
Prerequisite	**Nil**	**L – T – P**	**2 – 1 – 0**
Stream	**Core**	**Credits**	**3**

Course Objectives:

1. To learn numbering systems used in digital world and its representation, arithmetic operations, error detection and correction methods.
2. To learn Boolean algebra, logic gates, logic families, realization of Boolean expressions and minimization techniques.
3. To study the sequential logic circuits design used in synchronous and asynchronous modes.
4. To describe various programmable logic devices.

Course Outcomes:

After learning the course the students should be able to:

1. Illustrate theory of Boolean algebra and the underlying features of various numbering systems.
2. Design various combinational & sequential logic circuits.
3. Demonstrate working of flip-flop.

Course Content:

UNIT I

Number Systems and Codes: Number systems: Binary, Octal, Hexadecimal number systems, Binary arithmetic, Codes: Binary code, Excess-3 code, Gray code, Error detection and correction codes.

UNIT II

Boolean algebra and Logic Functions: Boolean algebra: Postulates and theorems, Logic functions, Minimization of Boolean functions using algebra, Karnaugh map and Quine – McClusky methods, Realization using logic gates.

UNIT III

Classification of logic families, Characteristics of digital ICs- Speed of operation, power dissipation, figure of merit, fan in, fan out, current and voltage parameters, noise immunity, operating temperatures and power supply requirements, TTL logic, Operation of TTL NAND gate, active pull up, wired AND, open collector output, unconnected inputs, Tri-State logic, CMOS logic, CMOS inverter, NAND, NOR gates, unconnected inputs, wired logic, open drain output, Interfacing CMOS and TTL.

UNIT IV

Combinational Functions: Realizing logical expressions using different logic gates, Design of combinational circuits using combinational IC’s, Realization of adders and subtractors, Design of code converters, Comparators and decoders, Design of multiplexers, Demultiplexers.

UNIT V

Introduction to Sequential Circuits: Moore and mealy machines, Introduction to flip-flops like SR, JK, D and T with truth tables, Logic diagrams and timing relationships, Conversion of flip-flops, Excitation table, State tables, Realization of state stables.

UNIT VI

Programmable Logic Devices: Semiconductor memories, RAM, ROM, EPROM, EEPROM, NVRAM, SRAM, DRAM, PLA, PAL, Memory System design.

Text Books:

1. M. M. Mano, ***"Digital Logic and Computer Design"***, Prentice Hall of India Publication, 4th Edition, 2006.
2. R.P. Jain, ***"Modern Digital Electronics"***, Tata McGraw Hill Publication, 4th Edition, 2010.

Reference Books:

1. D. P. Leach, A. P. Malvino, G. Saha, ***"Digital Principles and Applications"***, Tata McGraw Hill Publication, 8th Edition, 1993.
2. Comer, ***"Digital Logic & State Machine Design"***, Oxford Universities Press, 3rd Edition, 2014.

Course Title:	**Object Oriented Paradigm with C++**	**Semester III**	
Course Code	**BTITC303**	**Course Type**	**Compulsory**
Prerequisite	**ICT106**	**L – T – P**	**2 – 1 – 0**
Stream	**Core**	**Credits**	**3**

Course Objectives:

1. This course focuses on principles of object oriented programming paradigm. The course also includes practice of writing programs in C++ and Java

Course Outcomes:

After learning the course, the students should be able:

1. To draw the control flow of a program.
2. To understand the storage concepts in a simple program.
3. To program using basic concepts of OO languages i.e. objects, encapsulation, data hiding etc.
4. To program using advanced concepts of OO languages i.e. associations, packages, interfaces, exception handling etc.
5. To work with functional, Logic programming paradigms.

Course Content:

UNIT I

Elements of computer systems, DOS commands and Linux environment, Language processors, Algorithms, Flowcharts, Object-Oriented Programming Paradigm: Benefits, Applications, Object-Oriented Systems Development, Object-Oriented Analysis: Static and dynamic modeling, Object-Oriented Design: Class design and algorithm.

UNIT II

Beginning with C++: Tokens, Data types, Operators, Expressions, and Control structures, Array, Functions, Structures and Unions, Class and Objects, specifying a class, Defining member functions, Private member functions, Static data and member functions, Arrays of objects, Friend functions.

UNIT III

Constructors and Destructors: Constructor, Parameterized constructors, Multiple constructors in a class, Copy constructors, Dynamic constructors, Destructor. Programming for class diagram and relationship.

UNIT IV

Inheritance: Single inheritance, Multilevel inheritance, Multiple inheritance, Hierarchical inheritance, Hybrid inheritance, Virtual base classes, Abstract classes.

UNIT V

Polymorphism: Operator overloading, Function overloading, Virtual functions, pure virtual functions, Abstract class, Working with Files: Classes for file stream operations and I/O stream operation, Opening and closing a file, Detecting end-of-file, More about Open(): File Modes, Sequential input and output operations.

UNIT VI

Exception Handling: Fundamentals, Types of exceptions, Catching exceptions, Multiple catching, Nested try statements, Uncaught exceptions, Throw and throws, Built-in exceptions, Creating exception subclasses, Using exceptions.

Text Books:

1. Robert Lafore, ***"Object Oriented Programming in C++"***, Pearson Education, 4th Edition, 2008.
2. E. Balagurusamy, ***"Object Oriented Programming with C++"***, Tata McGraw Hill Publication, 6th Edition, 2013.

Reference Books:

1. J. R. Hubbard, ***"Programming with C++: Schaum's Outlines"***, Tata McGraw-Hill publication, 2005.
2. P. J. Deitel, H.M.Deitel, ***"C++ How to Program"***, Pearson Education, 9th Edition, 2016.

Course Title:	**Computer Architecture and Organization**	**Semester III**	
Course Code	**BTCOC304**	**Course Type**	**Compulsory**
Prerequisite	**Nil**	**L – T – P**	**2 – 1 – 0**
Stream	**Core**	**Credits**	**3**

Course Objectives:

1. To understand the structure, functions and characteristics of computer systems.
2. To learn basics of Parallel Computer Architecture.
3. To study hierarchical memory system including cache memories and virtual memory.
4. To identify input / output devices and their data transfer mechanism.

Course Outcomes:

After learning the course, the students should be able:

1. To identify components of a computer system, including CPU, memory, and input/output units.
2. To explain instruction types, its execution and interrupt mechanism.
3. To illustrate numerical and character representations in digital logic and floating point arithmetic.

Course Content:

UNIT I

Introduction: Concept of computer organization and architecture, Fundamental unit, Computer function and interconnection, CPU structure and function.

UNIT II

Instruction Sets: Characteristics, Types of operands, Types of operations, Assembly language, Addressing modes, Instruction format, Types of instruction, Instruction execution, Machine state and processor status, Structure of program, Introduction to RISC and CISC architecture.

UNIT III

Computer Arithmetic: The arithmetic and logic Unit, Integer representation, Integer arithmetic, Floating point representation, Floating point arithmetic, Introduction of arithmetic co-processor.

UNIT IV

Memory Organization: Internal Memory: Semiconductor main memory, Error correction, Advanced DRAM organization, Virtual memory systems and cache memory systems, External Memory: Organization and characteristics of magnetic disk, Magnetic tape, Optical memory, RAID, Memory controllers.

UNIT V

Control Unit: Control unit operation: Micro-operations, Control of the processor, Hardwired implementation, Micro-programmed Control Unit, Basic concepts, Micro-instruction sequencing, Micro-instruction execution, Applications of micro-programming.

UNIT VI

Input/ Output Organization: External devices, I/O module, Programmed I/O, Interrupt driven I/O, Direct memory access, I/O channels and processors, External interface.

Instruction pipe-lining: Concepts, Parallel processing: Multiple processor organization, Symmetric multiprocessor, Cache coherence and the MESI protocol.

Text Books:

1. William Stalling, ***"Computer Organization and Architecture: Designing for Performance"***, 8th Edition, Prentice Hall Publication, 2009.
2. Hayes, ***"Computer Architecture and Organization"***, 3rd Edition, McGraw-Hill Publication, 2012.
3. Zaky, ***"Computer Organization"***, 5th Edition, McGraw-Hill Publication, 2011.

Reference Books:

1. Morgan and Hennessy and Patterson, ***"Computer Architecture: A Quantitative Approach"***, 4th Edition, Kaufman Publication, 2007.
2. Morris Mano, ***"Computer System Architecture"***, 3rd Edition, Pearson Education India, 2007.
3. Mostafa Abd-El-Barr, Hesham El-Rewini, ***"Fundamentals of Computer Organization and Architecture"***, 1st Edition, Wiley Publication, 2004.
4. Miles J. Murdocca, Vincent P. Heuring, ***"Computer Architecture and Organization: An Integrated Approach"***, 1st Edition, Wiley Publication, 2007.

Course Title:	**Advanced Engineering Chemistry**	**Semester III**	
Course Code	**BTBSCOE305A**	**Course Type**	**Elective**
Prerequisite	**CHM103**	**L – T – P**	**1 – 1 – 0**
Stream	**Basic Science**	**Credits**	**2**

Course Objectives:

1. To introduce this subject of Advanced Engineering Chemistry.
2. To impart the basic and advanced knowledge to the students.
3. To understand, remember and capable to explain and apply this knowledge in the field of Engineering/ Technology.

Course Outcomes:

After learning the course, the students should be able:

1. To classify and explain various types of Corrosion and should apply methods to minimize the rate of Corrosion.
2. To apply concepts of Photochemical and Thermal reactions.
3. To explain basic concepts of Polymers, Polymerization.
4. To determine molecular weight of High-Polymer.
5. To apply the basic techniques in Chemistry and capable to explain concept of Solvent Extraction.
6. To explain concept of Thermo Gravimetric Analysis (TGA).

Course Content:

UNIT I

Corrosion and its Control:
Introduction, Fundamental reason, Electrochemical Corrosion, Direct Chemical Corrosion, Factors affecting the rate of corrosion, types of corrosion-Galvanic, Pitting Corrosion, Stress corrosion, methods to minimize the corrosion- Proper design, Cathodic and Anodic protection.

UNIT II

Photochemical and Thermal Reactions
Introduction, Laws of Photochemistry, Measurement of absorbed intensity, Quantum yield or efficiency, Jablonski Diagram, Photosynthesis reaction of Hydrogen Bromide, Brief discussion on Thermal Reactions- Cope Rearrangement.

UNIT III

Polymers
Introduction, Nomenclature of polymers, types of polymerisation, molecular weight determination by osmotic pressure and viscosity method. Plastic and its classification, Constituents of Plastic, Moulding of plastic by Injection method.

UNIT IV

Reaction Mechanism and Reaction Intermediates
Introduction of reaction mechanism, Brief introduction of reactivity of substrate (Inductive effect,

Mesomeric effect, Electromeric Effect, Hyperconjugative effect), Bond fission: Homolytic and Heterolytic bond fission, Reaction Intermediates: Carbocation(Structure, Stability and applications), Carbanion (Structure, Stability and applications).

Rearrangement reactions:

Intramolecular Rearrangement: Isomerisation, Beckmann Rearrangement, Benzidine Rearrangement
Intermolecular Rearrangement: Orton Rearrangement, Diazoamino Rearrangement

UNIT V

Spectroscopy

Brief introduction to spectroscopy, UV – Visible Spectroscopy: Laws of absorption, instrumentation and application. IR spectroscopy: introduction, theory, instrumentation and application. Brief discussion on NMR Spectroscopy, AAS (Atomic Absorption Spectroscopy)

UNIT VI

Instrumental Methods of Analysis

Introduction to Chromatography, Types of Chromatography (Adsorption and partition chromatography), Thin Layer Chromatography, Gas Chromatography – introduction, theory, instrumentation. Brief discussion of Thermo gravimetric analysis (TGA).

Text Books:

1. Bhal and Bhal, ***"Advance Organic Chemistry"***, S. Chand & Company, New Delhi, 1995.
2. Jain P.C & Jain Monica, ***"Engineering Chemistry"***, Dhanpat Rai & Sons, New Delhi, 1992.
3. Bhal & Tuli, ***"Text book of Physical Chemistry",*** S. Chand & Company, New Delhi, 1995.
4. Chatwal Anand, **"Instrumental Methods of Analysis"**, Himalaya Publication.
5. Rakesh K. Parashar, V.K. Ahluwalia, "***Text Book of Organic Chemistry***".

Reference Books:

1. Finar I.L., ***"Organic Chemistry (Vol. I & II)"***, Longman Gr. Ltd & English Language Book Society, London.
2. Barrow G.M., ***"Physical Chemistry"***, McGraw-Hill Publication, New Delhi.
3. Shikha Agarwal, ***"Engineering Chemistry- Fundamentals and Applications"***, Cambridge Publishers, 2015.
4. O. G. Palanna, ***"Engineering Chemistry"***, Tata McGraw-Hill Publication, New Delhi.
5. WILEY, ***"Engineering Chemistry"***, Wiley India, New Delhi, 2014.
6. Willard, Dean, Merrit, ***"Instrumental Methods of Analysis"***, McGraw - Hill.
7. Glasstone, ***"Physical Chemistry"***.
8. Peter Atkins, ***"Physical Chemistry"***, W.H. Freeman & Co. 9^{th} Edition, 2009.

Course Title:	**Interpersonal Communication Skills and Self Development for Engineers**	**Semester III**	
Course Code	**BTHSMCOE305B**	**Course Type**	**Elective**
Prerequisite	**HS202**	**L – T – P**	**1 – 1 – 0**
Stream	**Humanities, Social Science and Management**	**Credits**	**2**

Course Objectives:

1. To build the skills like team building so that they can work efficiently in groups.
2. To provide knowledge of conflict management while working in large organizations.
3. To develop management skills required in routine work environment.
4. To polish the personality of the learners in order to make them good leaders and employees.

Course Outcomes:

1. Learners will acquire interpersonal communication skills.
2. Learners will develop the ability to work independently.
3. Learners will develop the qualities like self-discipline, self-criticism and self-management.
4. Learners will have the qualities of time management and discipline.

UNIT I

Development of Proficiency in English

Speaking skills, Feedback & questioning technique, Objectivity in argument (Both one on one and in groups), 5 Ws & 1 H & 7 Cs for effective Communication, Imbibing Etiquettes and manners, Study of different pictorial expressions of non-verbal communication and their analysis

UNIT II

Self Management

Self Management, Self Evaluation, Self discipline, Self criticism, Recognition of one’s own limits and deficiencies, dependency, etc.

Self Awareness, Self Management, Identifying one’s strengths and weaknesses, Planning & Goal setting, Managing self-emotions, ego, pride,- Leadership & Team Dynamics

UNIT III

Time Management Techniques

Practice by game playing and other learning strategies to achieve the set targets Time Management Concept, Attendance, Discipline & Punctuality, Acting in time, Quality /Productive time.

UNIT IV

Motivation/ Inspiration

Ability to shape and direct working methods according to self-defined criteria, Ability to think for oneself, Apply oneself to a task independently with self-motivation,

Motivation techniques: Motivation techniques based on needs and field situations

UNIT V

Interpersonal Skills Development

Positive Relationship, Positive Attitudes, Empathies: comprehending others' opinions, points of views, and face them with understanding, Mutuality, Trust, Emotional Bonding, Handling Situations (Interview), Importance of interpersonal skills

UNIT VI

Effective Computing Skills

Designing an effective Presentation: Contents, appearance, themes in a presentation, Tone and Language in a presentation, Role and Importance of different tools for effective presentation

Reference books:

1. Mitra, Barun, ***"Personality Development and Soft Skills"***, Oxford University Press, 2016.
2. Ramesh, Gopalswamy, ***"The Ace of Soft Skills: Attitude, Communication and Etiquette for Success"***, Pearson Education, 2013.
3. Covey, Stephen R., ***"Seven Habits of Highly Effective People: Powerful Lessons in Personal Change"***.
4. Osenberg Marshall B., ***"Nonviolent Communication: A Language of Life"***.

Course Title:	**Programming in Java**	**Semester III**	
Course Code	**BTITOE305C**	**Course Type**	**Elective**
Prerequisite	**ICT106**	**L – T – P**	**1 – 1 – 0**
Stream	**Professional Core**	**Credits**	**2**

Course Objectives:

1. Understand fundamentals of programming such as variables, conditional and iterative execution, methods, etc.
2. Understand fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries, etc.
3. Be able to use the Java SDK environment to create, debug and run simple Java programs.

Course Outcomes:

After learning the course, the students should be able to:

1. Know the structure and model of the Java programming language.
2. Use the Java programming language for various programming technologies.
3. Develop software in the Java programming language (application).

UNIT I

Introduction to Java

Fundamentals of Object-oriented Programming, Evolution of Java, Overview of Java Language: Data types in Java, Operators and expressions, Decision Making and Branching: Control Statements such as If Else, Do statement, For statement, The Else if ladder, Jumps in loops, Labelled loops, While repetition statement, Switch statement, Break and continue statement, Arrays, Strings and Vectors: Creating one dimensional and multidimensional array, Strings, Vectors, Wrapper classes, Enumerated types, Annotations.

UNIT II

Object Oriented Programming

Classes , Objects And Methods: Defining class , Methods, Creating objects , Accessing Class members, Static Methods , Finalize Methods, Visibility Control, Method overloading, Method Overriding, Recursion. Interfaces, Constructors and finalizes Methods.

UNIT III

Packages and Applet Programming

Java API Packages, Using System Packages, Naming conventions, Creating Packages and Jar Files, Accessing and using a package, Hiding Classes, Applet Programming.

UNIT IV

Multithreading

Creating threads, Extending Thread Class, Stopping and Blocking a thread, Life cycle of a thread, Using thread method, Thread exceptions, Implementing the Run able interface, Interthread communication.

Managing Errors and Exceptions: Types of errors, Exceptions, Syntax of exception handling code, Multiple catch statements, Throwing your own exception, Using exceptions for debugging.

UNIT V

Graphics Programming

The Graphics class, Lines and Rectangles, Circles, Arc and ellipses, Polygons, Drawing Bar charts, AWT Package and Swings.

UNIT VI

Managing Files & I/O Handling

Files and Streams, Stream classes, Byte Stream Classes , Character Stream Classes, Using Streams, Reading / writing bytes and characters , Interactive Input and Output, Other Stream classes.

Text Books

1. E. Balagurusamy, ***"Programming with Java – A Primer"***, Tata – McGraw-Hill Publication, 4th Edition, 2010.
2. Steven Holzner et al. ***"Java 2 Programming"***, Black Book, Dreamtech Press, 2009.

Reference Books

1. H.M. Deitel, P.J. Deitel, ***"Java - How to Program"***, PHI Publication, 6th Edition, 2005.
2. Bruce Eckel, ***"Thinking in Java"***, PHI Publication.
3. Patric Naughton, Michael Morrison, ***"The Java Handbook"***, McGraw Hill Publication.
4. Tim Lindholm, Frank Yellin, Bill Joy, Kathi Walrath, ***"The Java Virtual Machine Specification"***, Addison Wesley Publication.

Course Title:	**Introduction to Web Technology**	**Semester III**	
Course Code	**BTITOE305D**	**Course Type**	**Elective**
Prerequisite	**Nil**	**L – T – P**	**1 – 1– 0**
Stream	**Professional Core**	**Credits**	**2**

Course Objectives:

1. Overview of modern Web technologies.
2. To use different web scripting technology.
3. To understand web hosting, server type, debugging, and performance driven application development.
4. To understand user interface and awareness of real-world knowledge.

Course Outcomes:

1. To understand World Wide Web and latest trends in web-development.
2. Real world knowledge of design and development.
3. Design and development of web application with all industrial standards.
4. Awareness of web hosting, server type, debugging.

UNIT I

Introduction to World Wide Web, Features of web, HTTP, Web Servers, Introduction to Scripting Language, Browser, Integrated Development Environment.

UNIT II

HTML: Introduction to HTML, Basics of HTML, Formatting and fonts, Commenting code, HTML heading, Block element, Inline element, Comment, Attributes, Hyperlink, Lists, Tables, Images, Forms, Meta tags, Character entities, Frames sets.

UNIT III

Advance HTML: Overview and features of HTML5, Includes External File, Responsive Layout with Media Queries, Marquee, Semantic Tags, HTML Symbol, URL Encode, Cashing, Video Tags, Audio Tags, Image Maps.

UNIT IV

CSS: Introduction To CSS, Selector, Basic Syntax And Structure, Padding, Margin, Manipulating Texts, Display, Height, Width, Border, Color, Fonts, Positioning Using CSS, Overview And Features Of CSS3.

UNIT V

PHP: Introduction to PHP, Features of PHP, Basics of PHP, Syntax, Variable, Printing Output, Array, String, Function, Data types, Operator, Loops, Conditional Statement, Introduction To Advance PHP, Form Processing, Files, PHP Cookies, PHP Sessions, Constant, PHP Magic Function, PHP Global Variable, Error Handling, Exception, Connection with Database, Curd Operation in PHP.

UNIT VI

Web Hosting, Debugging and Unit Testing, Browser Compatibility.

Text Book

1. Snehal Joglekar, ***"HTML and CSS- Web Technologies"***, Nirali Prakashan, 2013.

Reference Books

1. Thomas Powell, ***"HTML & CSS: The Complete Reference"***, 5th Edition, McGraw Hill Publication.
2. Steven Holzner, ***"PHP: The Complete Reference"***, 1st Edition, McGraw Hill Publication.

Course Title:	**Basic Human Rights**	**Semester III**	
Course Code	**BTHM306**	**Course Type**	**Audit**
Prerequisite	**Nil**	**L – T – P**	**2 – 0 – 0**
Stream	**Humanities, Social Science and Management**	**Credits**	**Audit**

Course Objectives:

1. To work for ensuring that basic human rights are respected everywhere.
2. To cooperate to avoid compromising on human rights for economic or political expediency.
3. To recognize democratic institutions as a fundamental human right.
4. To work towards the sovereignty and self-determination of entities with historical, cultural and ecological identity.
5. To actively engage with the Government of India and other countries to promote human rights education.
6. To bring diplomatic and commercial pressures on regimes that violates human rights, to ensure that they respect the basic rights of their citizens.
7. To keep the interests of disempowered communities foremost in all dealings with countries in which human rights violations occur.
8. To develop a more distinctive and effective role for the International Court of Justice in the field of human rights.
9. To promote a culture for educating the citizenry that cultivation and promotion of human rights culture is the sine qua non for the smooth functioning of the organs of a democratic State and for the kind of development that results into overall development of the society.
10. To train the young men and women for facing the challenges of the pluralistic society and the rising conflicts and tensions in the name of particularistic loyalties to caste, religion, region and culture.
11. To study the effect of draconian laws and unlawful use of State’s machinery and force by the enforcement agencies.

Course Outcomes:

After learning the course, the students should be able to:

1. Appreciate the importance of the values of human rights.
2. Strengthen respect for human rights and fundamental freedoms and respect others caste, religion, region and culture.
3. Know about regional, national, state, and local law that reinforces international human rights law.
4. Understand being able to use global, regional, national, and local human rights instruments and mechanisms for the protection of human rights.
5. Be aware of rights as Indian citizen.
6. Understand the importance of groups and communities in the society.
7. Realize the philosophical and cultural basis and historical perspectives of human rights.
8. Make students aware of their responsibilities towards the nation.

Course Content:

UNIT I

Introduction: Magna Carta, English bill of rights, American/French declaration, Universal declaration of human rights: Background, Content and relevance, Theories/Justification/Perspectives on Human Rights, Natural, Moral, Legal and human rights, Natural rights, Positivist, Liberal, Marxist, Feminist, Asian perspectives.

UNIT II

Debates: Universality of rights, Rights vs. duties, Individual vs. group rights, Civil and political rights vs. social, The notion of rights in various religious traditions (Hindu, Muslim, Buddhist traditions), Western Influence (especially the impact of the British rule), National freedom movement, The roles of Gandhi, Ambedkar and Nehru.

UNIT III

Constitutional provisions (especially fundamental rights vs. directive principles of state policy and emergency), Intergovernmental Organization, The United Nations (study of specific UN agencies related to human rights), Regional instruments.

UNIT IV

International NGO - Amnesty international: It's working and impact on India, Case studies of selected national NGOs, Case studies of selected regional NGOs, The government: Role of some of its agencies including the army, Police and paramilitary forces.

UNIT V

National Human Rights Commission of India - Background, Structure and functioning, International humanitarian law, International refugee law, The judiciary including public interest litigation, The medical profession and human rights, The role of the media in human rights.

UNIT VI

Some Issues in Human Rights : Violence and terrorism, Women's rights, Child rights, Dalit rights, Minority rights, Tribal rights, Refugee rights, Capital punishment, Euthanasia, Rights of the elderly, Gay Rights.

Text Books

1. D. D. Basu, V. R. Manohar, B. P. Banerjee, S.A. Khan, ***"Introduction to the Constitution of India"***, 20th Edition, Lexis Nexis Butterworths publication, 2008.
2. A. R. Desai, ***"Violation of Democratic Rights in India"***, Bombay Popular Prakashan.

Reference Books:

1. M. Mohanty, P. N. Mukherji, O. Tornquist, ***“People’s Rights: Social Movements and the State in the Third World”***, New Delhi, Sage Publications, 1998.
2. Nanda, P. Ved, J. R. Scarritt, G. W. Shepherd, ***“Global Human Rights: Public Policies Comparative Measures and NGO Strategies”***, Boulder Westview Press Inc., 1981.
3. Nirmal, J. Chiranjivi, ***“Human Rights in India: Historical, Social and Political Perspectives”***, New Delhi, Oxford University Press, 2000.
4. Kothari, Smitu, Harsh Sethi, ***“Rethinking Human Rights: Challenges for Theory and Action”***, Lokayan, Delhi, 1991.
5. A. J. M. Milne, ***“Human Rights and Human Diversity: An Essay in the Philosophy of Human Rights”***, New York State University of New York Press, 1986.

Course Title:	**Switching Theory and Logic Design Lab**	**Semester III**	
Course Code	**BTESCL307**	**Course Type**	**Compulsory**
Prerequisite	**Nil**	**L – T – P**	**0 – 0 – 2**
Stream	**Core**	**Credits**	**1**

Lab Experiments Objective:

1. Implement Flip-Flops, Multiplexer and De-multiplexer, Counters and arithmetic operations

Lab Experiments List:

1. Study of basic and Universal gates
2. Implementation of Boolean functions using Gates
3. Implementation of following code conversions:
    a) Binary to gray
    b) Gray to binary
    c) Excess –3 to BCD
    d) BCD to Excess –3.
4. Implementation of half adder, full adder
5. Implementation of half subtractor, full subtractor
6. Implementation of K-map examples
7. Implementation of Quine- McClusky examples
8. Implementation of Multiplexer and Demultiplexer
9. Implementation of BCD adder using 4 bit adder IC
10. Study of flip flops:
    a) RS flip-flop
    b) D flip-flop
    c) T flip-flop
    d) J-K flip-flop

Course Title:	**Object Oriented Paradigm with C++ Lab**	**Semester III**	
Course Code	**BTITL308**	**Course Type**	**Compulsory**
Prerequisite	**Nil**	**L – T – P**	**0 – 0 – 4**
Stream	**Core**	**Credits**	**2**

Lab Experiments Objective:

1. Programming using C++

Lab Experiments List:

1. Raising a number n to a power p is the same as multiplying n by itself p times. Write a function called power () that takes a double value for n and an int value for p, and returns the result as double value. Use a default argument of 2 for p, so that if this argument is omitted, the number will be squared. Write a main () function that gets values from the user to test this function.

2. A point on the two-dimensional plane can be represented by two numbers: an X coordinate and a Y coordinate. For example, (4,5) represents point 4 units to the right of the origin along the X axis and 5 units up the Y axis. The sum of two points can be defined as a new point whose X coordinate is the sum of the X coordinates of the points and whose Y coordinate is the sum of their Y coordinates. Write a program that uses a structure called point to model a point. Define three points, and have the user input values to two of them. Then set the third point equal to the sum of the other two, and display the value of the new point. Interaction with the program might look like this:

   Enter coordinates for P1: 3 4
   Enter coordinates for P2: 5 7
   Coordinates of P1 + P2 are: 8, 11

   Create the equivalent of a four-function calculator. The program should request the user to enter a number, an operator, and another number. It should then carry out the specified arithmetical operation: adding, subtracting, multiplying, or dividing the two numbers. (It should use a switch statement to select the operation). Finally, it should display the result. When it finishes the calculation, the program should ask if the user wants to do another calculation. The response can be Y or N. Some sample interaction with the program might look like this:

   Enter first number, operator, second number: 10/ 3
   Answer = 3.333333
   Do another (Y/ N)? Y
   Enter first number, operator, second number 12 + 100
   Answer = 112
   Do another (Y/ N)? N

3. A phone number, such as (212) 767-8900, can be thought of as having three parts: the area code (212), the exchange (767) and the number (8900). Write a program that uses a structure to store

these three parts of a phone number separately. Call the structure phone. Create two structure variables of type phone. Initialize one, and have the user input a number for the other one. Then display both numbers. The interchange might look like this:

Enter your area code, exchange, and number: 415 555 1212

My number is (212) 767-8900

Your number is (415) 555-1212

Create two classes DM and DB which store the value of distances. DM stores distances in meters and centimeters and DB in feet and inches. Write a program that can read values for the class objects and add one object of DM with another object of DB. Use a friend function to carry out the addition operation. The object that stores the results maybe a DM object or DB object, depending on the units in which the results are required. The display should be in the format of feet and inches or meters and centimeters depending on the object on display.

4. Create a class rational which represents a numerical value by two double values- NUMERATOR and DENOMINATOR. Include the following public member Functions: constructor with no arguments (de-fault), constructor with two arguments, void reduce () that reduces the rational number by eliminating the highest common factor between the numerator and denominator.

   Overload + operator to add two rational numbers

   Overload - operator to enable input through cin

   Overload * operator to enable output through cout

   Write a main ( ) to test all the functions in the class.

5. Consider the following class definition:

```
class father {
protected age;
public;
father (int x) {age = x;}
virtual void iam()
{
cout<<"I AM THE FATHER " ;
cout << "My age is : " <<age<< endl;}
};
```

Derive the two classes son and daughter from the above class and for each, define iam () to write similar but appropriate messages. You should also define suitable constructors for these classes. Now, write a main() that creates objects of the three classes and then calls iam ( ) for them. Declare pointer to father. Successively, assign addresses of objects of the two derived classes to this pointer and in each case, call iam () through the pointer to demonstrate polymorphism in action.

6. Write a program that creates a binary file by reading the data for the students from the terminal. The data of each student consist of roll number, name (a string of 30 or lesser number of characters) and marks.

7. A hospital wants to create a database regarding its indoor patients. The information to store include

   Name of the patient
   Date of admission
   Disease
   Date of discharge

   Create a structure to store the date (year, month and date as its members). Create a base class to store the above information. The member function should include functions to enter information and display a list of all the patients in the database. Create a derived class to store the age of the patients. List the information about all the patients to store the age of the patients. List the information about all the pediatric patients (less than twelve years in age).

8. Imagine a tollbooth with a class called toll Booth. The two data items are a type Unsigned Int to hold the total number of cars, and a type double to hold the total amount of money collected. A constructor initializes both these to 0. A member function called payingCar ( ) increments the car total and adds 0.50 to the cash total. Another function called nopayCar( ), increments the car total but adds nothing to the cash total. Finally, a member function called display() displays the two totals i.e. total cars and total cash. Include a program to test this class. This program should allow the user to push one key to count a paying car, and another to count a nonpaying car. Pushing the ESC key should cause the program to print out the total cars and total cash and then exit.

Course Title:	**Programming Lab (Python)**	**Semester III**	
Course Code	**BTITL309**	**Course Type**	**Compulsory**
Prerequisite	**Nil**	**L – T – P**	**0 – 0 – 4**
Stream	**Core**	**Credits**	**2**

Lab Experiments Objective:

1. To learn Python programming

Lab Experiments List:

1. Program to find the union of two lists.
2. Program to find the intersection of two lists.
3. Program to remove the “i” th occurrence of the given word in a list where words repeat.
4. Program to remove all tuples in a list of tuples with the USN outside the given range.
5. Program to count the occurrences of each word in a given string sentence.
6. Program to check if a substring is present in a given string.
7. Program to map two lists into a dictionary.
8. Program to count the frequency of words appearing in a string using a dictionary.
9. Program to create a dictionary with key as first character and value as words starting with that character.
10. Program to find the length of a list using recursion.
11. Program to read a file and capitalize the first letter of every word in the file.
12. Program to read the contents of a file in reverse order.
13. Program to create a class in which one method accepts a string from the user and another prints it.
14. Program to create a class and get all possible subsets from a set of distinct integers.

Course Title:	**Advanced Engineering Chemistry Lab**	**Semester III**	
Course Code	**BTITOEL310**	**Course Type**	**Elective**
Prerequisite	**Nil**	**L – T – P**	**0 – 0 – 2**
Stream	**Basic Science**	**Credits**	**1**

List of Experiments: (Perform any 8 – 9 Experiments)

1. To determine λmax of given solutions.
2. To Verify Beer's Lambert's law.
3. Experiments on Paper and Thin Layer Chromatography. (two experiments)
4. Determination of rate of corrosion of metal.
5. Experiments related with Organic Chemistry. (three experiments)
6. Experiments on pH metry.
7. Experiments on Conductometry.
8. Experiments on Flame Photometry.
9. Experiments on Solvent Extraction.
10. Estimation of Metals from Solution/ Alloys. (two experiments)
11. Synthesis of materials by various techniques. (two experiments)

Reference Books:

1. A. Sethi, "***Systematic experiments in Chemistry***", New Age International Publication, New Delhi.
2. A. I. Vogel, "***Practical Inorganic Chemistry***", ELBS Publication.
3. S. S. Dara, ***"Practical in Engineering Chemistry"***.
4. A. I. Vogel, "***Practical Organic Chemistry***", ELBS Publication.

Course Title:	**Interpersonal Communication Skills and Self Development for Engineers Lab**	**Semester III**	
Course Code	**BTITOEL310**	**Course Type**	**Elective**
Prerequisite	**Nil**	**L – T – P**	**0 – 0 – 2**
Stream	**Humanities, Social Science and Management**	**Credits**	**1**

List of Experiments:

1. General etiquettes and manners
2. Team building and group dynamics
3. Presentation Skills
4. Conducting meetings
5. Leadership Development
6. Skills in dealing with difficult people/situations
7. Persuasive writing
8. Negotiation skills
9. Conflict Resolution
10. Y-O-U-R-N-M-A-M-E Activity

Course Title:	**Programming in Java Lab**	**Semester III**	
Course Code	**BTITOEL310C**	**Course Type**	**Elective**
Prerequisite	**Nil**	**L – T – P**	**0 – 0 – 2**
Stream	**Professional Core**	**Credits**	**1**

Lab Experiments Objective:

1. To learn Java Programming

Lab Experiment Lists:

1. To create simple application to access data base using JDBC.
2. To read and write the files.
3. To implement polymorphism and method overriding in java.
4. To write programs implementing exception handling.
5. To write programs to illustrate interfaces in java.
6. To write programs to create package in java.
7. To design multi threaded programs in java.
8. To write programs to manipulate strings.
9. To write programs to draw various shapes using java applets.

Course Title:	**Introduction to Web Technology Lab**	**Semester III**	
Course Code	**BTITOEL310D**	**Course Type**	**Elective**
Prerequisite	**Nil**	**L – T – P**	**0 – 0 – 2**
Stream	**Professional Core**	**Credits**	**1**

Lab Experiments List:

1. Download XAMPP or WAMPP server, IDE, browsers to run HTML program
2. Develop page to display fruits list with different color with heading on top of the page and link each fruit with fruit description page
3. Develop using semantic element, page having menu bar in header section
4. Develop user personal info form using HTML5 input control and decorate with CSS
5. Develop responsive page layout using media queries
6. Write a PHP program to print list of user info using array
7. Write a PHP program to fetch user info from MYSQL database
8. Write a PHP program to perform crud operation
9. Write a PHP function to check palindrome string
10. Write a PHP program using for loop to add all the integers between 0 and 30 and display the total
11. Create a script to construct the pyramid of asterisk ('*') using nested for loop
12. Write a program to calculate factorial of a number using for loop
13. Write a program which will count the specific characters in the text
14. Debug web site using developer tools, inspect element

Course Title:	**Microprocessors and Microcontrollers**	**Semester IV**	
Course Code	**BTITC401**	**Course Type**	**Compulsory**
Prerequisite	**BTCOC304**	**L – T – P**	**2– 1 – 0**
Stream	**Core**	**Credits**	**3**

Course Objectives:

1. To understand 8086 microprocessor Architecture.
2. To understand design aspects of I/O and Memory Interfacing circuits.
3. To acquaint with instruction set and logic required to build assembly language programs.
4. To learn micro-controller architecture, its instruction set and interfaces.

Course Outcomes:

After learning the course the students should be able:

1. To design and implement programs on 8086 microprocessor.
2. To design I/O circuits and Memory Interfacing circuits.
3. To exhibit knowhow on micro-controller interfaces & programming.
4. To experiment with MCS51 and PIC18 micro-controller.

Course Content:

UNIT I

Intel 8086/8088 Microprocessor Family: Architecture and organization of 8086/8088 microprocessor family, Instruction set, Assembly language programming, Introduction to mixed language programming using C and Assembly language, 8086 family minimum and maximum mode operation, Timing diagram for 8086 family, Detailed study of maximum mode connection: Study of 8288 bus controller, 8086 interrupt structure.

UNIT II

8086 Instruction Set and Programming: Addressing modes, Instruction Set, ALP, Mixed language programming, Stacks, Strings, Procedures, Macros, Timers, Counters and delay, Programming examples using DOS and BIOS Interrupts, Device drivers programming.

UNIT III

8086 Interrupt System: 8086 Interrupt structure, Types and applications: Study of Interrupt Controller 8259A and Interrupt Priority Management using 8259A.

UNIT IV

Memory System Design and I/O Interfacing: Interfacing SRAM, ROM and DRAM to 8086, Address decoding and Timing Considerations, I/O interfacing in 8086: Serial communication interface includes Synchronous and Asynchronous, Protocols, Parallel communication interface includes I/O Mapped I/O, Memory Mapped I/O, and Handshaking Signals, 8087 Math Co-processor: Study of architecture of 8087, Floating point coprocessor, Data types supported by 8087, Host and coprocessor interface, Assembly language Programming for 8086 - 8087 based systems.

UNIT V

Intel MCS 51 Family: Introduction to Single chip microcontrollers of Intel MCS 51 family, Architectural and operational features, Instruction set, CPU timing and machine cycles, Interrupt structure and priorities, Internal Timer / counters, Serial interface, Connection of external memory, Power saving modes, Interfacing of 8051 with EPROM, Programming for EPROM versions, 8051 variation.

UNIT VI

Introduction to the PIC18 Microcontroller: Overview of the PIC18 MCU, The PIC18 Memory Organization, The PIC18 CPU Register, The PIC18 Pipelining, PIC18 Instruction Format, Addressing Modes, A Sample of PIC18 Instruction, Overview of the 8-Bit MCU Market.

Text Books:

1. Douglas Hall, ***"Microprocessors and Interfacing: Programming and Hardware"***, Tata McGraw-Hill, 2nd Edition.
2. Han-Way Huan, ***"An Introduction to Software and Hardware Interfacing"***, Delmar Cengage Learning, 2nd Edition, 2006.

Reference Books:

1. Peter Norton, ***"IBM PC, Assembly Language programming"***, BPB publication.
2. John Uffenback, ***"8086/8088 Interfacing, Programming and Design"***, Prentice Hall of India Publication.
3. A. K. Ray, K. M. Bhurchandi, ***"Advanced Microprocessors and Peripherals"***, Tata McGraw Hill, 2000.
4. John Uffenback***, "8086/8088 Interfacing, Programming and Design",*** Prentice Hall of India Publication.

Course Title:	**Data Structures and Applications**	**Semester IV**	
Course Code	**BTITC402**	**Course Type**	**Compulsory**
Prerequisite	**BTITC303**	**L – T – P**	**3 – 1 – 0**
Stream	**Core**	**Credits**	**4**

Course Objectives:

1. To assess how the choice of data structures and algorithm design methods affects the performance of programs.
2. To choose the appropriate data structure and algorithm design method for a specified application.
3. To solve problems using data structures such as linear lists, stacks, queues, hash tables, binary trees, heaps, tournament trees, binary search trees, and graphs and writing programs for these solutions.
4. To solve problems using algorithm design methods such as the greedy method, divide and conquer, dynamic programming, backtracking, branch and bound and writing programs for these solutions.

Course Outcomes:

After learning the course, the students should be able:

1. To write neat code by selecting appropriate data structure and demonstrate a working solution for a given problem.
2. To think of all possible inputs to an application and handle all possible errors properly.
3. To analyze clearly different possible solutions to a program and select the most efficient one.
4. To write an application requiring an effort of at least 1000 lines of code to demonstrate a good working solution.
5. To demonstrate the ability to write reusable code and abstract data types in C, using object-based way of thinking.

Course Content:

UNIT I

Introduction to Data Structures and Analysis of Algorithms: Need of data structures, Types of data structures, Recursion, ADT (Abstract Data Types), Basics of algorithm, Analysis of algorithm through time complexity and space complexity, Asymptotic notations, Pseudo code analysis, Recurrence relations and solving recurrences using substitution, Recursion tree and master method.

UNIT II

Stack and Queue: Stack: Representation, Stack operation, Application. Queue: Representation, Queue operation, Circular and priority queue, Applications.

UNIT III

Linked list: Operation on linked list, Linked stacks and Queues, Array implementation of linked list, Linked list using dynamic variable, doubly linked list, Circular linked list.

UNIT IV

Binary Tree: Basic tree concept, Binary tree operations, Binary tree representation, Binary tree traversals, Binary search tree and operations, Balanced tree: AVL trees and operations, Applications of binary trees, implementing priority queue using binary heap data structure.

UNIT V

Graphs: Basics concepts of graphs, Representation of graphs, Graph traversals BFS and DFS, Minimum spanning tree algorithms: Kruskal's algorithm and Prim's algorithm, Applications of graphs.

UNIT VI

Searching Techniques and Hashing: Linear search and binary search, Hashing: Direct-address tables, Hash tables, Open addressing, Perfect Hashing, Sorting techniques: Various sorting methods and their time complexity analysis: Insertion sort, Selection sort, Merge sort, Quick sort, Heap sort.

Text Books:

1. E. Horowitz, D. Mehta, S. Sahni, ***"Fundamentals of Data Structures in C++"***, Silicon Press, 2nd Edition, 2008.
2. R.S. Bichkar, ***"Programming with C and Data structures"***, Universities Press, 1st Edition, 2014.

Reference Books:

1. Goodrich, Tamassia, "***Data Structures and Algorithm in Java***", Wiley publication, 6th Edition, 2014.
2. T. H. Cormen, C. E. Leiserson, R. L. Rivest, C. Stein, "***Introduction to Algorithms***", MIT Press, 3rd Edition, 2009.
3. Y. Langsam, M. J. Augenstein and A. M. Tanenbaum, "***Data structures using Java***", Pearson Education, 2003.
4. J. Murach, "***Murach's Java Programming***", Shroff Publishers, 4th Edition, 2012.
5. V. Goyal, L. Goyal, P. Kumar, "***A Simplified Approach to Data Structures***", Shroff Publishers, 1st Edition, 2014.

Course Title:	**Discrete Structures and Applications**	**Semester IV**	
Course Code	**BTITC403**	**Course Type**	**Compulsory**
Prerequisite	**Nil**	**L – T – P**	**2 – 1 – 0**
Stream	**Core**	**Credits**	**3**

Course Objectives:

1. To develop a foundation of set theory concepts, notation and applications.
2. To inculcate the habit of logical and mathematical thinking and its application to computer science and IT.
3. Understand logic, basic counting principles, relations, induction, sequences and summations.
4. To be able to present a coherent and mathematically accurate argument.
5. To understand the theory of graphs and algebraic structures and their applications.

Course Outcomes:
After learning the course the students should be able:

1. To perform operations on various discrete structures such as sets functions, relations, and sequences.
2. To solve problems using counting techniques, permutation and combination, recursion and generating functions
3. To construct and verify correctness of a Boolean expression using K-Maps and truth tables.
4. To use graphs as tools to visualize and simplify Problems.
5. To solve problems using algebraic structures (Rings, Monoids and Groups).

Course Content:

UNIT I

The Foundations: Sets theory and its applications sets, Set operations, Laws of set theory, Power sets, Partitions, Multi-sets, Cardinality, Principle of inclusion and exclusion, Algebra of sets and duality, Applications of sets: Problems on set operations and principle of inclusion-exclusion, Logics and proofs, Propositional logic, Propositional equivalences, Propositional algebra, Basic logical operations, De Morgan’s laws, Predicates and quantifiers, Nested quantifiers, Rules of inference, Proof methods and strategy, Applications of logic: Translating English statements into propositions, Boolean searches in web pages, Bit operations.

UNIT II

Induction, Sequences and Summations: Induction and recursion: Mathematical induction, Strong induction, Recursive definitions, Re-cursive algorithms, Applications: Proofs using mathematical induction, Program correctness, Well formed formula, Functions, Sequences and summations, Definition and types of functions: Injective, subjective and bijective , Composition, Identity and inverse of function, Re-cursively defined functions, Applications of functions, Job scheduling problem, Countability of rational numbers.

UNIT III

Basic Counting Principles: Permutations, Combinations, Binomial coefficients, Generalized permutations and combinations, Combinations and permutations with repetition, Generating permutations and combinations, Recurrence relation, Solving linear recurrence relations with constant coefficients, Applications of counting principles, Pigeonhole principle and its applications.

Relations: Properties of binary relations, Closure of relations, Warshall's algorithm, Equivalence relations and partitions, Partial ordering relations and lattice application of relations: N-ary relations and their applications, Databases and relations.

UNIT V

Graph Theory: Basic terminology, Multi graphs and weighted graphs, Paths and circuits, Shortest path in weighted graph, Hamiltonian and Euler paths and circuits, Factors of a graph, Shortest path algorithm, Traveling salesman problem, Transport networks, Special types of graphs and applications: Job assignment, LAN, Interconnection networks for parallel computation, Mesh networks, Graph coloring and applications.

UNIT VI

Algebraic Structures: Algebraic systems, Groups, Semi groups, Monoid, Subgroups, Permutation groups, Codes and group codes, Isomorphism and automorphisms, Homomorphism, Fermat's little theorem, Polynomial rings, Applications of groups.

Text Books:

1. K. H. Rosen, ***"Discrete Mathematics and Its Applications"***, Tata McGraw Hill Publication, 7^{th} Edition, 2012.
2. J. P. Tremblay, R. Manohar, ***"Discrete Mathematical Structures with Applications to Computer Science"***, 1^{st} Edition, McGraw Hill Publication, 2001.

Reference Books:

1. B. Kolman, R. Busby, S. Ross, ***"Discrete Mathematical Structures"***, Pearson Education, 6^{th} Edition, 2009.
2. R. K. Bisht, H. S. Dhami, ***"Discrete Mathematics"***, Oxford University Press, 2015.

Course Title:	**Internetworking Protocols**	**Semester IV**	
Course Code	**BTITC404**	**Course Type**	**Compulsory**
Prerequisite	**Nil**	**L – T – P**	**2 – 1 – 0**
Stream	**Core**	**Credits**	**3**

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:

After learning the course, the students should be able:

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 Content:

UNIT I

Introduction and Underlying Technologies : ARPANET, Birth of the Internet, Transmission Control Protocol/Internetworking Protocol (TCP/IP) , MILNET , CSNET , NSFNET ,ANSNET, The Internet Today ,World Wide Web, Time Line, Growth of the Internet, Protocols and Standards, Standards Organizations: Internet Standards Internet Administration.

The OSI Model and the TCP/IP Protocol Suite:

Protocol Layers: Hierarchy Services, The OSI Model: Layered Architecture , Layer-to-Layer Communication, Encapsulation, Layers in the OSI Model, TCP/IP Protocol Suite: Comparison between OSI and TCP/IP Protocol Suite, Layers in the TCP/IP Protocol Suite, Addressing: Physical Addresses, Logical Addresses, Port Addresses, Application-Specific Addresses, Wired Local Area Networks: IEEE Standards, Frame Format, Addressing, Ethernet Evolution, Standard Ethernet, Fast Ethernet, Gigabit Ethernet, Ten-Gigabit Ethernet.

UNIT II

Wireless LANS: IEEE, MAC Sublayer, Addressing Mechanism, Bluetooth, Point-to-Point WANS, DSL Technology, Cable Modem, ATM, Connecting devices: Repeaters, Bridges and Routers.

Introduction to Network Layer: Switching: Packet Switching, Circuit Switching, Packet Switching at Network Layer, Network Layer Services, Other Network Layer Issues.

IPv4 Addresses, Address Space Notation, Range of Addresses, Operations, Classful Addressing: Classes, Classes And Blocks, Two-Level Addressing, Three-Level Addressing: Subnetting, Supernetting, Classless Addressing: Variable-Length Blocks, Two-Level Addressing, Block Allocation, Special Addresses: Special Blocks, Special Addresses in Each block, NAT, Address Translation, Translation Table.

UNIT III

Delivery and Forwarding of IP Packets: Delivery: Direct Delivery, Indirect Delivery, Forwarding: Forwarding Based on Destination Address, Forwarding Based on Label, Structure of a Router: Components.

Internet Protocol Version 4(IPv4): Datagrams, Fragmentation, Maximum Transfer Unit (MTU), Fields Related to Fragmentation, Options: Format, Option Types, Checksum: Checksum Calculation at the Sender, Checksum Calculation at the Receiver, Checksum in the IP Packet, IP PACKAGE : Header-Adding Module, Processing Module, Queues, Routing Table, Forwarding Module, MTU Table, Fragmentation Module, Reassembly Table, Reassembly Module

Address Resolution Protocol (ARP): Address Mapping: Static Mapping, Dynamic Mapping, The ARP Protocol: Packet Format, Encapsulation, Operation, Proxy ARP, ARP Package: Cache Table, Queues, Output Module, Input Module, Cache-Control Module.

UNIT IV

Internet Control Message Protocol (ICMP): Messages: Message Format, Error Reporting Messages, Query Messages, Checksum, Debugging Tools: Ping, Traceroute, ICMP Package: Input Module, Output Module.

Unicast Routing Protocols (RIP, OSPF, and BGP), Static versus Dynamic Routing Tables, Routing Protocol, Intra- And Inter-Domain Routing, Distance Vector Routing :Bellman-Ford Algorithm, Distance Vector Routing Algorithm, Count to Infinity, RIP: RIP Message Format, Requests and Responses Timers in RIP, RIP Version, Encapsulation , Link State Routing: Building Routing Tables, OSPF, Areas, Metric Types of Links, Graphical Representation OSPF Packets, Link State Update Packet, Other Packets, Encapsulation, Path Vector Routing: Reachability , Routing Tables, BGP: Types of Autonomous Systems, Path Attributes, BGP Sessions, External and Internal BGP, Types of Packets, Packet Format, Encapsulation.

UNIT V

Introduction to Transport Layer: Transport-Layer Services: Process-to-Process communication, Addressing: Port Numbers, Encapsulation and Decapsulation , Multiplexing and Demultiplexing, Flow Control, Error Control , Combination of Flow and Error Control, Congestion Control, Connectionless and Connection-Oriented Services.

User Datagram Protocol (UDP): User Datagram, UDP Services: Process-to-Process Communication, Connectionless Services, Flow Control, Error Control, Congestion Control, Encapsulation and Decapsulation, Queuing, Multiplexing and Demultiplexing, Comparison between UDP and Generic Simple Protocol, UDP Applications: UDP Features, Typical Applications, UDP Package: Control-Block Table, Input Queues, Control-Block Module, Input Module, Output Module.

UNIT VI

Transmission Control Protocol (TCP): TCP Services: Process-to-Process Communication, Stream Delivery Service, Full-Duplex Communication, Multiplexing and Demultiplexing, Connection-Oriented Service, Reliable Service. TCP Features: Numbering System, Flow Control, Error Control, Congestion Control, Segment: Format, Encapsulation, A TCP Connection: Connection Establishment, Data Transfer, Connection Termination, Connection Reset, State Transition Diagram, Scenarios ,Windows in TCP ,Send Window, Receive Window, Flow Control : Opening and Closing Windows, Shrinking of

Windows, Silly Window Syndrome, Error Control :Checksum, Acknowledgment, Retransmission, Out-of-Order Segments, Data Transfer in TCP, Some Scenarios, Congestion Control : Congestion Window, Congestion Policy, TCP Timers: Retransmission Timer, Persistence Timer, Keepalive Timer, Time-Wait Timer, TCP Package: Transmission Control Blocks (TCBs), Timers, Main Module, Input Processing Module, Output Processing Module.

Text Books:

1. Douglas E. Comer, ***"Internetworking with TCP/IP: Principles, Protocols and Architecture"***, Volume 1, 6th Edition, PHI publication, 2013.
2. Behrouz A. Forouzan, ***"TCP-IP Protocol Suite"***, 4th Edition, McGraw Hill publication, 2010.

Reference Books:

1. Comer, ***"Internetworking with TCP-IP"***, Volume 3, 5th Edition, Pearson publication, 2013.
2. W. Richard Stevens, ***"UNIX Network Programming: Interprocess Communications"***, Volume 2, 2nd Edition, PHI publication, 1999.
3. William Stalling, ***"SNMP, SNMPv2, SNMPv3, and RMON 1 and 2"***, 2nd Edition, Pearson education publication, 2001.
4. Hunt Craig, ***"TCP-IP Network Administration"***, 3rd Edition, O'Reilly publication, 2002.
5. Loshin, Harwurt, ***"TCP-IP Cleanly Explained"***, BPB publication.

Course Title:	**Physics of Engineering Materials**	**Semester III**	
Course Code	**BTBSCOE405A**	**Course Type**	**Elective**
Prerequisite	**PHY203**	**L – T – P**	**1 – 1 – 0**
Stream	**Basic Science**	**Credits**	**2**

Course Objectives:

1. To impart the basic and advanced knowledge to the students.
2. To understand, remember and capable to explain and apply this knowledge in the field of Engineering/ Technology.

Course Outcomes:

After learning the course, the students should be able:

1. To explain the concepts of Crystallography, X -rays, Conducting Materials, Magnetic Materials.

Course Content:

UNIT I

Crystallography: Crystal directions and planes, Diatomic Crystal (CsCl, NaCl, Diamond, BaTiO3) Crystal imperfection, Point defects, Line defects, Surface and Volume defects, Structure properties relationship, structure determination by X-ray diffraction.

UNIT II

Magnetic Materials: Origin of magnetization using atomic theory, classification of magnetic materials and properties, Langevin's theory of Dia, Para and ferromagnetism, Soft and Hard magnetic materials and their uses, Domain theory of ferromagnetism, Hysteresis loss, Ant ferromagnetic and Ferromagnetic materials, Ferrites and Garnets, magnetic bubbles, magnetic recording.

UNIT III

Conducting and Superconducting Materials: Band theory of solids, Classical free electron theory of metals, Quantum free electron theory, Density of energy states and carrier concentration, Fermi energy, Temperature and Fermi energy distribution, Superconductivity, Factor affecting Superconductivity, Meissner effect, Type-I and Type-II superconductors, BCS theory, Josephson effect, High temperature superconductors, Application of superconductors (Cryotron, magnetic levitation)

UNIT IV

Semiconducting Materials: Band structure of semiconductor, Charge carrier concentration, Fermi level and temperature, Electrical conductivity, Hall effect in semiconductors, P-N junction diode, Preparation of single crystals, LED, Photovoltaic Cell

UNIT V

Dielectric Materials: Dielectric constant and polarizability, types of polarization, temperature and frequency dependences of Dielectric parameter, internal fields in solids, Clausius-Mosotti equation, dielectric loss, dielectric breakdown, ferroelectric, pyroelectric and piezoelectric materials, applications of dielectric materials

UNIT VI

Nano Materials: Introduction and properties, synthesis of nanomaterials, Carbon Nano Tubes, Characterization techniques of nanomaterials- SEM, TEM, EDAX, FMR, XRD. Applications of nanomaterials.

Text Books:

1. C. Kittle, ***"Introduction to Solid state Physics"***.
2. C. M. Srivastava, C. Srinivasan, ***"Science of Engineering Materials and Carbon Nanotubes"***.
3. A. J. Dekker, ***"Solid State Physics"***.

Reference Books:

1. V. Raghavan, ***"Material Science and Engineering"***.
2. A. J. Dekker, ***"Electrical Engineering Materials"***.

Course Title:	**Organizational Behavior**	**Semester IV**	
Course Code	**BTHMOE405B**	**Course Type**	**Elective**
Pre-requisite	**Nil**	**L – T – P**	**2 – 1 – 0**
Stream	**Humanities, Social Science and Management**	**Credits**	**3**

Course Objectives:

1. To explore the organization as a micro-social system - a medium to facilitate and improve the interpersonal relationships in the context of organizational functioning.

Course Outcomes:

1. Students will become more self aware and will have identified areas of development for long term effectiveness.
2. Students will understand the role that individuals play collectively to perform in organizations.

Course Content:

UNIT I

Introduction to Organizational Behavior: Definition of organization and behavior, Historical Development of OB, Human relations movement, Impact of technology on organizational behavior.

Organizational Design: Key factors in organizational design, Types of organizational design, Need and significance of a sound organizational design, Organizational Structures - traditional and contemporary structures.

UNIT II

Organizational 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, Organizational Communication - Tool and Techniques, Johari window transactional analysis, Lateral thinking, Brain storming, Delphi technique, Power of grapevine and other informal communication techniques.

UNIT III

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 behavior, 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 IV

Foundations of Individual Behavior: Factors affecting individual behavior - personal, environmental and organizational, 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

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.

UNIT V

Work Related Attitudes, Values and Perception: Meaning and definitions, Factors influencing perception Social and Person perception, When perception fails, Perception and OB.

Organizational Outcomes: Power and Politics, Power - Dynamics, Sources and Tactics, Politics - Essence, Types of political activities, Ethics of power and politics.

UNIT VI

Conflicts and Negotiations, Nature of conflict, Functional and Dysfunctional conflict, Conflict resolution and negotiations, Managing conflict during change initiatives.

Stress: Meaning and definition, Work stress model, Sources of stress, Stress Management - Individual and organizational strategies, Impact of stress on performance.

Text books:

1. Uma Sekaran, ***"Organization Behaviors"***, McGraw Hill Company, New Delhi, 2011.
2. LM Prasad, ***"Organization Behavior"***, S. Chand and Co. Ltd, New Delhi, 2008.
3. Nair, Banerjee, Agarwal, ***"Organization Behavior"***, Prgathi Prakashan, New Delhi, 2006.

Reference books:

1. Rosy Joshi and Sashi K Gupta, ***"Organization Behaviors"***. Kalyani publishers, New Delhi, 2005.
2. S.S. Khanka, ***"Organization Behavior"***, S. Chand and Co. Ltd, New Delhi, 2008.
3. Fred Luthans, ***"Organizational Behavior",*** McGraw Hill Book Co., 2005.

Course Title:	**Development Engineering**	**Semester IV**	
Course Code	**BTXXOE405C**	**Course Type**	**Elective**
Pre-requisite	**Nil**	**L – T – P**	**2 – 1 – 0**
Stream	**Interdisciplinary**	**Credits**	**3**

Course Objectives:

1. Development Engineering prepares students to develop, pilot, and evaluate technological interventions designed to improve human and economic development within complex, low-resource settings.
2. Students can include topics related to the application of technology to address the needs of people living in poverty.

Course Outcomes:

After learning the course, the students should be able:

1. To understand the core disciplines issues in development.
2. To understand certifications.
3. To understand the planning of developing of rural areas.

Course Content:

UNIT I

Introduction to Development Engineering: Introduction to development engineering, need of development engineering, core disciplines and concept, major issues in development, urban development, rural development, socioeconomic development, scientific social research, formulation of research problem, field work and data collection, report drafting.

UNIT II

Design of Sustainable Communities: Concept and development of sustainable communities, Sustainable design principles, Building regulations, Codes and standards – ANSI, ASTM, ASHRAE, Approval process, Green buildings – green building techniques-energy solutions, Site solutions, Exterior and interior solutions, Certification – BREEAM, GRIHA, NAHB, LEED, IGBC.

UNIT III

Town/City Planning: Town Planning, History of town planning in India, Characteristics of city/town, Town planning at national, Regional and local levels, Planning standards, Master plan, Site layout and development, Zoning and density control, Green belt, Slum redevelopment, Smart city planning, Introduction to city planning, Infrastructure elements of smart city planning, Dimensions of smart cities global standards and performance benchmark, Smart solutions e-governance, Waste management, Water management, Energy management, Urban mobility, Citizen services, Other services such as telemedication and education, Trade facilitation, Skill development, GIS for Planning.

UNIT IV

Planning and Development of Rural Areas: District administration, District Planning, Introduction to various sectors of rural areas such as drinking water, Waste water treatment, Electricity, Public transport, Irrigation, Sanitation and cooking energy, Issues and challenges associated with these sectors, People's participation and role in development of rural areas, Various schemes and policies floated by state and central government – phases in the schemes; life cycle costing of these schemes.

UNIT V

GeoInformatics for Planning and Development: Introduction to GeoInformatics, Advantages, Benefits and limitations, Interdisciplinary applications, Data extraction, Use of GeoInformatics for planning, Mapping and preparation of layouts.

UNIT VI

Development aspects: Urban and Rural: Planning and designing of a model town / city and using Auto-CAD and/or GIS, Visit to a village or small town – The project will be carried out in groups, Problem faced by the villagers pertaining to various sectors or existing schemes, Define the need, method, Tools and techniques for development, Deliver technology based solution.

Text Books

1. Chand M. and Purr U.K., ***"Regional Planning in India"***, Allied Publisher, New Delhi, 1983.
2. Kaiser E. J., et.al, ***"Urban Land use Planning"***, 4th Edition Urbana, University of Illinois Press.
3. Sundaram K. V., ***"Geography Planning"***, Concept Publishing Co., New Delhi.
4. Ayyar C.P.V., ***"Town Planning in Early South India"***, Mittal Publications, Delhi.
5. Reeder, Hoboken, ***"Guide to green building rating systems"***, John Wiley and Sons Inc.
6. Longley, et.al, ***"Geographic Information Systems and Science"***, John Wiley and Sons, New York.
7. Desai V., ***"Rural Development of India"***, Himalaya Publishing House, Mumbai.
8. Rau S. K., ***"Global Search for Rural Development"***, NIRD, Hyderabad.

Reference Books:

1. Institute of Town Planners, India, Ministry of Urban Affairs and Employment, Government of India, New Delhi, UDPFI Guidelines, 1996.
2. Miles R. Simon, 1970, ***"Metropolitan Problems"***, Methuen Publications, Canada.
3. B.I.S., 1980, ***"National Building Code of India"***, ISI, New Delhi.
4. ANSI/ASHRAE/USGBC/IES Standard 189.1, Standard for the Design of High – Performance Green Buildings Except Low-Rise Residential Buildings.
5. ASHRAE Standard 90.1, Energy Standard for Buildings Except Low-Rise Residential Buildings.

Course Title:	**Product Design Engineering**	**Semester IV**	
Course Code	**BTXX406**	**Course Type**	**Compulsory**
Prerequisite	**Nil**	**L – T – P**	**2 – 0 – 0**
Stream	**Interdisciplinary**	**Credits**	**2**

Course Outcomes:

After completing this programme, participants will be able to:

1. Create simple mechanical designs.
2. Create documents for knowledge sharing.
3. Manage own work to meet requirements.
4. Work effectively with colleagues.
5. Maintain a healthy, safe and secure working environment.
6. Provide data/information in standard formats.
7. Develop their knowledge, skills and competence.

Course Content:

UNIT I
Creating simple products and modules Document Creation and Knowledge Sharing
UNIT II
Self and work Management
UNIT III
Team Work and Communication
UNIT IV
Managing Health and Safety
UNIT V
Data and Information Management
UNIT VI
Learning and Self Development

Course Title:	**Microprocessors and Microcontrollers Lab**	**Semester IV**	
Course Code	**BTITL407**	**Course Type**	**Compulsory**
Prerequisite	**Nil**	**L – T – P**	**0 – 0 – 2**
Stream	**Core**	**Credits**	**1**

Lab Experiments Objective:

1. To learn assembly language.
2. To program microprocessor and microcontroller for arithmetic operations.
3. To interface microprocessor and microcontroller with I/O devices.

Lab Experiments List:

1. 8085 and 8086 kit familiarization and basic experiments
2. Arithmetic operation of 16 bit binary numbers
3. Programming exercise: sorting, searching and string
4. Interfacing with A/D and D/A converters
5. Interfacing with stepper motors
6. Keyboard interfacing to 8086
7. 8255 interface to 8086
8. Assembly language programming of 8051
9. Timer programming of 8051, using interrupts
10. LCD interfacing to 8051 – project

Course Title:	**Data Structures and Applications Lab**	**Semester IV**	
Course Code	**BTITL408**	**Course Type**	**Compulsory**
Prerequisite	**BTITL308**	**L – T – P**	**0 – 0 – 4**
Stream	**Core**	**Credits**	**2**

Lab Experiments Objective:

1. To implement all linear and non-linear data structures in C++/Java.

Lab Experiments List:

1. To implement a character stack data type and use it to reverse a string
2. To implement an integer stack data type that grows on demand
3. To write a program using appropriate stacks for evaluating an infix expression with parenthesis
4. To write a program, using a queue data type, to simulate a bank where customers are served on a first-come-first-serve basis
5. To write one program for each of the following operations with singly linked lists:
    - Concatenate two linked list and create third one
    - Free all nodes in a linked list
    - Reverse a linked list

   Given two linked list, create a third list which is set-intersection of the elements in the two.
6. To delete every third element from the linked list
7. To copy a given linked list into another (new) list
8. To implement a queue using a doubly linked list
9. To write the following recursive functions for a singly-linked NULL-terminated list: insert(), traverse(), search()

Course Title:	**Internetworking Protocols Lab**	**Semester IV**	
Course Code	**BTITL409**	**Course Type**	**Compulsory**
Prerequisite	**Nil**	**L – T – P**	**0 – 0 – 2**
Stream	**Core**	**Credits**	**1**

Lab Experiments List:

1. Conversion of IP addresses
   (e.g. I/P: 10.24.164.254 O/P: 00001010.00011000.10000000.11111110 and I/P:binary dotted O/P: decimal dotted)
2. Introduction to Wireshark
3. Wireshark Lab: Ethernet and ARP
4. Wireshark Lab: IP
5. Wireshark Lab: ICMP, study of ping and traceroute command
6. Wireshark Lab: UDP
7. Wireshark Lab: TCP
8. Study of ftp, telnet tools and network configuration files
9. DHCP server configuration
10. Socket programming for UDP and TCP

Teaching and Evaluation Scheme Third Year B. Tech. (Information Technology)

Sr. No	Code	Course title	Weekly Teaching hours			Evaluation Scheme			Credit	Total Hours
			L	T	P	MSE	CA	ESE		
		Semester V								
1	BTITC501	Database Management Systems	3	-	-	20	20	60	3	3
2	BTITC502	Design and Analysis of Algorithms	3	-	-	20	20	60	3	3
3	BTITC503	Software Engineering	3	-	-	20	20	60	3	3
4	BTITOE504	Open/Departmental Elective - Group 1	3	-	-	20	20	60	3	3
5	BTITSE505	Stream Elective - Group 1	3	-	-	20	20	60	3	3
6	BTITS506	Seminar	-	2	-	-	-	50	2	2
7	BTITL507	Programming Lab – Minor (R Programming)	-	-	2	-	25	25	1	2
8	BTHM508	Constitutions of India/ Essence of Indian Traditional Knowledge	-	-	-	-	-	-	-	Audit
9	BTITL509	Database Management Systems Lab	-	-	2	-	25	25	1	2
10	BTITL510	Design and Analysis of Algorithms Lab	-	-	2	-	25	25	1	2
Summary of Semester Assessment Marks, Credit & Hours			**15**	**2**	**6**	**100**	**175**	**425**	**20**	**23**
		Semester VI								
1	BTITC601	Operating Systems	3	-	-	20	20	60	3	3
2	BTITC602	Compiler Construction	3	-	-	20	20	60	3	3
3	BTITC603	Object Oriented Software and Web Engineering	3	-	-	20	20	60	3	3
4	BTITOE604	Open/Departmental Elective Group 2	3	-	-	20	20	60	3	3
5	BTITSE605	Stream Elective - Group 2	3	-	-	20	20	60	3	3
6	BTITL606	Programming Lab – Major (Web Technologies)	-	-	4		25	25	2	4
7	BTITL607	Operating Systems Lab	-	-	2	-	25	25	1	2
8	BTITL608	Object Oriented Software and Web Engineering Lab	-	-	2	-	25	25	1	2
9	BTITSEL609	Departmental Elective - Group 2 Lab	-	-	2	-	25	25	1	2
Summary of Semester Assessment Marks, Credit & Hours			**15**	**-**	**10**	**100**	**200**	**400**	**20**	**25**

List of Open/Departmental Electives – Group 1

Sr. No.	Course Code	Title of the Course	Prerequisite
1	BTITOE504A	Graph Theory	Nil
2	BTITOE504B	Human Computer Interaction	Nil
3	BTITOE504C	Probability and Queuing Theory	Engineering Mathematics III

List of Stream Electives – Group 1

Sr. No.	Course Code	Title of the Course	Prerequisite
1	BTIT SE505A	Embedded Systems	Microprocessors and Microcontrollers
2	BTIT SE505B	IT Service Management	Nil
3	BTIT SE505C	Information Storage Management	Computer Architecture &Organization
4	BTIT SE505D	Network Management	Internetworking Protocols
5	BTIT SE505E	Data Visualisation	Database Management Systems

List of Open/Departmental Electives – Group 2

Sr. No.	Course Code	Title of the Course	Prerequisite
1	BTITOE604A	Enterprise Resource Planning	Database Management Systems
2	BTITOE604B	Decision Support System	Database Management Systems
3	BTITOE604C	Software Project Management	Software Engineering

List of Stream Electives – Group 2

Sr. No.	Course Code	Title of the Course	Prerequisite
1	BTITSE605A	Software Testing	Software Engineering
2	BTITSE605B	Data Storage Technologies & Networks	Internetworking Protocols, Operating Systems
3	BTITSE605C	Service Oriented Architecture	Nil
4	BTITSE605D	Network Programming	Internetworking Protocols, Operating Systems
5	BTITSE605E	Advanced Database Technology	Database Management Systems

Course Title:	**Database Management Systems**	**Semester V**	
Course Code	**BTITC501**	**Course Type**	**Mandatory**
Pre-requisite	**Nil**	**L – T – P**	**3 – 0 – 0**
Stream	**Core**	**Credits**	**3**

Course Objectives:

1. To understand architecture and functioning of database management systems.
2. To learn relational mode.
3. To use structured query language (SQL) and its syntax, transactions, database recovery and techniques for query optimization.
4. To acquaint with various normalization forms and query processing.
5. To learn indexing methods.

Course Outcomes:

After learning the course the students should be able:

1. To explain need of database management.
2. To design and implement a database schema for a given problem-domain.
3. To normalize a database.
4. To create and query a database using SQL DML/DDL commands, stored procedures and functions.
5. To declare and enforce integrity constraints on a database.
6. To illustrate understanding of indexing methods.

Course Content:

UNIT I

Introduction: Basic concepts, Advantages of DBMS over file-processing systems, Data abstraction, Data models and data independence, Components of DBMS and overall structure of DBMS, Data modeling, Entity, Attributes, Relationships, Constraints, Keys E-R diagrams, Components of E-R Model.

UNIT II

Relational Model: Basic concepts, Attributes and domains, Concept of integrity and referential constraints, Schema diagram. Relational query languages, Relational Algebra and Relational Calculus: Tuple relational and domain relational calculus.

UNIT III

Structured Query Language-I: Introduction, Characteristics and advantages, Data types and literals, DDL, Tables: creating, modifying, deleting, Views: creating, dropping, Updation using views, DML, Operators, SQL DML queries, SELECT query and clauses.

UNIT IV

Structured Query Language- II: Set operations, Predicates and joins, Set membership, Tuple variables, Set comparison, Ordering of tuples, Aggregate functions, Nested queries, Database modification using SQL Insert, Update and Delete queries, Dynamic and embedded SQL and concept of stored procedures, Query-by-example.

UNIT V

Relational Database Design: Notion of normalized relations, Functional dependency, Decomposition and properties of decomposition, Normalization using functional dependency, Multi-valued dependency and join dependency. Storage and File Systems: Secondary storage, RAID, File organization, Indices, Static and dynamic hashing, B-Trees and B+ Trees.

UNIT VI

Query Processing and Transaction Management: Measures of query cost, Selection operation, Sorting and join operation, Transaction concept, Components of transaction management, Concurrency and recovery sys-tem, Different concurrency control protocols such as timestamps and locking, Validation, Multiple granularity, Deadlock handling, Different crash recovery methods such as log-based recovery, Shadow-paging, Buffer management and Remote backup system.

Text Books

1. Abraham Silberschatz, Henry F. Korth, and S. Sudarshan, ***"Database System Concepts"***, , McGraw Hill Education, 6th Edition, 2011.
2. Ramez Elmasri and Shamkant B. Navathe, ***"Fundamental Database Systems"***, Pearson Education, 7th Edition, 2015.
3. Raghu Ramkrishnan, Johannes Gehrke, ***"Database Management Systems"***, McGraw Hill Education, 3rd Edition, 2007.

Reference Books:

1. Carlos Coronel, Steven Morris ***"Database systems: Design Implementation and Management"***, Cengage Learning Press, 11th Edition, 2014.
2. J. Murach, ***"Murach's MySQL"***, Shroff Publication, 2nd Edition, 2016.
3. J. Murach, ***"Murach's Oracle SQL and PL/SQL: Works with All Versions Through 11g"***, Shroff Publication, 2008.

Course Title:	**Design and Analysis of Algorithms**	**Semester V**	
Course Code	**BTITC502**	**Course Type**	**Mandatory**
Pre-requisite	**Data Structures**	**L – T – P**	**3 – 0 – 0**
Stream	**Core**	**Credits**	**3**

Course Objectives:

1. To learn fundamentals of algorithms design techniques.
2. To understand basic knowledge of computational complexity, approximation and randomized algorithms, selection of the best algorithm to solve a problem.
3. To analyze the performance of algorithms, to compare algorithms with respect to time and space complexity.
4. To develop proficiency in problem solving and programming.

Course Outcomes:

After learning the course the students should be able:

1. Develop efficient algorithms for simple computational tasks.
2. Gain understanding of concepts of time and space complexity, worst case, average case and best case complexities and the big-O notation.
3. Design standard algorithms such as sorting, searching, and problems involving graphs.
4. Compute complexity measures of algorithms, including recursive algorithms using recurrence relations.

Course Content:

UNIT I

Introduction: Instruction counts, Growth functions, Necessity of time and space analysis of algorithms, Order notations (O, Θ, Ω notations), Problem instance size, frequently occurring recurrence relations in analysis of algorithms.

UNIT II

Design Techniques-I: Divide and Conquer: Binary search, finding maximum and minimum, Merge sort, Quick sort, Strassen's matrix multiplication. Greedy Algorithms: Knapsack problem, Job sequencing with deadlines, optimal storage on tapes, Optimal merge pattern, Single source shortest paths.

UNIT III

Design Techniques-II: Dynamic Programming: Multistage graphs, All pairs shortest paths, 0/1 Knapsack, Travelling salesman problem.

UNIT IV

Design Techniques: Backtracking: 8-Queens Problems, Sum of subsets, Graph coloring. Branch-and-bound: Least cost (LC) search, Control abstractions for LC search, FIFO branch and bound, LC branch and bound.

UNIT V

Selected Algorithms from Various Areas: Graph Theory, Elementary Algorithms: DFS, BFS, Topological Sort, Minimum spanning trees (Kruskal and Prim's algorithms), Shortest Paths: Single source shortest paths, all pairs shortest paths, String Matching: The naive string-matching algorithm, The Robin-Karp algorithm, The Knuth-Morris-Pratt algorithm.

UNIT VI

Complexity Theory: Lower-bound arguments, NP-completeness: Introduction to NP-Complete, Reducibility (SAT, Independent Set, 3VC, Subset Sum and Partition, Hamiltonian Circuit).

Text Books:

1. Thomas Cormen, Charles Leiserson, Ronald Rivest and Cliford Stein, ***"Introduction to Algorithms"***, MIT Press, 3rd Edition, 2009.
2. E. Horowitz, S. Sahni and S. Rajsekaran, ***"Computer Algorithms"***, Silicon Press, 2nd Edition, 2008.

Reference Books:

1. B. K. Joshi, ***"Data Structures and Algorithms in C++"***, Tata McGraw Hill Education, 2010.
2. G. T. Heineman, Gary Pollice, Stanley Selkow, ***"Algorithms in a Nutshell"***, Shroff Publication, 1st Edition, 2008.
3. Kyle Loudon, ***"Mastering Algorithms with C"***, Shroff Publication, 1st Edition, 2008.

Course Title:	**Software Engineering**	**Semester V**	
Course Code	**BTITC503**	**Course Type**	**Core**
Pre-requisite	**Nil**	**L – T – P**	**3 – 0 – 0**
Stream	**Core**	**Credits**	**3**

Course Objectives:

1. To understand software lifecycle development models.
2. To understand and apply software requirements engineering techniques, software design principles, modeling and software testing techniques.
3. To understand the use of metrics in software engineering.
4. To understand software project management.

Course Outcomes:

After learning the course the students should be able:

1. To use the techniques, skills, and modern engineering tools necessary for engineering practice.
2. To design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
3. To identify, formulate and solve engineering problems.

Course Content:

UNIT I

Software Development Process: Software crisis and myths, Software process and development: Generic view of process, Software life cycle and models, Analysis and comparison of varies models, an agile view of process.

UNIT II

Requirement Engineering: Requirements engineering tasks, Initiating requirement engineering process, Eliciting requirement, developing use-cases, Building the analysis model, Negotiating and validating requirement, Building the analysis model.

UNIT III

System Design Overview: Design process and design quality, Design concepts, Design model, Pattern based software design, Architectural design, User interface design. UML: Different methods: Rambaugh / Booch / Jakobsons, Need for standardization. Developing diagrams in UML (Use CASE, Class, Interaction, State diagrams) CASE TOOLS.

UNIT IV

Validation and Testing: Strategic approach to Software testing, Strategic issues, Test strategies for conventional software, Validation testing, System testing, Debugging. White box testing and Black box testing.

UNIT V

Web Engineering: WebApps engineering layers, Web engineering processes planning for web engineering projects, Project management issue for web engineering. Metrics, Requirement analysis, Analysis models for web engineering design for WebApps, testing for WebApps.

UNIT VI

Planning and Management of Project: Project management, Metrics for process and projects, Estimation, Project scheduling, Risk management, Importance of software quality and measurements software engineering techniques for quality assurance, and Change management. ISO 9000 and CMM/PCMM.

Text Books

1. Roger S. Pressman, "***Software Engineering***", Tata McGraw-Hill, 6th Edition, 2006.
2. G. Booch, J. Rambaugh, and I. Jacobson, ***"The Unified Modeling Language User Guide"***,
3. Addison Wesley, 2nd Edition, 2005.

Reference Books:

1. Shari Pfleeger, ***"Software Engineering"***, Pearson Education, 3rd Edition, 2008.
2. Ian Sommerville, ***"Software Engineering"***, Pearson Higher Education, 10th Edition, 2016.
3. Pankaj Jalote, ***"An Integrated Approach to Software Engineering"***, Springer New York, 2nd
4. Edition, 2013.

Course Title:	**Graph Theory**	**Semester V**	
Course Code	**BTITOE504A**	**Course Type**	**Elective**
Pre-requisite	**Discrete Structures and Applications**	**L – T – P**	**3 – 0 – 0**
Stream	**Departmental Elective**	**Credits**	**3**

Course Content:

UNIT I

Basics – Graphs, degree sequences, distance in graphs, complete, regular and bipartite graphs, basic properties.

UNIT II

Structure and Symmetry – Cut vertices, bridges and blocks, automorphism groups, reconstruction problem.

UNIT III

Trees and connectivity – Properties of trees, Arboricity, vertex and edge connectivity, Mengers theorem

UNIT IV

Eulerian and Hamiltonian graphs – Characterization of Eulerian graphs -Sufficient conditions for Hamiltonian graphs.

UNIT V

Colouring and planar graphs – vertex and edge colouring, perfect graphs, planar graphs, Euler's theorem, Kuratowski's theorem, Colouring of planar graphs, Crossing number and thickness.

UNIT VI

Matching, factors, decomposition and domination. Extremal Graph theory – Turan's theorem, Ramsay's theorem, Szemeredi's 97 regularity lemma, applications.

Text Books:

1. J. A. Bondy, U. S. R. Murthy, ***"Graph Theory"***, Springer Verlag, 2008.
2. D. B. West, ***"Introduction to Graph Theory"***, PHI, 2004.

Reference Books:

1. R. Diestel , ***"Graph Theory"***, Springer Verlag (Free Download available), 2003.

Course Title:	**Human Computer Interaction**	**Semester V**	
Course Code	**BTITOE504B**	**Course Type**	**Elective**
Pre-requisite	**Nil**	**L – T – P**	**3 – 0 – 0**
Stream	**Departmental**	**Credits**	**3**

Course Content:

UNIT I

Introduction: The human, The computer, The interaction, Paradigms, Usability of Interactive Systems, Guidelines, Principles, and Theories.

UNIT II

Design Process- Interaction design basics, HCI in the software process, Design rules, Implementation support, Evaluation techniques, Universal design, User support.

UNIT III

Models and Theories0 Cognitive models, Socio-organizational issues and stakeholder requirements, Communication and collaboration models, Task analysis, Dialogue notations and design, Models of the system, Modeling rich interaction.

UNIT IV

Interaction Styles- Direct Manipulation and Virtual Environments, Menu Selection, Form Filling and Dialog Boxes, Command and Natural Languages, Interaction Devices, Collaboration and Social Media Participation.

UNIT V

Design Issues- Quality of Service, Balancing Function and Fashion, User Documentation and Online Help, Information Search, Information Visualization.

UNIT VI

Outside the Box- Group ware, Ubiquitous computing and augmented realities, Hypertext, multimedia, and the World Wide Web

Text Books:

1. Alan Dix, Janet Finlay, ***"Human Computer Interaction"***, Pearson Education, 2004.
2. Ben Shneiderman, ***"Designing the User Interface - Strategies for Effective Human Computer Interaction"***, Pearson Education, 2010.

Reference Books:

1. M. B. Rosson, J. M. Carroll ***"Usability Engineering: Scenario-Based Development of Human-Computer Interaction"***, Elsevier, 2002.
2. Alan Cooper, ***"The Essentials of Interaction Design"***, Wiley Publishing, 2007.
3. Nielsen, J. Morgan Kaufmann, San Francisco, ***"Usability Engineering"***, 1993.
4. Heim, S., ***"The Resonant Interface: HCI Foundations for Interaction Design"***, Addison-Wesley, 2007.

Course Title:	**Probability and Queuing Theory**	**Semester V**	
Course Code	**BTITOE504C**	**Course Type**	**Elective**
Pre-requisite	**Engineering Mathematics-III**	**L – T – P**	**3 – 0 – 0**
Stream	**Departmental Elective**	**Credits**	**3**

Course Objectives:

1. Be through with probability concepts.
2. To acquire knowledge on Probability Distributions.
3. Get exposed to the testing of hypothesis using distributions.
4. Gain strong knowledge inn principles of Queuing theory.
5. Get exposed to Discrete time Markov chain.

Course Outcomes:

1. To acquire analytical ability in solving mathematical problems as applied to the respective branches of engineering.

Course Content:

UNIT I

Random Variables: Review of probability concepts, Types of Events, Axioms, Conditional probability, Multiplication theorem, Applications.

Discrete and continuous Random Variables – Discrete case, Probability Mass function, Cumulative distribution function, Applications, Characteristics of random variables – Continuous case, Probability density function, Cumulative distribution function, Applications, Expectation, Variance, Expectation, Variance, Moment Generating Function, Functions of Random Variable (One dimensional only) Chebychev‟s Inequality – (Statement only). Applications of Chebychev's Inequality.

UNIT II

THEORETICAL DISTRIBUTIONS:

Discrete Probability distribution: Binomial distribution – MGF, Mean, Variance, Applications of Binomial distribution, Fitting a Binomial distribution, Poisson distribution – MGF, Mean, Variance, Applications of Poisson distribution, Fitting a Poisson distribution, Geometric distribution – MGF, Mean, Variance, Memoryless Property , Applications of Geometric distribution, Continuous Probability Distributions: Uniform distribution – MGF, Mean, Variance & Applications, Exponential Distribution - MGF, Mean, Variance, Memoryless Property Applications of Exponential distribution, Normal distribution – Mean, Variance, Standard Normal distribution and Applications of Normal distribution

UNIT III

Testing of Hypothesis:

Introduction to Sampling Distributions, Population and Sample, Null Hypothesis and Alternative Hypothesis, Single and Two Tailed Test.

Testing of Hypothesis, Level of Significance, Critical Region, Procedure for Testing of Hypothesis

Large Sample Test- Test For Single Proportion, Two Sample Proportions.

Large Sample Test- Test For Single Mean, Two Sample Means.
Small Sample Tests – „t‟ Test For a Single Mean „t‟ Test For The Difference Of Means, Paired „t‟ Test
F Test – Test of Significance of the Difference between Two Population Variances.
Chi Square Test for Goodness of Fit, Independence of Attributes.

UNIT IV

Queuing Theory: Introduction to Markovian queuing models.
Single Server Model with Infinite system capacity, Characteristics of the Model (M/M/1): (∞/FIFO)
Problems on Model (M/M/1): (∞/FIFO), Problems on Model (M/M/1): (∞/FIFO), Single Server Model with Finite System Capacity, Characteristics of the Model (M/M/1): (K/FIFO), Problems on Model (M/M/1): (K/FIFO).

UNIT V

Markov Chains:
Introduction to Stochastic process, Markov process, Markov chain one step & n-step Transition Probability, TPM and Applications, Chapman Kolmogorov theorem (Statement only), Applications on Chapman Kolmogorov theorem.

UNIT VI

MARKOV CHAINS: Transition probability- Applications, Classification of states of a Markov chain, Classification of states of a Markov chain – Applications.

Text Books:

1. Veerarajan T., ***"Probability, Statistics and Random Processes"***, Tata McGraw Hill, 1st Reprint 2004.
2. S.C. Gupta and V.K. Kapoor, ***"Fundamentals of Mathematical Statistics"***, Sultan Chand & Sons, 9th extensively revised Eition,1999

Reference Books:

1. Trivedi K S, ***" Probability and Statistics with reliability, Queueing and Computer Science Applications***", Prentice Hall of India, New Delhi, 1984
2. Gross.D, Harris.C.M. , ***"Fundamentals of Queuing Theory"***, John Wiley and Sons, 1985.
3. Allen.A.O., ***"Probability Statistics and Queuing Theory"***, Academic Press, 1981

Course Title:	**Embedded Systems**	**Semester V**	
Course Code	**BTITSE505A**	**Course Type**	**Elective**
Pre-requisite	**Microprocessor & Microcontroller**	**L – T – P**	**3 – 0 – 0**
Stream	**Software Application and Development**	**Credits**	**3**

Course Objectives:

1. To understand the fundamental concepts in Embedded Systems.
2. To learn Real Time Operating Systems.
3. To get acquainted with hardware & interfaces.
4. To know Embedded System Design Techniques.

Course Outcomes:

After learning the course the students should be able:

1. To demonstrate & explain embedded systems hardware & software components.
2. To define embedded systems using real time operating system – VxWorks/ µCOS II RTOS.
3. To design & develop embedded applications using C language.
4. To apply design techniques in real-life application.

Course Content:

UNIT I

Introduction: Introduction to embedded systems-hardware and software components, Types, Examples, Characteristics, Challenges in embedded computing system design, Embedded sys-tem design processes, Introduction to IC technology.

UNIT II

Analysis and Design of Embedded System: Software engineering practices in the embedded systems, Software develop process, Interprocess communication and synchronization of process, Task and threads, Programme language, Program concept and embedded programming in C, Software components-Interpreter, Compiler, Assembler, Cross assembler.

UNIT III

OS for Embedded Systems: Introduction to real time theory, Operating system services, Real time operating system concepts, Basic design using a RTOS, Introduction to RTOS programming tools Micro C/OSII and VxWorks.

UNIT IV

Hardware for Embedded Systems: Hardware components, SOC, Processors, CPU, Types of memory, Memory management, I/O devices and interfacing, Parallel I/O interface, Blind counting synchronization and busy waiting, Parallel port interfacing with switches, Keypads and display unit, Memory and high speed interfacing, Interfacing of data acquisition systems, Interfacing of controllers, Serial communication interface, Implementation of above using C language.

UNIT V

Performance Issues of an Embedded System: CPU performance, CPU power consumption, Analysis and optimization of CPU power consumption program execution time, Analysis and optimization of energy and power, Analysis of program size, Hardware accelerators.

UNIT VI

Design Examples and Case Studies: Personal Digital Assistants, Set Top Boxes, Ink Jet Printers, Digital thermometer, Case Studies of digital camera, Smart card, Case study of coding for sending application layer byte stream on TCP/IP network using RTOS VxWorks.

Text Books

1. Raj Kamal, ***"Embedded Systems Architecture, and Programming"***, TMH Publication, 3rd Edition, 2015.
2. Iyer, Gupta, ***"Embedded Real Time Systems Programming"***, TMH Publication, 2003.

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.

Course Title:	**IT Service Management**	**Semester V**	
Course Code	**BTITSE505B**	**Course Type**	**Elective**
Pre-requisite	**Nil**	**L – T – P**	**3 – 0 – 0**
Stream	**Infrastructure & Security Management**	**Credits**	**3**

Course Objectives:

1. To introduce practical implementation of Information Technology Service Management (ITSM).
2. To understand how an integrated ITSM framework can be utilized to achieve IT business integration, cost reductions and increased productivity.
3. To learn the best practices of ITSM methodology.

Course Outcomes:

After learning the course the students should be able:

1. To identify IT services as a means to provide functionality and value to customers.
2. To describe the needs and targets of the different stakeholders (service providers, customers, suppliers/partners) in the services value chain.
3. To demonstrate the value of a service management framework.
4. To explain the service management processes for given customers.
5. To select the appropriate tools to support a given designed service management solution.

Course Content:

UNIT I

IT Infrastructure: Introduction, Challenges in IT Infrastructure Management, Design Issues of IT Organizations and IT Infrastructure, IT System Management Process, IT Service Management Process, Information System Design Process.

UNIT II

Service Delivery Process: Service Level Management, Financial Management, IT Service Continuity Management, Capacity Management & Availability Management.

UNIT III

Service Support Process: Configuration Management, Incident Management, Problem Management, Change Management & Release Management.

UNIT IV

Storage Management: Storage, Backup, Archive and Retrieve, Disaster Recovery, Space Management, Database and Application Protection and Data Retention.

UNIT V

Security Management: Computer Security, Internet Security, Physical Security, Identity Management, Access Control System and Intrusion Detection.

UNIT VI

Case Studies on how IT Service Management and ITIL processes make IT efficient and save cost for organizations.

Text Books

1. Phalguni Gupta, Surya Prakash & Umarani Jayaraman, ***"IT Infrastructure & Its Management"***, Tata McGraw-Hill Education.

Reference Books:

1. W. Ronald Hudson, Ralph C. G. Haas, Waheed Uddin, ***"Infrastructure Management: Integrating Design, Construction, Maintenance, Rehabilitation, and Renovation"***, McGraw-Hill, 1997.
2. Anita Sengar, ***"IT Infrastructure Management"***, S.K. Kataria and Sons, 2^{nd} Edition, 2009.

Course Title:	**Information Storage Management**	**Semester V**	
Course Code	**BTITSE505C**	**Course Type**	**Elective**
Pre-requisite	**Computer Architecture & Organization**	**L – T – P**	**3 – 0 – 0**
Stream	**Information Management & Quality Control**	**Credits**	**3**

Course Objectives:

1. To evaluate storage architecture; understand logical and physical components of storage Infrastructure including storage subsystems.
2. To describe storage networking technologies such as FC-SAN, NAS, IP-SAN and data archival solution –CAS.
3. To identify different storage virtualization technologies and their benefits.
4. To understand and articulate business continuity solutions including, backup and recovery technologies, and local and remote replication solutions.
5. To define information security, and storage security domains and Identify parameters of managing and monitoring storage infrastructure and describe common storage management activities and solutions.

Course Outcomes:

After learning the course the students should be able:

1. To describe and apply storage technologies.
2. To identify leading storage technologies that provide cost-effective IT solutions for medium to large scale businesses and data centers.
3. To describe important storage technologies' features such as availability, replication, scalability and performance.
4. To design, analyze and manage clusters of resources.

Course Content:

UNIT I

Introduction to Information Storage Management - Intelligent Storage System (ISS) and its components Implementation of ISS as high-end and midrange storage-arrays. Direct Attached -Storage - Introduction to SCSI.

UNIT II

Introduction to parallel SCSI, SCSI Command Model – Storage Area Networks - Fiber Channel Connectivity, Login types, Topologies.

UNIT III

Storage networking technologies: Network-Attached Storage- General purpose servers vs. NAS Devices - Benefits of NAS, NAS File I/O – NAS Components, Implementation, File Sharing protocols, I/O operations – IPSAN-ISCSI, Components of ISCSI- Content-Addressed Storage.

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, offsite 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. EMC Corporation, ***"Information Storage and Management"***, Wiley India, 1st Edition, 2009.

Reference Books:

1. IBM, ***"Introduction to Storage Area Networks and System Networking"***, 5th edition, November 2012.
2. Robert Spalding, ***"Storage Networks: The Complete Reference"***, Tata McGraw Hill, Osborne, 6th reprint 2003.
3. Marc Farley, ***"Building Storage Networks"***, Tata McGraw Hill, Osborne, 1st Edition, 2001.
4. Tom Clark, ***"Designing Storage Area Networks -A Practical Reference for Implementing Fiber Channel and IP SANs",*** Tata McGraw Hill 2003, 2nd edition.

Course Title:	**Network Management**	**Semester V**	
Course Code	**BTITSE505D**	**Course Type**	**Elective**
Pre-requisite	**Internetworking Protocols**	**L – T – P**	**3 – 0 – 0**
Stream	**Network**	**Credits**	**3**

Course Objectives:

1. To understand the principles of network management, different standards and protocols used in managing complex networks.
2. To understand the automation of network management operations and making use of readily available network management systems.

Course Outcomes:

After learning the course the students should be able:

1. To acquire the knowledge about network management standards (OSI and TCP/IP).
2. To acquire the knowledge about various network management tools and the skill to use them in monitoring a network.
3. To analyze the challenges faced by Network managers.
4. To evaluate various commercial network management systems and open network management systems.
5. To analyze and interpret the data provided by an NMS and take suitable actions.

Course Content:

UNIT I

Data communication and network management overview: Analogy of Telephone Network Management, Communications protocols and Standards, Case Histories of Networking and Management, Challenges of Information Technology Managers, Network Management: Goals, Organization, and Functions, Network and System Management, Network Management System Platform, Current Status and future of Network Management.

UNIT II

SNMPV1 network management, Managed network: Organization and Information Models. Managed network: Case Histories and Examples, The History of SNMP Management, The SNMP Model, The Organization Model, System Overview, The Information Model.

UNIT III

SNMPV1 Network Management: Communication and Functional Models, The SNMP Communication Model, Functional model. SNMP MANAGEMENT: SNMPv2 Major Changes in SNMPv2, SNMPv2 System architecture, SNMPv2 Structure of Management Information, The SNMPv2 Management Information Base, SNMPv2 Protocol, Compatibility with SNMPv1.

SNMP MANAGEMENT: RMON: What is Remote Monitoring? , RMON SMI and MIB, RMON1, RMON2, ATM Remote Monitoring, A Case Study of Internet Traffic Using RMON

UNIT IV

Telecommunication management network: Why TMN? , Operations Systems, TMN Conceptual Model, TMN Standards, TMN Architecture, TMN Management Service Architecture, An Integrated View of TMN, Implementation Issues.

UNIT V

Network management tools and systems: Network Management Tools, Network Statistics Measurement Systems, History of Enterprise Management, Network Management systems, Commercial Network management Systems, System Management and Enterprise Management Solutions.

UNIT VI

Web-Based Management: NMS with Web Interface and Web-Based Management, Web Interface to SNMP Management, Embedded Web-Based Management, Desktop management Interface, Web-Based Enterprise Management, WBEM: Windows Management Instrumentation, Java management Extensions, Management of a Storage Area Network , Future Directions. Case Studies:

Text Books:

1. Mani Subrahmanian, ***"Network Management Principles and Practice"***, Pearson Education, 2nd Edition, 2010.

Reference Books:

1. Morris, ***"Network management"***, Pearson Education, 1st Edition, 2008.
2. Mark Burges, ***"Principles of Network System Administration"***, Wiley DreamTech, 1st Edition, 2008.

Course Title:	**Data Visualisation**	**Semester V**	
Course Code	**BTITSE505E**	**Course Type**	**Elective**
Pre-requisite	**Database Management Systems**	**L – T – P**	**3 – 0 – 0**
Stream	**Data Science**	**Credits**	**3**

Course Objectives:

1. Learn and understand the importance of data visualization.
2. Learn what is user experience in data visualization and its importance.
3. Learn about basic and advance chart types used in data visualization.
4. Learn the psychology of visualization with Gestalt Principles.

Course Outcomes:

After learning the course the student will be able:

1. Get a solid understanding of how people work in data visualization project.

Course Content:

UNIT I

The seven stages of Data Visualization: Why data display requires planning, An example, Iteration and Combination, Principles.

Getting Started with Processing: Sketching with processing, Example and Distributing your work, Examples and references, Functions, Sketching and Scripting

Mapping: Drawing a Map, Locations on map, Data on Map, Using your own data, Next step.

UNIT II

Time series:

Milk, Tea, and Coffee (Acquire and parse), Cleaning the table(Filter and Mine), A simple plot(Represent and refine), Labeling the current data set(Refine and Interact), Drawing Axis labels(Refine), Choosing a proper representation(Represent and refine), Using rollovers to Highlights points(Interact), Ways to connect points(refine), Text labels as tabbed panes(Interact), Interpolation between data sets(Interact).

UNIT III

Connections and Correlations:

Changing data sources, Problem statement, Preprocessing, Using the processed data(Acquire, Parse Filter and Mine), Displaying the results(Represent), Returning to the questions(Refine), Sophisticated sorting: Using salary as a Tiebreaker(Mine), Moving to multiple days(Interact), Smoothing out Interaction(Refine), Deployment Consideration(Acquire, Parse, filter).

UNIT IV

Scatterplot Maps: ++Preprocessing, Loading the data(Acquire and Parse), Drawing a scatterplot of Zip codes(Mine and represent), Highlighting Points while typing(Refine and Interact), Show the currently selected points(refine), Progressively Dimming and Brightening points(Refine), Zooming In (Interact),Changing How Points are Drawn when Zooming (Refine), Development issues(Acquire and Refine)

UNIT V

Trees, Hierarchies, and Recursion: Using recursion to build a Directory Tree, Using a Queue to Load Asynchronously (Interact), An improving the TreeMaps Display (Refine), Flying through files(Interact).

Networks and Graphs: A simple graph Demo, A more complicated Graph, Approaching Network Problem, Advanced graph example, Mining additional example.

UNIT VI

Acquiring Data:Where to find data, Tools for Acquiring data from Internet, Loading files for use with processing, Loading text data, Dealing with files and folders, Listing files in folders, Asynchronous Image download, Using openStream() As a bridge to Java, Dealing with Byte arrays, Advanced web techniques, Using Databases, Dealing with large number of files.

Parsing Data**:** Levels of efforts, Tools for gathering clues, Text is Best, Text Markup language, Regular expressions(regexps), Grammars and BNF Notations, Compressed Data, Vectors and Geometry, Binary data formats, Advanced detective work.

Text Books:

1. Ben Fry, ***"Visualizing Data: Exploring and Explaining data with Processing Environment"***, Shroff/O'Reilly Media, 2016

Reference Books:

1. Scott Murray, ***"Interactive Data Visualization for the web"***, Shroff/O'Reilly Media, 2016.
2. Julia Steele, Noah Lliinsky, ***"Designing Data Visualizations"***, Shroff/O'Reilly Media, 2012.
3. Kyran Dale, ***"Data Visualization with Python and JavaScript: Scrape, Clean, Explore & Transform your data"***, Shroff/O'Reilly Media, 2016.
4. Julia Steele, Noah Lliinsky, ***"Beautiful Visualization"***, Shroff/O'Reilly Media, 2016.

Course Title:	**Seminar**	**Semester V**	
Course Code	**BTITS506**	**Course Type**	**Mandatory**
Pre-requisite	**Nil**	**L – T – P**	**0 – 2 – 0**
Stream	**Core**	**Credits**	**2**

Seminar topic is included to enable the students to apply their knowledge to understand advanced technologies, designs etc. Literature survey may help to select such topics which are invaluable to an engineer in an Information Technology industry. It will encourage students to develop their presentation skills, good communication skills and skills of collecting the correct information regarding the technical topic.

The students will be able to deliver seminar with useful information. He/she should under-stand the technologies, designs and skills of writing technical report, to do literature survey and to attempt the queries from examiner.

Course Title:	**Programming Lab – Minor(R programming)**	**Semester V**	
Course Code	**BTITL507**	**Course Type**	**Mandatory**
Pre-requisite	**Nil**	**L – T – P**	**0 – 0 – 2**
Stream	**Core**	**Credits**	**1**

Lab Experiments Objective:

1. To learn R programming.

Lab Experiments List:

1. Download R programming language SDK and setup to run programs.
2. Develop and write a program to declare R variables, constants, operators and reserved words and understand the operator precedence.
3. Write a program to declare and understand the functioning of all the decision and loop constructs like If-Else, While, Break-Next and Repeat.
4. Execute all R functions.
5. Execute program to demonstrate Vectors, Matrix, data frame and factor.
6. Execute programs to test R Objects and Class.
7. Write a program to use and display various graphs and charts in R.
8. Execute programs to use plot in R.

Course Title:	**Database Management Systems Lab**	**Semester V**	
Course Code	**BTITL509**	**Course Type**	**Mandatory**
Pre-requisite	**Nil**	**L – T – P**	**0 – 0 – 2**
Stream	**Core**	**Credits**	**1**

Lab Experiments Objective:

1. To design a database adopting the principles of relational database model.
2. To practice and master DDL and DML through SQL.
3. To learn building efficient queries to interact with a database.

Lab Experiments List:

1. Creation of databases and use of SQL commands (DDL, DML and DCL).
2. Suitable exercises to practice SQL commands may be given for Insert, Update and Delete.
3. Write SQL procedure for an application which uses exception handling.
4. Write SQL procedure for an application with cursors.
5. Write SQL for implementing Nested Queries.
6. Write SQL for implementing Join Queries.
7. Write a DBMS program to prepare reports for an application using functions.
8. Write SQL block containing triggers.
9. Write SQL block containing stored procedures.
10. Develop a menu driven, GUI-based database application in any one of the domains such as Banking, Billing, Library management, Payroll, Insurance, Inventory, Healthcare etc. integrating all the features specified in the above exercises.

Course Title:	**Design and Analysis of Algorithms Lab**	**Semester V**	
Course Code	**BTITL510**	**Course Type**	**Mandatory**
Pre-requisite	**Nil**	**L – T – P**	**0 – 0 – 2**
Stream	**Core**	**Credits**	**1**

Lab Experiments Objective:

1. To design and develop various algorithms and analyze its efficiency to a specific problem.

Lab Experiments List:

1. Sort a given set of n integer elements using Quick Sort method and compute its time complexity. Run the program for varied values of n and record the time taken to sort. Plot a graph of the time taken versus non graph sheet. The elements can be read from a file or can be generated using the random number generator. Demonstrate how the divide and conquer method works along with its time complexity analysis: worst case, average case and best case.
2. Implement the 0/1 Knapsack problem using (a) Dynamic Programming method (b) Greedy method.
3. From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm. Write the program.
4. Find Minimum Cost Spanning Tree of a given connected undirected graph using Kruskal's algorithm. Use Union-Find algorithms in your program.
5. Find Minimum Cost Spanning Tree of a given connected undirected graph using Prim's algorithm.
6. Write programs to (a) Implement All-Pairs Shortest Paths problem using Floyd's algorithm
7. (b) Implement Travelling Sales Person problem using Dynamic programming.
8. Design and implement a program to find a subset of a given set S = Sl, S2,.....,Sn of n positive integers whose SUM is equal to a given positive integer d. For example, if S = 1, 2, 5, 6, 8 and d = 9, there are two solutions 1, 2,6and 1, 8. Display a suitable message, if the given problem instance doesn't have a solution.
9. Design and implement a program to find all Hamiltonian Cycles in a connected undirected Graph G of n vertices using backtracking principle.

Course Title:	**Operating Systems**	**Semester VI**	
Course Code	**BTITC601**	**Course Type**	**Mandatory**
Pre-requisite	**Nil**	**L – T – P**	**3 – 0 – 0**
Stream	**Core**	**Credits**	**3**

Course Objectives:

1. To study the basic concepts and functions of operating systems.
2. To understand the structure and functions of OS.
3. To learn about Processes, Threads and Scheduling algorithms.
4. To understand the principles of concurrency and Deadlocks.
5. To learn various memory management schemes.
6. To study I/O management and File systems.

Course Outcomes:

After learning the course the students should be able:

1. To design various Scheduling algorithms.
2. To apply the principles of concurrency.
3. To design deadlock, prevention and avoidance algorithms.
4. To compare and contrast various memory management schemes.
5. To design and Implement a prototype file systems.

Course Content:

UNIT I

Operating System Structures: Definition, Types of operating system, Real time operating system, System components, Sys-tem services, Systems calls, System programs, System structure, Virtual machines, System design and implementation.

UNIT II

Processes and CPU scheduling: Process concept, Process scheduling, Operation on a process, Co-operating processes, Threads, Interprocess communication, Scheduling criteria, Scheduling algorithms, Multiple-processor scheduling, Real-time scheduling, Scheduling algorithms and performance evaluation.

UNIT III

Process Synchronization: The critical-section problem, Critical regions, Synchronization hardware, Semaphores, Classical problems of synchronization, Monitors.

UNIT IV

Deadlocks: Systems model, Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock, Combined approach to deadlock handling.

UNIT V

Memory Management and Virtual Memory: Logical versus physical address space, Swapping, Contiguous allocation, Paging, Segmentation with paging, Demand paging, Page replacement algorithms, Thrashing.

UNIT VI

File Management: File system and secondary storage devices, Real-time operating systems.

Text Books

1. A. Silberschatz, P. Galvin, ***"Operating System Concepts"***, Wiley Publication, 9th Edition, 2013.
2. A. S. Tanenbaum, H. Bos, ***"Modern Operating Systems"***, Pearson Education, 4th Edition, 2015.

Reference Books:

1. D.M. Dhamdhere, ***"Systems Programming and Operating Systems"***, Tata McGraw Hill Publication, 2nd Edition, 2001.
2. G. Nutt, ***"Operating Systems Concepts"***, Addison Wesley Publication, 3rd Edition.
3. H. M. Deitel, ***"An Introduction to Operating Systems"***, Addison Wesley Publication, 1990.

Course Title:	**Compiler Construction**	**Semester VI**	
Course Code	**BTITC602**	**Course Type**	**Elective**
Pre-requisite	**Data Structures**	**L – T – P**	**3 – 0 – 0**
Stream	**Core**	**Credits**	**3**

Course Objectives:

1. To introduce the major concept areas of language translation and compiler design.
2. To develop an awareness of the function and complexity of modern compilers.
3. To provide practical, hands on experience in compiler design.

Course Outcomes:

After learning the course the students should be able:

1. To understand the major concept areas of language translation and compiler design.
2. To develop an awareness of the function and complexity of compilers.
3. To identify the similarities and differences among various parsing techniques and grammar transformation techniques.

Course Content:

UNIT I

Introduction to Compiling and Lexical Analysis: Definition, analysis of the source program, the phases of a compiler, the grouping of phases, Compiler-Construction tools, The role of the Lexical analyzer, Input buffering, Specification of Tokens, A Language for Specifying Lexical Analyzers, Design of a Lexical Analyzer generator.

UNIT II

Syntax Analysis: The role of the Parser, Context-free grammars, Writing a Grammar, Top-Down Parsing, Bottom- Up Parsing, Operator-precedence Parsing, LR-Parsers, Using Ambiguous Grammars, Parser Generators.

UNIT III

Syntax-Directed Translation: Definitions, Construction of Syntax Trees, Bottom-Up Evaluation of S-Attributed definitions, Top-Down Translation, Bottom-Up Evaluation of Inherited attributes.

UNIT IV

Intermediate Code Generation: Intermediate Languages, Declarations, Assignment Statements, Boolean Expressions, Case Statements, Back patching, Procedure Calls.

UNIT V

Code Generation: Issues in the Design of a Code Generator, The target Machine, Run-Time Storage Management, Basic Blocks and Flow Graphs, Next-Use Information, Simple Code Generator, Register allocation and Assignment, The DAG Representation of Basic Blocks, Generating Code from DAGs, Dynamic Programming, Code-Generation Algorithm, Code-Generators.

UNIT VI

Code Optimization: Peephole optimization, principal sources of optimization, introduction to Global data flow analysis.

Text Books:

1. Aho, Sethi, Ullman, ***"Compilers-Tools and Techniques"***, Pearson, 2^{nd} Edition, 2011.
2. Tremblay, Sorenson, ***"Theory and Practice of Compiler Writing"***, McGraw Hill Publication.
3. Hopcroft, ***"Introduction to Automata Theory, Languages and Computation"***, Pearson Publication.

Reference Books:

1. Paul G. Sorenson, ***"Compiler Writing"***, Tata McGraw Hill.
2. Robin Hunter, ***"The Essence of Compilers"***, Pearson Publication, 1998.

Course Title:	**Object Oriented Software and Web Engineering**	**Semester VI**	
Course Code	**BTITC603**	**Course Type**	**Mandatory**
Pre-requisite	**Object Oriented Paradigm with C++**	**L – T – P**	**3 – 0 – 0**
Stream	**Core**	**Credits**	**3**

Course Objectives:

1. To learn the concept of Object Oriented Software Development Process.
2. To get acquainted with UML Diagrams.
3. To understand Object Oriented Analysis Processes.
4. Understand the characteristics of web application.
5. Learn to Model web applications.
6. Be aware of Systematic methods.
7. Be familiar with the testing techniques for web applications.

Course Outcomes:

After learning the course the students should be able:

1. To understand Object Oriented Software Development Process.
2. To gain exposure to Object Oriented Methodologies & UML Diagrams.
3. To apply Object Oriented Analysis Processes for projects.
4. Apply the characteristics of web applications.
5. Model web applications.
6. Design web applications.
7. Test web applications.

Course Content:

UNIT I

Object Basics, Object oriented philosophy, objects, classes, attributes, object behavior and methods, encapsulation and information hiding, class hierarchy, polymorphism, object relationships and associations, aggregations and object containment, case study, object identity, persistence.. Object oriented systems development life cycle: Software development process, building high quality software, use- case driven approach, reusability.

UNIT II

Object Oriented Methodologies: Rumbaugh et al.'s object modeling technique, Booch methodology, Jacobson et al methodologies, patterns, frameworks, and the unified approach. Unified modeling language: Static and dynamic models, UML diagrams, UML class diagrams, use-case diagrams, UML dynamic modeling, packages, UML extensibility and UML Meta model.

UNIT III

Object Oriented Analysis Process: Business object analysis, use-case driven object oriented analysis, business process modeling, use-case model, developing effective documentation, case study. Classification: Classification theory, noun phrase approach, common class patterns approach, use-case driven approach, classes, responsibilities, and collaborators, naming classes.

UNIT IV

Identifying Object Relationships, Attributes and Methods: Association, super-subclass relationships, a-part of relationships, case study, class responsibility, Defining attributes for vianet bank objects, object responsibility, defining methods for vianet bank objects Design process and design axioms: Corollaries, design patterns.

Designing Classes: UML object constraint languages, designing classes, class visibility, refining attributes for the vianet bank objects, designing methods and protocols, designing methods for the vianet bank objects, packages and managing classes. Designing access layer, Designing view layer, macro level process.

UNIT V

Introduction to Web Engineering and requirement engineering: Motivation, Categories of Web Applications, Characteristics of Web Applications, Product-related Characteristics, Usage related Characteristics, Development-related Characteristic, Evolution of web engineering – Requirements Engineering Activities RE Specifics in Web Engineering, Principles for RE of Web Applications, Adapting RE Methods to Web Application Development, Requirement Types, Notations, Tools.

Web Application Architecture and Modelling Web Applications: Introduction- Categorizing Architectures, Specifics of Web Application Architectures, Components of a Generic Web Application Architecture, Layered Architectures, 2-Layer Architectures, N-Layer Architectures Data-aspect Architectures, Database-centric Architectures, Architectures for Web Document Management, Architectures for Multimedia Data Modeling Specifics in Web Engineering, Levels, Aspects, Phases Customization, Modeling Requirements, Hypertext Modeling, Hypertext Structure Modeling Concepts, Access Modeling Concepts, Relation to Content Modeling, Presentation Modeling, Relation to Hypertext Modeling, Customization Modeling, Relation to Content, Hypertext, and Presentation Modeling

UNIT VI

Web Application Design: Introduction, Web Design from an Evolutionary Perspective, Information Design, Software Design: A Programming Activity, Merging Information Design and Software Design, Problems and Restrictions in Integrated Web Design, A Proposed Structural Approach, Presentation Design, Presentation of Nodes and Meshes, Device-independent Development, Approaches, Inter action Design, User Interaction User Interface Organization, Navigation Design, Designing a Link Representation, Designing Link Internals, Navigation and Orientation, Structured Dialog for Complex Activities, Interplay with Technology and Architecture, Functional Design.

Testing Web Applications: Introduction, Fundamentals, Terminology, Quality Characteristics, Test Objectives, Test Levels, Role of the Tester, Test Specifics in Web Engineering, Test Approaches, Conventional Approaches, Agile Approaches, Test Scheme, Three Test Dimensions, Applying the Scheme to Web Applications, Test Methods and Techniques, Link Testing, Browser Testing, Usability

Testing, Load, Stress, and Continuous Testing, Testing Security, Test-driven Development, Test Automation.

Web Project Management: Understanding Scope, Refining Framework Activities, Building a Web Team, Managing Risk, Developing a Schedule, Managing Quality, Managing Change, Tracking the Project, Introduction to node JS – web sockets.

Text Books

1. Ali Bahrami, ***"Object Oriented Systems Development using the Unified Modeling Language"***, McGraw Hill, Reprint, 2009.
2. Craig Larman, ***"Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development"***, Pearson Education, 3rd Edition, 2005.
3. Gerti Kappel, Birgit Proll, ***"Web Engineering"***, John Wiley and Sons Ltd, 2006.
4. Roger S. Pressman, David Lowe, ***"Web Engineering"***, Tata McGraw Hill Publication, 2007.
5. Guy W. Lecky-Thompson, ***"Web Programming"***, Cengage Learning, 2008.

Reference Books:

1. Bernd Oestereich, ***"Developing Software with UML, Object-Oriented Analysis and Design in Practice"***, Addison-Wesley, 2000.
2. James Rumbaugh, Ivar Jacobson, Grady Booch, ***"The Unified Modeling Language Reference Manual"***, Addision Wesley, 2nd Edition, 2005
3. Simon Bennett, Steve Mc Robb and Ray Farmer, ***"Object Oriented Systems Analysis and Design Using UML"***, McGraw Hill Education, 4th Edition, 2010.
4. Erich Gamma, and Richard Helm, Ralph Johnson, John Vlissides, ***"Design Patterns: Elements of Reusable Object-Oriented Software"***, Addison-Wesley, 1995.
5. Chris Bates, **"Web Programming: Building Internet Applications"**, Third Edition, Wiley India Edition, 2007.
6. John Paul Mueller, **"Web Development with Microsoft Visual Studio 2005"**,Wiley Dream tech, 2006.

Course Title:	**Enterprise Resource Planning**	**Semester VI**	
Course Code	**BTITOE604A**	**Course Type**	**Elective**
Pre-requisite	**Nil**	**L – T – P**	**3 – 0 – 0**
Stream	**Departmental**	**Credits**	**3**

Course Objectives:

1. To introduce to enterprise systems and show how organizations use enterprise systems to run their operations more efficiently and effectively.
2. To learn about the critical success factors and implementation strategies that lead to enterprise system success.
3. To learn about the informational, knowledge, and decision-making opportunities afforded by enterprise systems.
4. To examine typical Enterprise Systems modules: materials management (MM), supply chain management (SCM), customer relationship management (CRM), financials, projects, human resource management (HRM).

Course Outcomes:

After learning the course the students should be able:

1. To demonstrate a good understanding of basic issues in Enterprise Systems.
2. To explain the scope of common Enterprise Systems (e.g., MM, SCM, CRM, HRM, procurement).
3. To explain the challenges associated with implementing enterprise systems and their impacts on organizations.
4. To describe the selection, acquisition and implementation of enterprise systems.
5. To use one of the popular ERP packages to support business operations and decision-making.
6. To communicate and assess an organization's readiness for enterprise system implementation with a professional approach in written form.
7. To demonstrate an ability to work independently and in a group.

Course Content:

UNIT I

Enterprise Resource Planning: Introduction, Disadvantages of non-ERP systems, What Is ERP? Need of ERP, Advantage of ERP, Risks of ERP, Growth of ERP.

UNIT II

ERP Modules: Finance, Production Planning, Control and Management, Sales and Distribution, Human Resource Management, Inventory Control System, Quality Management, Plant Maintenance.

UNIT III

ERP Implementation: ERP Implementation (Transition) strategies, ERP Implementation Life Cycle, Implementation Methodologies, Evaluation and selection of ERP package, ERP Project Team: Vendors, Employees, Consultants, Training & Education, Project management & Monitoring, Post Implementation Activities, Operation & maintenance of ERP system, Measuring the Performance of ERP System, Success & failure factors of an ERP, Implementation.

UNIT IV

ERP Market and Vendors: ERP Marketplace and Marketplace Dynamics, Comparison of Current ERP Packages and Vendors, like; SAP, Oracle, PeopleSoft, BAAN etc.

UNIT V

ERP and related technologies: Business Process Re-Engineering (BPR), Information Systems -Management Information, System (MIS), Decision Support System (DSS), Executive Support System (ESS) Data Warehousing, Data Mining, On-Line Analytical Processing (OLAP), Supply Chain Management, Customer Relationship Management

UNIT VI

ERP Case Studies: ERP systems implemented in – for example :TISCO, SKF Automotive Bearings Co. Ltd, Qualcomm CDMA, California, Post Implementation review of ERP packages – in, Manufacturing, Services and Others Organizations, Customization of ERP for different types of Industries.

Text Books

1. Alexis Leon, ***“ERP Demystified”***, TMH New Delhi, 2nd Edition.
2. V. K. Garg & N. K. Venkita Krishnan, ***“ERP Ware: ERP Implementation Framework”***, PHI.

Reference Books:

1. V. K. Garg & N. K. Venkita Krishna, ***“ERP Concepts & Planning”***, PHI, 2nd Edition.

Course Title:	**Decision Support Systems**	**Semester VI**	
Course Code	**BTITOE604B**	**Course Type**	**Elective**
Pre-requisite	**Database Management Systems**	**L – T – P**	**3 – 0 – 0**
Stream	**Departmental**	**Credits**	**3**

Course Objectives:

1. To select appropriate modeling techniques for supporting semi-structured business decision making.
2. To identify and select appropriate decision support systems for generating innovative business solutions.
3. To design and implement decision support systems for generating innovative business solutions.

Course Outcomes:

After learning the course the students should be able:

1. To recognize the relationship between business information needs and decision making.
2. To appraise the general nature and range of decision support systems.
3. To appraise issues related to the development of DSS.
4. To select appropriate modeling techniques.
5. To analyze, design and implement a DSS.

Course Content:

UNIT I

Basic Concepts: Decision making systems, Modeling and support, Basics and definition Systems models, Modeling process, Decision making, Intelligence phase, Design phase Choice phase, Evaluation, Implementation phase, Alternative decision making models, Decision support systems, Decision makers, Case applications.

UNIT II

Decision Support System Development: Decision support system development, Basics, Life cycle, Methodologies, Prototype, Technology levels and tools, Development platforms, Tool selection, Developing DSS, Enterprise systems, Concepts and definition, Evolution of information systems, Information needs, Characteristics and capabilities, Comparing and integrating EIS and DSS, EIS data access, Data warehouse, OLAP, Multidimensional analysis, Presentation and the Web, Including soft information enterprise on systems, Organizational DSS, Supply and value chains, Decision support, Supply chain problems and solutions, Computerized systems. MRP, ERP, SCM, Frontline decision support systems.

UNIT III

Knowledge Management: Organizational learning and memory, Knowledge management, Development Methods, Technologies and tools, Success , Knowledge management and artificial intelligence, Electronic Document Management, Knowledge Acquisition and Validation, Knowledge Engineering – Scope, Acquisition Methods, Interviews, Tracking Methods, Observation and other Methods, Grid Analysis, Machine Learning, Rule Induction, Case-Based Reasoning, Neural Computing, Intelligent Agents, Selection of an appropriate Knowledge Acquisition Methods, Multiple Experts, Validation and

Verification of the Knowledge Base-Analysis, Coding, Documenting, and Diagramming, Numeric and Documented.

UNIT IV

Knowledge Acquisition, Knowledge Acquisition and the Internet/Intranets, Knowledge Representation Basics, Representation in Logic and other Schemas, Semantic Networks, Production Rules, Frames, Multiple Knowledge Representation, Experimental Knowledge Representations, Representing Uncertainty. Intelligent System Development: Inference Techniques, Reasoning in Artificial Intelligence, Inference with Rules, Inference Tree, Inference with Frames, Model Based and Case Based Reasoning, Explanation and Meta Knowledge, Inference with Uncertainty, Representing Uncertainty, Probabilities and Related Approaches, Theory of Certainty, Approximate Reasoning using Fuzzy Logic

UNIT V

Intelligent Systems Development, Prototyping, Project Initialization, System Analysis and Design, Software Classification, Building Expert Systems with Tools, Shells and Environments, Software Selection, Hardware, Rapid Prototyping and a Demonstration Prototype, System Development, Implementation, Post Implementation.

UNIT VI

Management Support Systems: Implementing and Integrating Management Support Systems, Implementation, Major Issues, Strategies, System Integration, Generic Models MSS, DSS–ES, Integrating EIS, DSS and ES, Global Integration, Intelligent DSS, Intelligent Modeling and Model Management, Examples of Integrated Systems, Problems and Issues in Integration.

Text Books

1. Efrain Turban and Jay E. Aronson, “***Decision Support Systems and Intelligent Systems”***, Pearson Education, 6th Edition,2001.

Reference Books:

1. Ganesh Natarajan and Sandhya Shekhar, ***“Knowledge Management Enabling Business Growth”***, Tata McGraw Hill, 2002.
2. George M. Marakas, ***“Decision Support System”***, Prentice Hall, India, 2003.
3. Efrem A. Mallach, ***“Decision Support and Data Warehouse Systems”***, Tata McGraw, Hill, 2002.
4. Kimiz Dalkir, ***“Knowledge Management: Theory and Practice”***, Elsevier Science, 2005.
5. Becerra Fernandez and Laidener, ***“Knowledge Management: An Evolutionary View”***, PHI, 2009.

Course Title:	**Software Project Management**	**Semester VI**	
Course Code	**BTITOE604C**	**Course Type**	**Elective**
Pre-requisite	**Software Engineering**	**L – T – P**	**3 – 0 – 0**
Stream	**Departmental**	**Credits**	**3**

UNIT I

Project Evaluation and Planning - Activities in Software Project Management, Overview of Project Planning, Stepwise planning, contract management, Software processes and process models.

UNIT II

Cost Benefit Analysis, Cash Flow Forecasting, Cost-Benefit Evaluation Techniques, Risk Evaluation. Project costing, COCOMO 2, Staffing pattern, Effect of schedule compression, Putnam's equation, Capers Jones estimating rules of thumb, Project Sequencing and Scheduling Activities, Scheduling resources, Critical path analysis, Network Planning, Risk Management, Nature and Types of Risks, Managing Risks, Hazard Identification, Hazard Analysis, Risk Planning and Control, PERT and Monte Carlo Simulation techniques.

UNIT III

Monitoring And Control- Collecting Data, Visualizing Progress, Cost Monitoring, review techniques, project termination review, Earned Value analysis, Change Control

UNIT IV

Software Configuration Management (SCM), Managing Contracts, Types Of Contracts, Stages In Contract Placement, Typical Terms of A Contract, Contract Management and Acceptance.

UNIT V

Quality Management and People Management- Introduction, Understanding Behavior, Organizational Behaviour, Selecting The Right Person For The Job, Motivation, The Oldman – Hackman Job Characteristics Model , Working in Groups, Organization and team structures, Decision Making, Leadership, Organizational Structures, Stress, Health and Safety. ISO and CMMI models, Testing, and Software reliability, test automation.

UNIT VI

Overview of project management tools.

Text Books:

1. Bob Hughes, Mike Cotterell, ***"Software Project Management"***, Tata McGraw Hill, 2009.

Reference Books:

2. Royce, ***"Software Project Management"***, Pearson Education, 2005.
3. Robert K. Wysocki, ***"Effective Software Project Management"***, Wiley, 2006.

Course Title:	**Software Testing**	**Semester VI**	
Course Code	**BTITSE605A**	**Course Type**	**Elective**
Pre-requisite	**Software Engineering**	**L – T – P**	**3 – 0 – 0**
Stream	**Software Application & Development**	**Credits**	**3**

Course Objectives:

1. To study fundamental concepts in software testing, including software testing objectives, processes, criteria, strategies, and methods.
2. To learn planning of a test project, designing test cases and test data, conducting test operations, managing software problems and defects, and generating a test report.
3. To develop an understanding of the meaning and importance of quality in relation to software systems and the software development process.
4. To study issues and techniques for implementing and managing software quality assurance processes and procedures.

Course Outcomes:

After learning the course the students should be able:

1. To apply software testing knowledge and its processes to software applications.
2. To identify various software testing problems.
3. To solve software testing problems by designing and selecting software test models, criteria, strategies and methods.
4. To apply the techniques learned to improve the quality of software development.
5. To prepare a software quality plan for a software project.

Course Content:

UNIT I

Principles of Testing Software development life cycle model: Phases of software project, Quality, Quality assurance and quality control, Testing, Verification and validation, Process models to represent various phases, Life cycle models, Software testing life cycle.

UNIT II

White Box Testing (WBT) and Black Box Testing: Static testing, Structural testing, Challenges in WBT. Black box testing: Black box testing process.

UNIT III

Integration Testing: Definition, As a type of testing: Top-down integration, Bottom-up integration, Bi-directional integration, System integration, Choosing integration method, As a phase of testing, Scenario testing: System scenarios, Use case scenarios, Defect bash.

UNIT IV

System and Acceptance Testing, Functional Vs non Functional, Functional system testing, Non-functional system testing, Acceptance testing.

UNIT V

Performance testing, Regression testing, Internationalization testing, Adhoc testing. Factors governing performance of testing, Methodology, tools and process for performance testing. Regression Testing: Introduction, Types of Regression testing, Regression testing process. Adhoc testing: Introduction, Buddy testing, Pair testing, exploratory testing, Iterative testing, Agile and Extreme testing, XP work flow, Defect seeding.

UNIT VI

Testing Object Oriented Software: Introduction, Comparison of object oriented and procedural software, Sys-tem testing example, Unit testing of classes, Tools for testing object oriented software, Testing web applications.

Text Books

1. Srinivasan Desikan, Gopalaswamy Ramesh, ***"Software Testing: Principles and Practices"***, Pearson publication, 2nd Edition, 2006.

Reference Books:

1. Loise Tamres, ***"Introducing Software Testing"***, Pearson publication, 2002.
2. Boris Beizer, ***"Software Testing Techniques"***, Dreamtech press, 2nd Edition, 2014

Course Title:	**Data Storage Technologies & Networks**	**Semester VI**	
Course Code	**BTITSE605B**	**Course Type**	**Elective**
Pre-requisite	**Internetworking Protocols,, Operating Systems**	**L – T – P**	**3 – 0 – 0**
Stream	**Infrastructure & Security Management**	**Credits**	**3**

Course Objectives:

1. To gain knowledge and understand the design of a Data Centre.
2. To understand the best practice of design in the Data Centre.
3. To learn the options in the running of an efficient Data Centre.
4. To understand the value of data to a business, Information Lifecycle.
5. To understand the challenges in data storage and data management.
6. To learn solutions available for data storage.

Course Outcomes:

After learning the course the students should be able:

1. To explain the design of a data center and storage requirements.
2. To discuss the various types of storage and their properties.
3. To explain physical and virtualization of storage.
4. To explain the backup, archiving with regard to recovery and business continuity.

Course Content:

UNIT I

DATA CENTRE: Introduction, Site Selection and Environmental Considerations, Hierarchical or Layered Architecture, Architect Roles, Goals and Skills, Architecture Precursors.

UNIT II

DATA CENTRE DESIGN: Architecture Design and Standards Recommendations, Raised Access Floor and Design Best Practices, connecting the infrastructure with copper and fiber. IT Hardware, Cooling System Options and Environmental Control, Electrical Power Systems, Room Layout, Fire Protection and Security Systems, Building Automation and Energy Management Systems, Commissioning and Handover.

UNIT III

STORAGE MANAGEMENT: Introduction to Storage Technology, Storage Systems Architecture, Physical and logical components of a connectivity environment, Major physical components of a disk drive and their functions, Concept of RAID and its components, Different RAID levels and their suitability for different application environments: RAID 0, RAID 1, RAID 3, RAID 4, RAID 5, RAID 0+1, RAID 1+0, RAID 6, Integrated and Modular storage systems, high-level architecture and working of an intelligent storage systems.

UNIT IV

NETWORKED STORAGE: Evolution of networked storage, Architecture, components, and topologies of FC-SAN, NAS, and IP-SAN, Benefits of the different networked storage options, Need for long-term archiving solutions and describe how CAS fulfill the need, Appropriateness of the different networked storage options for different application environments.

UNIT V

Managing Data Center: Reasons for planned/unplanned outages, Impact of downtime, Difference between business continuity (BC) and disaster recovery (DR), RTO and RPO, Identification of single points of failure in a storage infrastructure and solutions to mitigate these failures, Architecture of backup/recovery and the different backup/recovery topologies, replication technologies and their role in ensuring information availability and business continuity Remote replication technologies and their role in providing disaster recovery and business continuity capabilities, Key areas to monitor in a data center, Industry standards for data center monitoring and Management Key metrics to monitor storage infrastructure.

UNIT VI

Securing Storage and Storage Virtualization: Information Security, Critical security attributes for information systems, Storage security domains, Analyze the common threats in, each domain, Storage Virtualization: Forms, Configurations and Challenges, Types of Storage Virtualization: Block-level and File-Level.

Text Books

1. Mauricio Arregoces, ***"Data Center Fundamentals"***, Cisco Press, 1st edition, 2003.
2. Robert Spalding, ***"Storage Networks: The Complete Reference"***, Tata McGraw Hill, Osborne, 2003.
3. Marc Farley, ***"Building Storage Networks"***, Tata McGraw Hill, Osborne. 2001.
4. Meeta Gupta, ***"Storage Area Network Fundamentals"***, Pearson Education Limited, 2002

Reference Books:

1. G. Somasundaram, Alok Shrivastava, ***"Information Storage and Management"***, EMC Education Series, Wiley Publishing Inc., 2011.
2. Gustavo Santana, ***"Data Center Virtualization Fundamentals: Understanding Techniques and Designs for Highly Efficient Data Centers with Cisco Nexus, UCS, MDS, and Beyond"***, Cisco Press, 1st Edition, 2013

Course Title:	**Service Oriented Architecture**	**Semester VI**	
Course Code	**BTITSE605C**	**Course Type**	**Elective**
Pre-requisite	**Nil**	**L – T – P**	**3 – 0 – 0**
Stream	**Information Management & Quality Control**	**Credits**	**3**

Course Objectives:

1. To gain understanding of the basic principles of service orientation.
2. To learn service oriented analysis techniques.
4. To learn technology underlying the service design.
5. To learn advanced concepts such as service composition, orchestration and Choreography.
6. To know about various WS specification standards.

Course Outcomes:

After learning the course the students should be able:

1. Build applications based on XML.
2. Develop web services using technology elements.
3. Build SOA-based applications for intra-enterprise and inter-enterprise applications.

Course Content:

UNIT I

Introducing SOA: Fundamental SOA: Common Misperceptions about SOA, Common tangible benefits of SOA, Common pitfalls of adopting SOA, The Evolution of SOA:-from XML to Web services to SOA, The continuing evolution of SOA, The roots of SOA. Web Services and Primitive SOA: The Web services framework-Services, Service descriptions, messaging with SOAP.

UNIT II

Web Services and Contemporary SOA: Message exchange patterns- Service activity-coordination-Atomic transactions-Business activities-Orchestration-Choreography- Web Services and Contemporary SOA: Addressing- Reliable messaging-Correlation- Policies- Metadata exchange- Security- Notification and eventing.SOA and Service-Orientation: Principles of Service - Anatomy of a service-oriented architecture- Common principle of service orientation-Service Layers –Service orientation.

UNIT III

Building SOA: SOA Delivery Strategies- SOA delivery lifecycle phases. Service-Oriented Analysis: Introduction to service-oriented analysis-Benefits of a business-centric SOA- Deriving business services-Service-Oriented Analysis: Service modeling, Service modeling guidelines- Classifying service model logic- Contrasting service modeling approaches.

UNIT IV

Service-Oriented Design: Introduction to service-oriented design- WSDL-related XML Schema language basics- WSDL language basics- SOAP language basics- Service interface, design tools. SOA Composition Guidelines: Steps to composing SO Considerations for choosing service layers and SOA standards, positioning of cores and SOA extensions.

UNIT V

SOA Service Design: - Overview-Service design of business service, application service, task centric service and guidelines. SOA Business Process Design: WS-BPEL language basics-WS Coordination.

UNIT VI

SOA support in J2EE – Java API for XML-based web services (JAX-WS) - Java architecture for XML binding (JAXB) – Java API for XML Registries (JAXR) - Java API for XML based RPC (JAX-RPC)- Web Services Interoperability Technologies (WSIT)

Text Books

1. Thomas Erl, ***"Service-Oriented Architecture: Concepts, Technology, and Design"***, Pearson Education, 2006.
2. Frank. P. Coyle, ***"XML, Web Services And The Data Revolution"***, Pearson Education, 2002.
3. Sandeep Chatterjee, James Webber, ***"Developing Enterprise Web Services. An Architect's Guide"***, Pearson Education, 2005.
4. Eric Newcomer, Greg Lomow, ***"Understanding SOA with Web Services"***, Pearson Education, 2005.
5. Ron Schmelzer et al. ***"XML and Web Services"***, Pearson Education, 2002

Reference Books:

1. Dan woods and Thomas Mattern, ***"Enterprise SOA designing IT for Business Innovation"***, O'REILLY, 1st Edition, 2006.
2. James McGovern, Sameer Tyagi, Michael E. Stevens, Sunil Mathew, ***"Java Web. Services Architecture"***, Morgan Kaufmann Publishers, 2003.
3. Atul Kahate, ***"XML and Related technologies"***, Pearson Education, 2008.
4. Kennard Scibner and Mark C. Stiver, ***"Understanding SOAP"***, SAMS publishing.
5. B. V. Kumar, S. V. Subrahmanya, ***"Web Services: An Introduction"***, TMH India, 2nd Edition, 2012.

Course Title:	**Network Programming**	**Semester VI**	
Course Code	**BTITSE605D**	**Course Type**	**Elective**
Pre-requisite	**Internetworking Protocols, Operating Systems**	**L – T – P**	**3 – 0 – 0**
Stream	**Network**	**Credits**	**3**

Course Objectives:

1. To learn the basics of socket programming using TCP Sockets.
2. To learn about Socket Options.
3. To learn to develop Macros for including Objects In MIB Structure.
4. To understand SNMPv1, v2 and v3 protocols & practical issues.

Course Outcomes:

After learning the course the students should be able:

1. To analyze the requirements of a networked programming environment and identify the issues to be solved;
2. To create conceptual solutions to those issues and implement a programming solution;
3. To understand the key protocols that support the Internet;
4. To apply several common programming interfaces to network communication;
5. To understand the use of TCP/UDP Sockets
6. To apply advanced programming techniques such as Broadcasting, Multicasting.

Course Content:

UNIT I

Socket And Application Devlopment: Introduction to Socket Programming - System Calls - Address conversion functions - POSIX Signal Handling - Server with multiple clients - Boundary conditions - Server process Crashes, Server host Crashes, Server Crashes and reboots, Server Shutdown - I/O Multiplexing - I/O Models -TCP echo client/server with I/O Multiplexing

UNIT II

Socket Optian: Socket options - getsockopt and setsockopt functions - Generic socket options - IP socket options -ICMP socket options - TCP socket options - Multiplexing TCP and UDP sockets - SCTP Sockets -SCTP Client/server - Streaming Example - Domain name system - gethostbyname, gethostbyaddr, getservbyname and getservbyport functions - Protocol Independent functions in TCP Client/Server Scenario

UNIT III

Advanced Socket: IPv4 and IPv6 interoperability - Threaded servers - Thread creation and termination - TCP echo server using threads - Mutex - Condition variables - Raw sockets - Raw socket creation - Raw socket output - Raw socket input - ping program - traceroute program

UNIT IV

Simple Network Management: SNMP network management concepts - SNMPv1 - Management information - MIB Structure – Object syntax - Standard MIB’s - MIB-II Groups - SNMPv1 protocol and Practical issues.

UNIT V

SNMP V2, V3 and RMO: Introduction to SNMPv2 - SMI for SNMPV2 - Protocol - SNMPv3 - Architecture and applications -Security and access control model - Overview of RMON.

UNIT VI

Protocols, Sessions, State, and Implementing Custom Protocols State vs. Stateless, Methods for Maintaining State, What Is a Protocol? Designing a Custom Protocol, Our Chat Protocol, Protocol Registration

Elementary Name, Address Conversions and design decisions Domain Name System, gethostbyname Function, RES_USE_INET6 Resolver Option, gethostbyname2 Function and IPv6 Support, gethostbyaddr Function, uname Function, gethostname Function, getservbyname and getservbyport Functions

Text Books

1. W. Richard Stevens, ***"UNIX Network Programming Vol-I"***, Addison-Wesley Professional, 3rd Edition, 2003.

2. William Stallings, ***"SNMP, SNMPv2, SNMPv3 and RMON 1 and 2"***, Pearson Edition, 3rd Edition, 2009.

Reference Books:

1. D.E. Comer, ***"Internetworking with TCP/IP Vol- III: Client-Server Programming and Application BSD Sockets Version"***, Pearson Edition, 2nd Edition, 2003.

Course Title:	**Advanced Database Technology**	**Semester VI**	
Course Code	**BTITSE605E**	**Course Type**	**Elective**
Pre-requisite	**Database Management Systems**	**L – T – P**	**3 – 0 – 0**
Stream	**Data Science**	**Credits**	**3**

Course Objectives:

1. To learn the various types of databases and their advanced applications.
2. To understand how and where databases are used in industry.
3. To examine the requirements on special databases.
4. To learn complex queries and interface them with applications.

Course Outcomes:

After learning the course the students should be able:

1. To explain how databases are used in various fields of industry.
2. To apply query evaluation techniques and query optimization techniques.
3. To develop transaction processing systems with concurrency control.
4. To design and develop a database application system as part of a team.
5. To explore open issues in advanced databases.

Course Content:

UNIT I

PARALLEL AND DISTRIBUTED DATABASES: Database System Architectures: Centralized and Client-Server Architectures – Server System, Architectures – Parallel Systems- Distributed Systems – Parallel Databases: I/O Parallelism – Inter and Intra Query Parallelism – Inter and Intra operation Parallelism – Distributed Database Concepts - Distributed Data Storage – Distributed Transactions – Commit Protocols – Concurrency Control – Distributed Query Processing – Three Tier Client Server Architecture- Case Studies.

UNIT II

OBJECT AND OBJECT RELATIONAL DATABASES: Concepts for Object Databases: Object Identity – Object structure – Type Constructors – Encapsulation of Operations – Methods – Persistence – Type and Class Hierarchies – Inheritance – Complex Objects – Object Database Standards, Languages and Design: ODMG Model – ODL – OQL – Object Relational and Extended – Relational Systems: Object Relational features in SQL /Oracle – Case Studies.

UNIT III

XML DATABASES: XML Databases: XML Data Model – DTD - XML Schema - XML Querying – Web Databases – JDBC– Information Retrieval – Data Warehousing – Data Mining.

UNIT IV

MOBILE DATABASES: Mobile Databases: Location and Handoff Management - Effect of Mobility on Data Management - Location Dependent Data Distribution - Mobile Transaction Models - Concurrency Control - Transaction Commit Protocols- Mobile Database Recovery Schemes.

UNIT V

INTELLIGENT DATABASES: Active databases – Deductive Databases – Knowledge bases – Multimedia Databases-Multidimensional Data Structures – Image Databases – Text/Document Databases- Video Databases – Audio Databases – Multimedia Database Design.

UNIT VI

COMPLEX QUERIES AND REASONING: Logic of Query Languages – Relational Calculi – Recursive rules – Syntax and semantics of Datalog – Fix-point semantics – Implementation Rules and Recursion – Rule rewriting methods – Compilation and Optimization – Recursive Queries in SQL – Open issues.

Text Books

1. Carlo Zaniolo, Stefano Ceri, ***"Advanced Database Systems"***, Morgan Kauffmann Publishers.
2. Subramaniam, ***"Multimedia Databases"***, Morgan Kauffman Publishers, 2008.
3. Rajesh Narang, ***"Object Oriented Interfaces and Databases"***, Prentice-Hall of India, Pvt. Ltd., 2004.
4. Thomas Cannolly and Carolyn Begg, ***"Database Systems, A Practical Approach to Design, Implementation and Management"***, Pearson Education, 3rd Edition, 2007.
5. Jeffrey A. Hoffer, Mary B. Prescottand Fred R. McFadden, ***"Modern Database Management"***, Prentice Hall, 2007.

Reference Books:

1. Henry F Korth, Abraham Silberschatz and S. Sudharshan, ***"Database System Concepts"***, McGraw Hill, 6th Edition, 2011.
2. C. J. Date, A. Kannan and S. Swamynathan, ***"An Introduction to Database Systems"***, Pearson Education, 8th Edition,2006.
3. R. Elmasri, S. B. Navathe, ***"Fundamentals of Database Systems"***, Pearson Education/Addison Wesley, 5th Edition, 2007.
4. Ramakrishnan, Gehrke, ***"Database Management System"***, Tata McGraw Hill Publications, 4th Edition.
5. Ramez Elmasri, Sham Navathe, ***"Fundamentals of Database Systems"***, Addison-Wesley, 2000.

Course Title:	**Operating Systems Lab**	**Semester VI**	
Course Code	**BTITL607**	**Course Type**	**Mandatory**
Pre-requisite	**Nil**	**L – T – P**	**0 – 0 – 2**
Stream	**Core**	**Credits**	**1**

Lab Experiments Objective:

1. To learn shell programming and the use of filters in the UNIX environment.
2. To learn to programming in C using system calls.
3. To learn to use the file system related system calls.
4. To process creation and inter process communication.
5. To familiarize with implementation of CPU Scheduling Algorithms, page replacement algorithms and Deadlock avoidance.

Lab Experiments List:

1. Basics of UNIX commands.
2. Shell Programming.
3. Implement the following CPU scheduling algorithms:
   Round Robin
   SJF
   FCFS
   Priority
4. Implement all file allocation strategies:
   Sequential
   Indexed
   Linked
5. Implement Semaphores.
6. Implement all File Organization Techniques:
   Single level directory
   Two level
   Hierarchical
   DAG
7. Implement Bankers Algorithm for Dead Lock Avoidance.
8. Implement an Algorithm for Dead Lock Detection.
9. Implement e all page replacement algorithms:
   FIFO
   LRU
   LFU
10. Implement Shared memory and IPC.
11. Implement Paging Technique of memory management.
12. Implement Threading & Synchronization Applications.

Course Title:	**Object Oriented Software and Web Engineering Lab**	**Semester VI**	
Course Code	**BTITL608**	**Course Type**	**Mandatory**
Pre-requisite	**Programming in Java**	**L – T – P**	**0 – 0 – 2**
Stream	**Core**	**Credits**	**1**

Lab Experiments Objective:

1. To learn the concept of Object Oriented Software Development Process.
2. To get acquainted with UML Diagrams.
3. To understand Object Oriented Analysis Processes.

Lab Experiments List:

1. Program to implement classes and objects.
2. Program to implement constructors and destructors with array of objects.
3. Program to demonstrate function overloading.
4. Program to implement different types of inheritances like multiple, Multilevel and hybrid.
5. I/O Program to demonstrate the use of abstract classes.
6. Program to demonstrate I/O streams and functions.
7. Program to perform all possible type conversions.
8. Program to demonstrate exception handling technique.
9. Program to implement networking concepts.
10. Program to implement RMI concepts.
11. Program to implement AWT concepts.
12. Program to implement swing concepts.
13. Program to design and implement applet.
14. Program to design and implement JDBC.
15. Program to design an event handling event for simulating a simple calculator.

Course Title:	**Software Testing Lab**	**Semester VI**	
Course Code	**BTITSEL609A**	**Course Type**	**Elective**
Pre-requisite	**Nil**	**L – T – P**	**0 – 0 – 2**
Stream	**Software Application & Development**	**Credits**	**1**

Lab Experiments Objective:

1. To implement different testing techniques to practical teat and understand their merits and demerits.

Lab Experiments List:

1. Design, develop, code and run the program in any suitable language to solve the commission problem. Analyze it from the perspective of data flow testing, derive at least 10 different test cases, execute these test cases and discuss the test results.
2. Design, develop, code and run the program in any suitable language to solve the NextDate problem. Analyze it from the perspective of decision table-based testing, derive at least 10 different test cases, execute these test cases and discuss the test results.
3. Design, develop, code and run the program in any suitable object-oriented language to solve the calendar problem. Analyze it from the perspective of OO testing, derive test cases to test the method that increment the date and the method that increments the month., execute these test cases and discuss the test results.
4. Design, develop, code and run the program in any suitable object-oriented language to solve the currency converter problem. Analyze it from the perspective of use case-based system testing, derive appropriate system test cases, execute these test cases and discuss the test results.
5. Design, develop, code and run the program in any suitable language to implement an absolute letter grading procedure, making suitable assumptions. Determine the basis paths and using them derive different test cases, execute these test cases and discuss the test results.
6. Design, develop, code and run the program in any suitable language to implement the binary search algorithm. Determine the basis paths and using them derive different test cases, execute these test cases and discuss the test results.

Course Title:	**Data Storage Technologies & Networks Lab**	**Semester VI**	
Course Code	**BTITSEL609B**	**Course Type**	**Elective**
Pre-requisite	**Computer Networks, Operating Systems**	**L – T – P**	**0 – 0 – 2**
Stream	**Infrastructure & Security Management**	**Credits**	**1**

Lab Experiments Objective:

1. Understand the functionalities of storage network administration.
2. Set up a NAS server to support file level data access via the NSF and the CIFS protocols.
3. Set up a SAN server to support the iSCSI protocol for block level data access.
4. Demonstrate ability to design and build a small-scale data center and a small-scale cloud computing environment.
5. Be hand-on with data and network management software.

Lab Experiments List:

1. Install a hard disk on a Linux machine covering all the below activities:
a. Connecting the disk to an HBA (Host Bus Adapter) and BIOS setup for the disk;
b. Partitioning the disk;
c. Creating file systems within disk partitions;
d. Mounting the files systems;
e. Setting up automatic mounting;
f. Labeling disk partitions;
g. Setting up swapping on swap partitions.
2. Use “smartmontools” to monitor the disk performance monitoring and testing:
a. Use “smartctl” to enable S.M.A.R.T. support and offline data collection on the disk;
b. Check the overall health of the disk;
c. Run a self-test on the disk;
d. Set up “smartd” to do tests automatically.
3. Use “hdparm”, “iostat”, and “iometer” tools to measure the performance of different storage devices, such as SATA drive, SCSI drive, and USB drives.
a. Plot graphs to compare read/write and sequential/random access rates among different storage devices.
4. Use Navisphere Manager Simulator to perform management on SAN disk array systems:
a. Configure storage pools and LUNs (Logical Unit Number) for storage groups;
b. Configure snapshots and clones;
c. Create SANCopy full and incremental sessions;
d. Create MirrorView synchronous and asynchronous images;
e. Expand a LUN to create metaLUNs;
f. Migrate a LUN to another LUN.
5. Use Openfiler for network storage configuration management:
a. Configure the Openfiler to support locally attached USB drives;
b. Set up a NAS server to support NSF and CIFS protocols;
c. Set up a SAN server to support an iSCSI protocol.
6. Configure Openfiler as a NAS Server:
a. Configure access control rules and NFS/CIFS shares for the NAS server;
b. Configure the Linux client machine to access the NFS shares on the NAS server;

c. Configure a Windows VM on the Linux client machine to access the CIFS shares on the NAS server;

d. Use Openfiler to set up a SAN server, to supports iSCSI protocol for the block level data access;

e. Configure access control rules for the SAN server and configure iSCSI targets on the server.

7. Use VMware to create virtual disks, Virtual Machine File Systems and provisioning.

a. Use thin and thick provisioning concepts.

Course Title:	**Service Oriented Architecture Lab**	**Semester VI**	
Course Code	**BTITSEL609C**	**Course Type**	**Elective**
Pre-requisite	**Programming in Java**	**L – T – P**	**0 – 0 – 2**
Stream	**Information Management & Quality Control**	**Credits**	**1**

Lab Experiments Objective:

1. To learn to create web services and web service clients.
2. To learn SOAP, UDDI and WSDL platforms.

Lab Experiments List:

1. Write a simple web application program in Java to create web services incorporating:
   a. Development of web service.
   b. Testing the web service.
   c. Developing the client.
   d. Deploying the application.
2. Write a factorial application program in Java to create web services.
3. Implement a Calculator program and calculate Simple and Compound Interest using .Net.
4. Develop an invoice order processing system.
5. Invoke EJB components as Web Service.

Course Title:	**Network Programming Lab**	**Semester VI**	
Course Code	**BTITSEL609D**	**Course Type**	**Elective**
Pre-requisite	**Programming in Java/C**	**L – T – P**	**0 – 0 – 2**
Stream	**Network**	**Credits**	**1**

Lab Experiments Objective:

1. To develop TCP Socket Programming, UDP applications and to implement File Transfer Protocols.
2. To utilize RMI and Routing Algorithms.

Lab Experiments List:

1. Write a socket Program for Echo/Ping/Talk commands.
2. Create a socket (TCP) between two computers and enable file transfer between them.
3. Create a socket (UDP) between two computers and enable file transfer between them.
4. Write a program to implement Remote Command Execution. (Two M/Cs may be used)
5. Write a code simulating ARP /RARP protocols.
6. Create a socket for HTTP for web page upload and download.
7. Write a program for TCP module implementation.(TCP services)
8. Write a program for File Transfer in client-server architecture using following methods.
   a. (a) RS232C (b) TCP/IP
9. Write a program to implement RMI (Remote Method Invocation)
10. Perform a case study about the different routing algorithms to select the network path with its optimum and economical during data transfer.
    a. Shortest path routing
    b. Flooding
    c. Distance vector
11. Implement client in C and server in Java and initiate communication between them.
12. Using OPNET
    a. Create a scenario with the following specifications.
       i. No of subnets – 2
       ii. No. of nodes – 40
       iii. Traffic
          1. FTP - 11 to 21
          2. FTP - 30 to 40
          3. UDP - 5 to 7
       iv. Routing Protocol – AODV
       v. 802.16, Show the throughput using different bandwidths i.e., 10 Mbps and 100 Mbps respectively.
    b. Create a scenario as described below.

       No of students – 2
       SN -1 Nodes – 15
       SN -2 Nodes - 10
       Generate FTP Traffic & HTTP traffic between Nodes 1 to 11 (FTP)
       14 to 7 (HTTP / Gen FTP)

- · Trace the packet within the Simulation time and display the Trace file.

Course Title:	**Advanced Database Technology Lab**	**Semester VI**	
Course Code	**BTITSEL609E**	**Course Type**	**Elective**
Pre-requisite	**SQL**	**L – T – P**	**0 – 0 – 2**
Stream	**Data Science**	**Credits**	**1**

Lab Experiments Objective:

1. To learn the various types of databases and their advanced applications.
2. To understand how and where databases are used in industry.
3. To examine the requirements on special databases.
4. To learn complex queries and interface them with applications.

Lab Experiments List:

1. A University wants to track persons associated with them. A person can be an Employee or Student. Employees are Faculty, Technicians and Project associates. Students are Full time students, Part time students and Teaching Assistants.

a. Design an Enhanced Entity Relationship (EER) Model for university database. Write OQL for the following

1. Insert details in each object.
2. Display the Employee details.
3. Display Student Details.
4. Modify person details.
5. Delete person details.

b. Extend the design by incorporating the following information.

Students are registering for courses which are handled by instructor researchers (graduate students). Faculties are advisors to graduate students. Instructor researchers' class is a category with super class of faculty and graduate students. Faculty is having sponsored research projects with a grant supporting instruction researchers. Grants are sanctioned by different agencies. Faculty belongs to different departments. Department is chaired by a faculty. Implement for the Insertion and Display of details in each class.

2. Consider the application for University Counseling for Engineering Colleges. The college, department and vacancy details are maintained in 3 sites. Students are allocated colleges in these 3 sites simultaneously. Implement this application using parallel database [State any assumptions you have made].
3. There are 5 processors working in a parallel environment and producing output. The output record contains college details and students mark information. Implement parallel join and parallel sort algorithms to get the marks from different colleges of the university and publish 10 ranks for each discipline.
4. Create triggers and assertions for Bank database handling deposits and loan and admission database handling seat allocation and vacancy position. Design the above relational database schema and implement the following triggers and assertions.

a. When a deposit is made by a customer, create a trigger for updating customers account and bank account

b. When a loan is issued to the customer, create a trigger for updating customer's loan account and bank account.

c. Create assertion for bank database so that the total loan amount does not exceed the total balance in the bank.

d. When an admission is made, create a trigger for updating the seat allocation details and vacancy position.

5. Construct a knowledge database for kinship domain (family relations) with facts. Extract the following relations using rules.

   Parent, Sibling, Brother, Sister, Child, Daughter, Son, Spouse, Wife, husband, Grandparent, Grandchild, Cousin, Aunt and Uncle.

6. Work with Weka tool classification and clustering algorithms using the given training data and test with the unknown sample. Also experiment with different scenarios and large data set

7. Design XML Schema for the given company database, Department (deptName, deptNo, deptManagerSSN, deptManagerStartDate, deptLocation), Employee (empName, empSSN, empSex, empSalary, empBirthDate, empDeptNo, empSupervisorSSN, empAddress, empWorksOn), Project (projName, projNo, projLocation, projDeptNo, projWorker)

a. Implement the following queries using XQuery and XPath

   i. Retrieve the department name, manager name, and manager salary for every department’

   ii. Retrieve the employee name, supervisor name and employee salary for each employee who works in the Research Department.

   iii. Retrieve the project name, controlling department name, number of employees and total hours worked per week on the project for each project.

   iv. Retrieve the project name, controlling department name, number of employees and total hours worked per week on the project for each project with more than one employee working on it.

b. Implement a storage structure for storing XML database and test with the above schema.

Teaching and Evaluation Scheme Final year B. Tech. (Information Technology)

Sr. No	Code	Course title	Weekly Teaching hours			Evaluation Scheme			Credit	Total Hours
			L	T	P	MSE	CA	ESE		
Semester VII										
1	BTIT701	Cloud Computing and Storage Management	2	-	-	20	20	60	2	2
2	BTITDE702	Open / Departmental Elective - Group 3	3	-	-	20	20	60	3	3
3	BTIT DE703	Open / Departmental Elective - Group 4	3	-	-	20	20	60	3	3
4	BTIT SE704	Stream Elective - Group 3	3	-	-	20	20	60	3	3
5	BTITL705	Cloud Computing and Storage Management Lab	-	-	2		25	25	1	2
6	BTITDEL706	Open / Departmental Elective - Group 3 Lab	-	-	2	-	25	25	1	2
7	BTITSEL707	Stream Elective - Group 3 Lab	-	-	2	-	25	25	1	2
8	BTITP708	Project Phase I	-	-	8	-	50	50	4	8
9	BTIT709	Industrial Training Assessment	-	-	-	-	-	50	2	-
Summary of Semester Assessment Marks, Credit & Hours			**11**	**-**	**14**	**80**	**205**	**415**	**20**	**25**
Semester VIII										
1	BTIT DE801	Open/Departmental Elective - Group 5	3	-	-	20	20	60	3	3
2	BTITSE802	Stream Elective - Group4	3	-	-	20	20	60	3	3
3	BTIT SE803	Stream Elective - Group 5	3	-	-	20	20	60	3	3
4	BTITSE804	Stream Elective - Group 6	3	-	-	20	20	60	3	3
5	BTITDEL805	Open/Departmental Elective - Group 5 Lab	-	-	2		25	25	1	2
7	BTITSEL806	Stream Elective - Group 4 Lab	-	-	2	-	25	25	1	2
8	BTITSEL807	Stream Elective - Group 6 Lab	-	-	2	-	25	25	1	2
9	BTITP808	Project Phase II	-	-	12		50	50	5	12
Summary of Semester Assessment Marks, Credit & Hours			**12**	**-**	**18**	**80**	**205**	**365**	**20**	**30**

List of Open/Departmental Electives – Group 3

Sr. No.	Course Code	Title of the Course	Prerequisite
1	BTITDE702A	Pattern Recognition	Nil
2	BTITDE702B	Soft Computing	Nil

List of Open/Departmental Electives – Group 4

Sr. No.	Course Code	Title of the Course	Prerequisite
1	BTITDE703A	Natural Language Processing	Nil
2	BTITDE703B	Artificial Intelligence	Nil

List of Stream Electives – Group 3

Sr. No.	Course Code	Title of the Course	Prerequisite
1	BTITSE704A	Real Time Systems	Operating Systems, Design and Analysis of Algorithms
2	BTITSE704B	Information Security	Internetworking Protocols
3	BTITSE704C	Management Information Systems	Decision Support Systems
4	BTITSE704D	Distributed Computing	Operating Systems
5	BTITSE704E	Data Warehousing and Data Mining	Database Management Systems

List of Open/Departmental Electives – Group 5

Sr. No.	Course Code	Title of the Course	Prerequisite
1	BTITDE801A	Internet of Things	Microprocessor & Microcontrollers
2	BTITDE801B	E-commerce Systems	Nil

List of Stream Electives – Group 4

Sr. No.	Course Code	Title of the Course	Prerequisite
1	BTITSE802A	Mobile Computing	Internetworking Protocols, Operating Systems
2	BTITSE802B	Cryptography	Computer Architecture and Organization
3	BTITSE802C	Information Retrieval	Design and Analysis of Algorithms
4	BTITSE802D	Network Security	Internetworking Protocols, Network Programming
5	BTITSE802E	Big Data Analytics	Database Management Systems

List of Stream Electives – Group 5

Sr. No.	Course Code	Title of the Course	Prerequisite
1	BTITSE803A	User Experience Design	Software Engineering
2	BTITSE803B	Infrastructure Auditing & Implementation	IT Service Management
3	BTITSE803C	Cyber Law and IPR	Nil
4	BTITSE803D	Optical Networks	Internetworking Protocols
5	BTITSE803E	Web & Text Mining	Data Mining

List of Stream Electives – Group 6

Sr. No.	Course Code	Title of the Course	Prerequisite
1	BTITSE804A	Multimedia Applications	Nil
2	BTITSE804B	Ethical Hacking	Operating Systems
3	BTITSE804C	CRM & SCM	Enterprise Resource Planning
4	BTITSE804D	Wireless Networking	Internetworking Protocols
5	BTITSE804E	Machine Learning	Engineering Mathematics

Course Title:	**Cloud Computing and Storage Management**	**Semester VII**	
Course Code	**BTIT701**	**Course Type**	**Compulsory**
Pre-requisite	**Nil**	**L – T – P**	**2 – 0 – 0**
Stream	**Core**	**Credits**	**2**

Course Objectives:

1. To learn the concept of cloud computing.
2. To understand the trade-off between deploying applications in the cloud over local infrastructure.
3. To identify different storage virtualization technologies and their benefits.
4. To understand and articulate business continuity solutions including backup and recovery technologies, local and remote replication solutions.

Course Outcomes:

After learning the course the student will be able:

1. To understand the key dimensions of the challenge of Cloud Computing.
2. To assess the economics, financial and technological implications for selecting cloud computing for organization.
3. To describe and apply storage technologies.
4. To identify leading storage technologies that provide cost-effective IT solutions for medium to large scale businesses and data centers.
5. To describe important storage technology features such as availability, replication, scalability and performance.

Course Content:

UNIT I

Introduction: Distributed Computing and Enabling Technologies, Cloud Fundamentals: Cloud Definition, Evolution, Architecture, Applications, Deployment models and service models.

UNIT II

Virtualization: Issues with virtualization, Virtualization technologies and architectures, Internals of virtual machine monitors/hypervisors, Virtualization of data centers and Issues with Multi-tenancy.

UNIT III

Implementation: Study of Cloud computing Systems like Amazon EC2 and S3, Google App Engine and Microsoft Azure, Build Private/Hybrid Cloud using open source tools, Deployment of Web Services from inside and outside a Cloud Architecture, MapReduce and its extensions to Cloud Computing, HDFS and GFS.

UNIT IV

Storage virtualization: Fixed Content and Archives, Types, Features, Benefits, CAS Architecture, Object storage and retrieval, Examples: Storage Virtualization-forms of virtualization, SNIA Taxonomy – Storage virtualization configurations, Challenges, Types of storage virtualization - Business

Continuity- Overview of emerging technologies such as Cloud storage, Virtual provisioning, Unified Storage, FCOE, FAST.

UNIT V

Business Continuity and Recovery: Information Availability, BC Terminology, Life cycle, Failure analysis: Backup and Recovery- Backup purpose, considerations, Backup Granularity, Recovery considerations- Backup methods, Process, backup and restore operations, Overview of emerging technologies: Duplication, Off site backup.

UNIT VI

Storage security and Management: Storage security framework, Securing the Storage infrastructure, Risk triad: Managing the storage infrastructure, Monitoring the storage infrastructure, identify key parameters and components to monitor in a storage infrastructure, List key management activities and examples, Define storage management standards and initiative-Industry trend.

Text Books:

1. Rajkumar Buyya, James Broberg, Andrzej Goscinski, ***"Cloud Computing Principles and Paradigms"***, Wiley Publishers, 2011.
2. Barrie Sosinsky, ***"Cloud Computing Bible"***, Wiley Publishers 2010.
3. Tim Mather, Subra Kumaraswamy, Shahed Latif, ***"Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance"***, O'Reilly 2010.
4. EMC Corporation, ***"Information Storage and Management"***, 1st Edition, Wiley India 2009..

Reference Books:

1. Rajkumar Buyya, Christian Vacchiola, S Thamarai Selvi, ***"Mastering Cloud Computing"***, McGraw Hill, 2013
2. Michael Miller, ***"Cloud Computing : Web-based Applications that change the way you work and collaborate online"***, Pearson Education, 2008
3. IBM, ***"Introduction to Storage Area Networks and System Networking"***, 5th Edition, November 2012.
4. Robert Spalding, ***"Storage Networks: The Complete Reference"***, Tata McGraw Hill, Osborne, 6th reprint 2003.
5. Marc Farley, ***"Building Storage Networks"***, Tata McGraw Hill, Osborne, 1st Edition, 2001.

Course Title:	**Pattern Recognition**	**Semester VII**	
Course Code	**BTITDE702A**	**Course Type**	**Elective**
Pre-requisite	**Nil**	**L – T – P**	**3 – 0 – 0**
Stream	**Departmental**	**Credits**	**3**

Course Objectives:

1. To study pattern recognition topics and be exposed to recent developments in pattern recognition research.
2. To provide in-depth design concepts and implementation techniques of pattern recognitions.

Course Outcomes:

1. Identify and explain detailed aspects of internal structures of pattern recognitions.
2. Compare and contrast design issues for statistical pattern recognition.
3. Develop implementation skills for building pattern recognition.

Course Content:

UNIT I

Introduction: Machine Perception, Definition of Pattern Recognition (PR), Pattern Recognition system: Sensing, Segmentation & grouping, Feature extraction, Classification and Post processing, Design cycle: Data collection, Feature choice, Model choice, Training, Evaluation and computational complexity. Learning and adaptation: Supervised learning, Unsupervised learning and Reinforcement learning. Examples of PR Applications, Pattern Recognition Extensions. Machine learning : Components of learning, Learning models, Geometric models, Probabilistic models, Logic models, Grouping and grading, Learning versus design, Theory of learning, Feasibility of learning, Error and noise, Training versus testing, Theory of generalization, Generalization bound, Approximation-generalization tradeoff, Bias and variance, Learning curve.

UNIT II

Statistical Pattern Recognition (StatPR): Introduction to StatPR, Baye's theorem, Multiple features, Conditionally independent features, Decision boundaries, Unequal costs of error, Estimation of error rates, Characteristic curves, Estimating the composition of populations, Introduction to supervised parametric approaches and unsupervised approaches. Cluster analysis: Clustering techniques, Cluster analysis, Cluster validity. Feature selection & extraction: Feature selection criteria, Feature set search algorithm, Feature selection.

UNIT III

Tree Classifiers: (a) Decision Trees: CART, C4.5, ID3, (b) Random Forests, Linear Discriminants, Discriminative Classifiers: the Decision Boundary, (a) Separability, (b) Perceptrons, (c) Support Vector Machines.

UNIT IV

Parametric Techniques: Generative methods grounded in Bayesian Decision Theory (a) Maximum Likelihood Estimation (b) Bayesian Parameter Estimation (c) Sufficient Statistics. Non-Parametric Techniques :(a) Kernel Density Estimators (b) Parzen Window (c) Nearest Neighbor Methods.

UNIT V

Syntactic (Structural) Pattern Recognition (Syntpr): Introduction to SyntPR, Syntactic PR: primitive selection & pattern grammars, Higher dimensional grammars, Syntactic recognition, Automata, Error – correcting parsing, Shape & texture analysis, Image database management. Structural analysis using constraint satisfaction and structural matching, The Formal Language-based approach to SyntPR, Learning/Training in the Language-based Approach (Grammatical Inference). Problem solving methods for PR: Problem solving models, Problem solving algorithms.

UNIT VI

Unsupervised Methods : Exploring the Data for Latent Structure :(a) Component Analysis and Dimension Reduction: i. The Curse of Dimensionality, ii. Principal Component Analysis, iii. Fisher Linear Discriminant, iv. Locally Linear Embedding, (b) Clustering: i. K-Means, ii. Expectation Maximization, iii. Mean Shift. Classifier Ensembles : (a) Bagging, (b) Boosting / AdaBoost, Algorithm Independent, Topics Theoretical Treatments in the Context of Learned Tools: (a) No Free Lunch Theorem, (b) Ugly Duckling Theorem, (c) Bias-Variance Dilemma, (d) Jacknife and Bootstrap Methods.

Text Books:

1. Duda, R.O., Hart, P.E., Stork, D.G. ***"Pattern Classification",*** Wiley, 2nd Edition, 2001.
2. Eart Gose, Richard Johnsonburg and Steve Joust, ***"Pattern Recognition and Image Analysis"***, Prentice-Hall of India-2003.

Reference Books:

1. Bishop, C. M. ***"Pattern Recognition and Machine Learning"*** Springer, 2nd Edition, 2007.
2. Marsland, S., ***"Machine Learning: An Algorithmic Perspective"***, CRC Press. 2009.
3. Theodoridis, S. and Koutroumbas, K., ***"Pattern Recognition"***, 4th Edition, Academic Press, 2008.
4. Russell, S. and Norvig, N., ***"Artificial Intelligence: A Modern Approach",*** Prentice Hall, Series in Artificial Intelligence, 2003.

Course Title:	**Soft Computing**	**Semester VII**	
Course Code	**BTITDE702B**	**Course Type**	**Elective**
Prerequisite	**Nil**	**L – T – P**	**3 – 0 – 0**
Stream	**Departmental**	**Credits**	**3**

Course Objectives:

1. To introduce a relatively new computing paradigm for creating intelligent machines useful for solving complex real world problems.
2. To gain insight into the tools that make up the soft computing technique: fuzzy logic, artificial neural networks and hybrid systems
3. To create awareness of the application areas of soft computing technique
4. To learn alternative solutions to the conventional problem solving techniques in image/signal processing, pattern recognition/classification, control system

Course Outcomes:

After learning the course the student will be able:

1. To use a new tool /tools to solve a wide variety of real world problems
2. To find an alternate solution, more adaptable, resilient and optimum
3. To apply knowledge of soft computing domain to real world problems

Course Content:

UNIT I

Artificial Neural Network: Biological neuron, Artificial neuron model, Concept of bias and threshold, McCulloch Pits Neuron Model, Implementation of logical AND, OR, XOR functions. Soft Topologies of neural networks, Learning paradigms: Supervised, Unsupervised, Reinforcement, Linear neuron model: Concept of error energy, Gradient descent algorithm and application of linear neuron for linear regression, Activation functions: Binary, Bipolar (linear, signup, log sigmoid, tan sigmoid) Learning mechanisms: Hebbian, Delta Rule of Perceptron and its limitations.

UNIT II

Artificial Neural Network: Multilayer perceptron (MLP) and back propagation algorithm, Application of MLP for classification and regression of self organizing Feature Maps, Clustering of Learning vector quantization. Radial Basis Function networks: Cover's theorem,Mapping functions (Gaussian, Multi-quadrics, Inverse multiquadrics, Application of RBFN for classification and regression of Hopfield network, Associative memories.

UNIT III

Fuzzy Logic: Concept of Fuzzy number, Fuzzy set theory (continuous, discrete) of operations on fuzzy sets, Fuzzy membership functions (core, boundary, support), Primary and composite linguistic terms, Concept of fuzzy relation, Composition operation (T-norm, T-conorm) of Fuzzy if-then rules.

UNIT IV

Fuzzy Logic: Fuzzification, Membership value assignment techniques, De-fuzzification (Maxmembership principle, Centroid method, Weighted average method), Concept of fuzzy inference, Implication rules: Dienes-Rescher Implication, Mamdani Implication, Zadeh Implication, Fuzzy Inference systems: Mamdani fuzzy model, Sugeno fuzzy model, Tsukamoto fuzzy model, Implementation of a simple two-input single output FIS employing Mamdani model Computing.

UNIT V

Fuzzy Control Systems: Control system design, Control (Decision) Surface, Assumptions in a Fuzzy Control System Design, Fuzzy Logic Controllers, Comparison with traditional PID control, Advantages of FLC, Architecture of a FLC: Mamdani Type, Example Aircraft landing control problem.

UNIT VI

Adaptive Neuro-Fuzzy Inference Systems (ANFIS): ANFIS architecture, Hybrid Learning Algorithm, Advantages and Limitations of ANFIS Application of ANFIS/CANFIS for regression.

Text Books:

1. Laurene Fausett, ***"Fundamentals of Neural Networks: Architectures, Algorithms And Applications"***, Pearson Education, 2008.
2. Timothy Ross, "***Fuzzy Logic With Engineering Applications"***, 3rd Edition, John Wiley & Sons, 2010.
3. J.S. Jang, C.T. Sun, E. Mizutani, ***"Neuro- Fuzzy and Soft Computing"***, PHI Learning Private Limited.
4. S. N. Sivanandam, S. N. Deepa, ***"Principles of Soft Computing"***, John Wiley & Sons, 2007.

Reference Books:

1. John Hertz, Anders Krogh, Richard Palmer, ***"Introduction to the theory of neural computation"***, Addison –Wesley Publishing Company, 1991.
2. Simon Haykin, ***"Neural Networks A comprehensive foundation"***, Prentice Hall International Inc-1999.
3. José C. Principe Neil R. Euliano , W. Curt Lefebvre, ***"Neural and Adaptive Systems: Fundamentals through Simulations"***, John-Wiley & Sons, 2000.
4. Peter E. Hart, David G. Stork Richard O. Duda, ***"Pattern Classification"***, 2nd Edition, 2000.
5. Sergios Theodoridis , Konstantinos Koutroumbas, ***"Pattern Recognition"***, 4th Edition, Academic Press, 2008.
6. Hung T. Nguyen, Elbert A. Walker, ***"A First Course in Fuzzy Logic"***, 3rd Edition, Taylor & Francis Group, LLC, 2008.
7. S. N. Sivanandam , S. Sumathi, S. N. Deepa, ***"Introduction to Fuzzy Logic using MATLAB"***, Springer Verlag, 2007.

Course Title:	**Natural Language Processing**	**Semester VII**	
Course Code	**BTITDE703A**	**Course Type**	**Elective**
Pre-requisite	**Nil**	**L – T – P**	**3 – 0 – 0**
Stream	**Open/Departmental**	**Credits**	**3**

Course Objectives:

1. To learn the leading trends and systems in natural language processing.
2. To understand the concepts of morphology, syntax, semantics and pragmatics of the language.
3. To recognize the significance of pragmatics for natural language understanding.
4. To describe simple system based on logic and demonstrate the difference between the semantic presentation and interpretation of that presentation.
5. To describe application based on natural language processing and to show the points of syntactic, semantic and pragmatic processing.

Course Outcomes:

After learning the course the student will be able:

1. To understand the models, methods and algorithms of statistical Natural Language Processing.
2. To implement probabilistic models in code, estimate parameters for such models and run meaningful experiments to validate such models.
3. To apply core computer science concepts and algorithms, such as dynamic programming.
4. To understand linguistic phenomena and explore the linguistic features relevant to each NLP task.
5. To identify opportunities and conduct research in NLP.
6. To analyze experimental results and write reports.

Course Content:

UNIT I

Introduction to NLP: Definition, Issues and strategies, Application domain, Tools for NLP, Linguistic organization of NLP, NLP vs. PLP.

UNIT II

Word Classes: Review of Regular Expressions, CFG and different parsing techniques. Morphology: Inflectional, derivational, Parsing and parsing with FST, Combinational Rules.

UNIT III

Phonology: Speech sounds, Phonetic transcription,Phoneme and phonological rules, Optimality theory, Machine learning of phonological rules, Phonological aspects of prosody and speech synthesis. Pronunciation, Spelling and N-grams: Spelling errors, Detection and elimination using probabilistic models, Pronunciation variation (lexical, allophonic, dialect), Decision tree model, Counting words in Corpora, Simple N-grams, smoothing (Add One, Written-Bell, Good-Turing), N-grams for spelling and pronunciation.

UNIT IV

Syntax: POS Tagging: Tagsets, Concept of HMM tagger, Rule based and stochastic POST, Algorithm for HMM tagging, Transformation based tagging. Sentence level construction & unification: Noun phrase, Co-ordination, Sub-categorization, Concept of feature structure and unification.

UNIT V

Semantics: Representing Meaning: Unambiguous representation, Canonical form, Expressiveness, Meaning structure of language, Basics of FOPC. Semantic Analysis: Syntax driven, Attachment & integration, Robustness. Lexical Semantics: Lexemes (homonymy, polysemy, synonymy, hyponymy), WordNet, Internal structure of words, Metaphor and metonymy and their computational approaches. Word Sense Disambiguation: Selectional restriction based, Machine learning based and dictionary based approaches.

UNIT VI

Pragmatics: Discourse: Reference resolution and phenomena, Syntactic and semantic constraints on coreference, Pronoun resolution algorithm, Text coherence, Discourse structure. Dialogues: Turns and utterances, Grounding, Dialogue acts and structures. Natural Language Generation: Introduction to language generation, Architecture, Discourse planning (text schemata, rhetorical relations).

Text Books:

1. D. Jurafsky & J. H. Martin, ***"Speech and Language Processing – An introduction to Language processing, Computational Linguistics, and Speech Recognition"***, Pearson Education.
2. Allen, James, ***"Natural Language Understanding"***, 2nd Edition, Benjamin/Cummings, 1996.

Reference Books:

1. Bharathi, A., Vineet Chaitanya and Rajeev Sangal, ***"Natural Language Processing-A Pananian Perspective",*** Prentice Hall India, 1995.
2. Eugene Cherniak, ***"Statistical Language Learning"***, MIT Press, 1993.
3. Manning, Christopher and Heinrich Schütze, ***"Foundations of Statistical Natural Language Processing",*** MIT Press, 1999.

Course Title:	**Artificial Intelligence**	**Semester VII**	
Course Code	**BTITDE703B**	**Course Type**	**Elective**
Pre-requisite	**Nil**	**L – T – P**	**3 – 0 – 0**
Stream	**Departmental**	**Credits**	**3**

Course Objectives:

1. To acquaint the students with the theoretical and computational techniques in Artificial Intelligence.
2. To use various symbolic knowledge representation to specify domains and reasoning tasks of a situated software agent.
3. To use different logical systems for inference over formal domain representations and trace how a particular inference algorithm works on a given problem specification.
4. To understand the conceptual and computational trade-offs between the expressiveness of different formal representations.

Course Outcomes:

After learning the course the students should be able:

1. To find appropriate idealizations for converting real world problems into AI search problems formulated using the appropriate search algorithm.
2. To analyze, formalize and write algorithmic methods for search problem.
3. To explain important search concepts, the definitions of admissible and consistent heuristics and completeness and optimality.
4. To implement and execute by hand alpha-beta search.
5. To design good evaluation functions and strategies for game playing.
6. To carry out proofs in first order and propositional logic using techniques such as resolution, unification, backward and forward chaining.
7. To choose and implement learning algorithms such as decision trees, support vector machines, and boosting.

Course Content:

UNIT I

Introduction: Overview of Artificial intelligence- Problems of AI, AI techniques, Tic - Tac - Toe problem. Intelligent Agents: Agents & environment, Nature of environment, Structure of agents, Goal based agents, Utility based agents, Learning agents.

UNIT II

Problem Solving: Problems, Problem Space & search: Defining the problem as state space search, Production system, Problem characteristics and issues in the design of search programs. Search techniques: Solving problems by searching: problem solving agents, Searching for solutions; uniform search strategies: Breadth first search, Depth first search, Depth limited search, Bidirectional search, Comparing uniform search strategies.

UNIT III

Heuristic search strategies: Greedy best-first search, A* search, Memory bounded heuristic search: local search algorithms & optimization problems: Hill climbing search, Simulated annealing search, Local beam search, Genetic algorithms; Constraint satisfaction problems, Local search for constraint satisfaction problems. Adversarial search: Games, optimal decisions & strategies in games, The minimax search procedure, Alpha-beta pruning, Additional refinements, Iterative deepening.

UNIT IV

Knowledge & reasoning: Knowledge representation issues, Representation & mapping, Approaches to knowledge representation, Issues in knowledge representation. Using predicate logic: Representing simple fact in logic, Representing instant & ISA relationship, Computable functions & predicates, Resolution, Natural deduction. Representing knowledge using rules: Procedural verses declarative knowledge, Logic programming, Forward verses backward reasoning, Matching, Control knowledge.

UNIT V

Probabilistic reasoning: Representing knowledge in an uncertain domain, The semantics of Bayesian networks, Dempster-Shafer theory, Fuzzy sets & fuzzy logics, Planning: Overview, Components of a planning system, Goal stack planning, Hierarchical planning and other planning techniques.

UNIT VI

Natural Language processing: Introduction, Syntactic processing, Semantic analysis, Discourse & pragmatic processing. Learning: Forms of learning, Inductive learning, Learning decision trees, explanation based learning, Learning using relevance information, Neural net learning & genetic learning. Expert Systems: Representing and using domain knowledge, Expert system shells and knowledge acquisition.

Text Books:

1. Rich, E. and Knight K., ***"Artificial Intelligence"***, Tata McGraw- Hill.
2. Russell, S. and Norvig P., ***"Artificial Intelligence: A Modern Approach"***, Pearson Education.
3. Patterson, Dan W. , ***"Introduction to Artificial Intelligence & Expert Systems"***, PHI, 2005.

Reference Book:

1. Nilsson, N. J., Morgan Kaufmann, ***"Artificial Intelligence: A New Synthesis"***,Tata McGraw-Hill.

Course Title:	**Real Time Systems**	**Semester VII**	
Course Code	**BTITSE704A**	**Course Type**	**Elective**
Pre-requisite	**Operating Systems, Design and Analysis of Algorithms**	**L – T – P**	**3 – 0 – 0**
Stream	**Software Application and Development**	**Credits**	**3**

Course Objectives:

1. To introduce students to the fundamental problems, concepts and approaches in the design and analysis of real-time systems.
2. To study issues related to the design and analysis of systems with real-time constraints.
3. To learn real-time scheduling and schedulability analysis.
4. To understand formal specification and verification of timing constraints and properties.
5. To design methods for real-time systems.
6. To learn new techniques of state-of-the-art real-time systems research.

Course Outcomes:

After learning the course the student will be able:

1. To characterize real-time systems and describe their functions.
2. To analyze, design and implement a real-time system.
3. To apply formal methods to the analysis and design of real-time systems.
4. To apply formal methods for scheduling real-time systems.
5. To characterize and debug a real-time system.

Course Content:

UNIT I

Introduction: Hard vs. Soft real time systems, A reference model of real time system. Real-time scheduling: Clock driven approach, Weighted Round-robin approach, Priority driven approach, Dynamic vs. static system, Effective Release Times and Deadlines, EDF and LST algorithm, Optimality and Non-Optimality of the EDF and LST algorithms, Off line vs. online Scheduling.

UNIT II

Clock-Driven Scheduling: Static, Time-Driven scheduler, General structure of Cyclic Schedules, Cyclic Executives, Improving the Average Response Time of a-periodic Jobs, Scheduling Sporadic Jobs.

UNIT III

Priority Driven Scheduling of Periodic Tasks: Fixed priority vs. Dynamic priority algorithms, Maximum Schedulable Utilization, Optimality of the RM and DM algorithms, A Schedulability test for fixed-priority tasks with short response times, Sufficient Schedulability conditions for the RM and DM algorithms.

UNIT IV

Scheduling Aperiodic and Sporadic Jobs in Priority-Driven Systems: Assumptions and Approaches, Deferrable Servers, Sporadic Servers, Constant Utilization, Total Bandwidth and Weighted Fair-Queuing Servers.

UNIT V

Resources and Resource Access control: Resource contention, Resource access control, Nonpreemptive critical section, Basic Priority-Inheritance protocol, Basic Priority Ceiling Protocol, Stack based, Priority-ceiling protocol, preemption ceiling protocol.

UNIT VI

Multiprocessor scheduling, Resource Access Control, and Synchronization: Model of multiprocessor & distributed systems, task assignment, multiprocessor Priority-ceiling protocol, Elements of Scheduling Algorithms for End-to-End Periodic Tasks- IPS protocols, PM protocols, MPM protocol.

Text Books:

1. Jane W. S. Liu, ***"Real-Time System"***, Pearson Education.
2. C. M. Krishna and K. G. Shin, ***"Real-Time Systems"***, McGraw Hill.

Reference Books:

1. Laplante, ***"Real Time System Design and Analysis: An Engineer Handbook"***, PHI.
2. Dr. K. V. K. Prasad, ***"Embedded Real Time System Concept Design and Programming"***, Wiley India.

Course Title:	**Information Security**	**Semester VII**	
Course Code	**BTITSE704B**	**Course Type**	**Elective**
Pre-requisite	**Internetworking Protocols**	**L – T – P**	**3 – 0 – 0**
Stream	**Infrastructure and Security Management**	**Credits**	**3**

Course Objectives:

1. To understand information security's importance in the increasingly computer-driven world.
2. To master the key concepts of information security and its working.
3. To develop a security mindset.
4. To learn to critically analyze situations of computer and network security usage.
5. To identify the salient issues, viewpoints and trade-offs of information security.

Course Outcomes:

After learning the course the student will be able:

1. To explain the challenges and scope of information security.
2. To explain security concepts as confidentiality, integrity and availability.
3. To explain the importance of cryptographic algorithms used in information security .
4. To identify and explain symmetric algorithms for encryption-based security of information.
5. To describe the access control mechanism used for user authentication and authorization.
6. To describe Secure Sockets Layer (SSL), Internet Protocol (IP) communications by using Internet Protocol Security (IPSec).
7. To explain the use of security tools as firewalls and intrusion prevention systems.
8. To explain malicious software issues introduced by software-based viruses and worms.
9. To describe the process of risk assessment in the context of IT security management.

Course Content:

UNIT I

Introduction to Information Systems: Security concepts, Computer security concepts, Threats, Attacks and Assets, Security functional requirements, A security architecture for Open Systems, Computer security trends, Computer security strategy.

UNIT II

Cryptographic Tools: Confidentiality with Symmetric Encryption, Message Authentication and Hash Functions, Public-Key Encryption, Digital Signatures and Key Management, Practical Application: Encryption of Stored Data.

UNIT III

Models, Frameworks, Standards & Legal Framework: A structure and framework of compressive security policy, policy infrastructure, policy design life cycle and design processes, PDCA model, Security policy standards and practices - ISO 27001, SSE-CMM, IA-CMM, ITIL & BS 15000, BS7799, Understanding Laws for Information Security: Legislative Solutions, Contractual Solutions, Evidential Issues, International Activity, Indian IT Act, Laws of IPR, Indian Copyright Act.

UNIT IV

Controls: Access control principles, Subjects, Objects and access rights, Discretionary access control, Role-based access control, Case study.

UNIT V

Virus and Malware: Introduction & types of Malicious Software (Malware), Propagation–Infected Content–Viruses, Propagation–Vulnerability Exploit–Worms, Propagation–Social Engineering–SPAM E-mail, Trojans, Payload–System Corruption, Payload–Attack, Agent–Zombie, Bots, Payload–Information Theft–Keyloggers, Phishing, Spyware, Payload–Stealthing–Backdoors, Rootkits, Countermeasures.

UNIT VI

Security issues: Database security challenge in the modern world, Federated Databases, securing Mobile databases, Network Security, Trusted and untrusted networks, Network attacks, Network security dimensions, Network attack – the stages; using firewalls effectively; Privacy – Privacy invasion due to direct marketing, Outsourcing using data masking ; privacy issues in smart card applications, Ethical Hacking ;Role of Cryptography in information security, digital signatures.

Text Books:

1. Nina Gobole, ***"Information Systems Security: Security Management, Metrics, Frameworks And Best Practices"***, Wiley, 2008.
2. Mark Rhodes –Ousley, ***"Information Security: The Complete Reference"***, McGraw-Hill Education, 2nd Edition, 2013.
3. Dhiren R Patel, ***"Information Security Theory and Practices"***, PHI Learning, 2008.
4. Mark Stamp, ***"Information Security: Principles and Practice"***, 2nd Edition, , Wiley, 2011.

Reference Books:

1. Gary R. McGraw, ***"Software Security: Building Security In"*** Addison Wesley, 2006.
2. Ankit Fadia, ***"Network Security: A Hacker's Perspective"***, 2006.

Course Title:	**Management Information Systems**	**Semester VII**	
Course Code	**BTITSE704C**	**Course Type**	**Elective**
Pre-requisite	**Decision Support Systems**	**L – T – P**	**3 – 0 – 0**
Stream	**Information Management & Quality Control**	**Credits**	**3**

Course Objectives:

1. To create interest and awareness about the proliferation of the Information Systems in today's organizations.
2. To understand categories of MIS: Operations Support System, Management Support System and Office automation system, Functional management system.
3. To learn Information Systems for strategic management and strategic role of information systems.
4. To plan for information systems: Identification of Applications, Business Application Planning, Systems and Critical Success Factors, Method of Identifying Applications.
5. To understand System Development Process and Approaches, System Implementation, System maintenance, Introduction to MIS Risks, System Evaluation, IT Procurement Options. Change management in IT Projects.

Course Outcomes:

After learning the course the student will be able:

1. To understand the usage and constituents of MIS in organizations.
2. To understand the classifications, understanding and the different functionalities of these MIS.
3. To explain the functions and issues at each stage of system development.
4. To identify emerging trends in MIS technologies.
5. To identify and assess MIS in real-life organization.

Course Content:

UNIT I

Management & organizational support systems for digital firm: Definition of MIS; Systems Approach to MIS: Report writing s/w, MIS and Human factor considerations, concept of organizational information sub-system, MIS & problem solving.

UNIT II

Information systems & business strategy: Information Management, Who are the users? Manager & Systems, Evolution of Computer based information system (CBIS), Model of CBIS. Information services organization: Trend to End-User computing, Justifying the CBIS, Achieving the CBIS, Managing the CBIS, Benefits & Challenges of CBIS implementation. Strategic Information System, Business level and Firm level Strategy.

UNIT III

Information systems in the enterprise: Systems from Management and functional perspective and their relationship: Executive Information System, Decision support system sales and Marketing Information System, Manufacturing Information System, Human-Resource Information System. Finance and Account Information System.

UNIT IV

Information technology for competitive advantage: Firm in its environment, What are the information resources? Who manages the information resources? Strategic planning for information resources. End-User Computing as a strategic issue, Information resource management concept.

UNIT V

E-commerce and international information system: Introduction to E-Commerce, Business Intelligence. E-Commerce strategy, Electronic Data Interchange, E-commerce methodology, E-commerce technology, Business application of the Internet. Electronic Business success strategies.

UNIT VI

Managing International Information Systems: IIS architecture, Global business Drivers, Challenges, Strategy: divide, conquer and appease, Cooptation, Business organization, Problems in implementing global information systems, Computer crime, ethics and social issues.

Text Book:

1. Kelkar, S.A., ***"Management Information Systems"***, Prentice Hall of India, 2003.

Reference Books:

1. Mark G. Simkin, ***"Introduction to computer Information System for Business"***, 1996.
2. James A. Senn, ***"Analysis & Design of Information Systems"***, McGraw-Hill.

Course Title:	**Distributed Computing**	**Semester VII**	
Course Code	**BTITSE704D**	**Course Type**	**Elective**
Pre-requisite	**Operating Systems**	**L – T – P**	**3 – 0 – 0**
Stream	**Networking**	**Credits**	**3**

Course Objectives:

1. To understand the major tools and techniques that allow programmers to effectively program the parts of the code that require substantial communication and synchronization.
2. To study the core ideas behind modern coordination and communication paradigms and distributed data structures
3. To introduce a variety of methodologies and approaches for reasoning about concurrent and distributed programs.
4. To realize basic principles and best practice engineering techniques of concurrent and distributed computing.
5. To study the safety and progress properties of concurrent and distributed algorithms.
6. To understand the performance of current multi-core and future many-core systems.

Course Outcomes:

After learning the course the student will be able:

1. To identify the core concepts of distributed systems.
2. To learn orchestration of multiple machines to correctly solve problems in an efficient, reliable and scalable way.
3. To examine concepts of distributed systems in designing large systems.
4. To apply distributed computing concepts to develop sample systems.

Course Content:

UNIT I

Introduction: Historical background, Key characteristics, Design goals and challenges, Review of networking and internetworking, Internet protocols.

UNIT II

Processes and Inter process Communication: Processes and threads, Virtualization, Code migration, The API for the Internet protocols, External data representation, Client-server communication, Multicast communication, Message oriented communication, Network virtualization, Overlay networks, RPC and MPI.

UNIT III

Naming: Name services and Domain Name System, Directory services, Case study: X.500 directory service.

UNIT IV

Time, Global States and Synchronization: Physical and logical clocks, Global states, Mutual exclusion, Election algorithms, Consistency and Replication: Consistency models, Replica management, Consistency protocols, Case studies of highly available services: the gossip architecture and Coda.

UNIT V

Fault Tolerance and Security: Distributed Commit, Recovery, Security Issues, Cryptography. Distributed File Systems: File service architecture, Case study: Sun Network File System, The Andrew File System.

UNIT VI

Peer to peer Systems: Introduction, Napster, Peer-to-peer middleware, Routing overlays, Case studies: Pastry, Tapestry. Distributed Object Based Systems: Distributed objects, Java beans, CORBA.

Text Books:

1. Tanenbaum A.S, ***"Distributed Systems: Principles and Paradigms"***, 2nd Edition, Pearson Education, 2006.
2. Coulouris G., Dollimore J., Kindberg T. and Blair G., ***"Distributed Systems: Concepts and Design"***, 5th Edition, Addison Wesley, 2011.
3. Mahajan S., Shah S., ***"Distributed Computing"***, 1st Edition, Oxford University Press, 2010.

Reference Books:

1. Hwang K., Dongarra J., Geoffrey C. Fox, ***"Distributed and Cloud Computing: From Parallel Processing to the Internet of Things"***, Morgan Kaufmann, 2011.
2. Comer D.E. and Droms, R.E., ***"Computer Networks and Internets"***, 4th Edition, Prentice-Hall, 2004.

Course Title:	**Data Warehousing and Data Mining**	**Semester VII**	
Course Code	**BTITSE704E**	**Course Type**	**Elective**
Pre-requisite	**Database Management Systems**	**L – T – P**	**3 – 0 – 0**
Stream	**Data Science**	**Credits**	**3**

Course Objectives:

1. Introduce the concepts, techniques, design and applications of data warehousing and data mining.
2. Enable students to understand and implement classical algorithms in data mining and data warehousing.
3. Enable students to learn how to analyze the data, identify the problems and choose the relevant algorithms to apply.

Course Outcomes:

After learning the course the student will be able:

1. Understand the functionality of the various data mining and data warehousing components.
2. Appreciate the strengths and limitations of various data mining and data warehousing models.
3. Compare the various approaches to data warehousing and data mining implementations.
4. Describe and utilize a range of techniques for designing data warehousing and data mining systems for real-world applications.

Course Content:

UNIT I

Introduction to data warehousing, Evolution of decision support systems, Modeling a data warehouse, granularity in the data warehouse, Data warehouse life cycle, building a data warehouse, Data Warehousing Components, Data Warehousing Architecture.

UNIT II

On Line Analytical Processing, Categorization of OLAP Tools, Introduction to Data mining and knowledge discovery, Relation to Statistics, Databases, Data Mining Functionalities, Steps In Data Mining Process, Architecture of a Typical Data Mining Systems, Classification of Data Mining Systems.

UNIT III

Overview of Data Mining Techniques, Data Preprocessing, Data Cleaning, Data Integration, Data Transformation and Data Reduction, Data Generalization and Summarization Based Characterization, Mining Association Rules In Large Databases.

UNIT IV

Classification and Prediction, Issues Regarding Classification and Prediction, Classification By Decision Tree Induction, Bayesian Classification, Other Classification Methods.

UNIT V

Prediction, Clusters Analysis, Types of Data In Cluster Analysis, Categorization of Major Clustering Methods, Partitioning methods, Hierarchical Methods.

UNIT VI

Applications of Data Mining, Social Impacts of Data Mining, Case Studies, Mining WWW, Mining Text Database, Mining Spatial Databases.

Text Books:

1. Adriaans, ***" Data mining"***, Addison- Wesley, 1996.
2. Margaret Dunham, ***"Data Mining: Introductory and Advanced Topics"***, Published by Prentice Hall.
3. Weiss, Sholom M.,***"Predictive data mining : a practical guide",*** Kaufmann Publishers, 1998.

Reference Books:

1. Pang-Ning Tan, Michael Steinback, Vipin Kumar, ***"Introduction to Data Mining"***, Pearson Education, 2008.
2. M.Humphires, M.Hawkins, ***"Data Warehousing: Architecture and Implementation"***, Pearson Education, 2009.
3. Anahory, Murray, ***"Data Warehousing in the Real World"***, Pearson Education, 2008.
4. Kargupta, Joshi, etc., ***"Data Mining: Next Generation Challenges and Future Directions"***, Prentice Hall of India Pvt. Ltd, 2007.

Course Title:	**Cloud Computing and Storage Management Lab**	**Semester VII**	
Course Code	**BTITL705**	**Course Type**	**Compulsory**
Pre-requisite	**Internetworking Protocols**	**L – T – P**	**0 – 0 – 2**
Stream	**Core**	**Credit**	**1**

Lab Experiments Objectives:

Learner will be able to...

1. Appreciate cloud architecture.
2. Create and run virtual machines on open source OS.
3. Implement Infrastructure, storage as a Service.
4. Install and appreciate security features for cloud.

Lab Experiments List:

1. Study of Cloud Computing & Architecture.
2. Study and implementation of Infrastructure as a Service.
3. Implementation of Private cloud using Eucalyptus or Open stake.
   - Working with KVM to create VM.
   - Installation and configuration of Private cloud.
   - Bundling and uploading images on a cloud.
   - Creating web based UI to launch VM.
   - Working with Volumes – Attached to the VM.

Course Title:	**Pattern Recognition Lab**	**Semester VII**	
Course Code	**BTITDEL706A**	**Course Type**	**Elective**
Pre-requisite	**NIL**	**L – T – P**	**0 – 0 – 2**
Stream	**Departmental**	**Credit**	**1**

Lab Experiments Objectives:

1. To study pattern recognition topics and be exposed to recent developments in pattern recognitions research.
2. To provide in-depth design concepts and implementation techniques of pattern recognitions.

Lab Experiments List:

1. Feature Representation.
2. Mean and Covariance.
3. Linear Perceptron Learning.
4. Generation of Random Variables.
5. Bayesian Classification.
6. MLE: Learning the classifier from data.
7. Data Clustering: K-Means, MST-based.

Course Title:	**Soft Computing – Lab**	**Semester VII**	
Course Code	**BTITDEL706B**	**Course Type**	**Elective**
Pre-requisite	**Programming in Java/C/C++**	**L – T – P**	**0 – 0 – 2**
Stream	**Departmental**	**Credit**	**1**

Lab Experiments Objectives:

1. To utilize Soft computing algorithms to solve engineering problems.
2. To compare results and provide a analysis of algorithms efficiency.
3. To apply soft computing thought process for solving issues.

Lab Experiments List:

1. Implement simple logic network using MP neuron model.
2. Implement a simple linear regression with a single neuron model.
3. Implement and test MLP trained with back-propagation algorithm.
4. Implement and test RBF network.
5. Implement SOFM for character recognition.
6. Implement fuzzy membership functions (triangular, trapezoidal, gbell, PI, Gamma, Gaussian)
7. Implement defuzzyfication (Max-membership principle, Centroid method, Weighted average method).
8. Implement FIS with Mamdani Inferencing mechanism.
9. A small project: may include classification or regression problem, using any soft computing technique studied earlier.

Course Title:	**Real Time Systems Lab**	**Semester VII**	
Course Code	**BTITSEL707A**	**Course Type**	**Elective**
Pre-requisite	**Programming in Java/C/C++**	**L – T – P**	**0 – 0 – 2**
Stream	**Software Application and Development**	**Credit**	**1**

Lab Experiments Objectives:

1. To design and write programs to demonstrate various real time system concepts of scheduling processes.
2. To demonstrate how real time principles can be applied to business problems by simulating business processes.

Lab Experiments List:

1. Execute a program to demonstrate real time scheduling EDF vs. LST to show a comparative result.
2. Demonstrate clock driven scheduler system.
3. Develop a random generator to set priority and demonstrate a priority driven scheduler system.
4. Simulate a manufacturing process to demonstrate resource and resource control scheduling system in real time.
5. Simulate a logistics service provider scheduling of product delivery system using the principles of real-time system learned in the course.

Course Title:	**Information Security – Lab**	**Semester VII**	
Course Code	**BTITSEL707B**	**Course Type**	**Elective**
Pre-requisite	**Programming in Java/C/C++**	**L – T – P**	**0 – 0 – 2**
Stream	**Infrastructure and Security Management**	**Credit**	**1**

Lab Experiments Objectives:

1. To be familiar with the algorithms of data mining,
2. To be acquainted with the tools and techniques used for Knowledge Discovery in Databases.
3. To be exposed to web mining and text mining.

Lab Experiments List:

1. Implement the following SUBSTITUTION & TRANSPOSITION TECHNIQUES concepts:
    a. Caesar Cipher
    b. Playfair Cipher
    c. Hill Cipher
    d. Vigenere Cipher
    e. Rail fence – row & Column Transformation.
2. Implement the following algorithms
    a. DES
    b. RSA Algorithm
    c. Diffiee-Hellman
    d. MD5
    e. SHA-1
3. Implement the SIGNATURE SCHEME - Digital Signature Standard.
4. Demonstrate how to provide secure data storage, secure data transmission and for creating digital signatures (GnuPG).
5. Setup a honey pot and monitor the honeypot on network (KF Sensor).
6. Installation of rootkits and study about the variety of options.
7. Perform wireless audit on an access point or a router and decrypt WEP and WPA.(Net Stumbler).
8. Demonstrate intrusion detection system (ids) using any tool (snort or any other s/w).

Course Title:	**Management Information Systems - Lab**	**Semester VII**	
Course Code	**BTITSEL707C**	**Course Type**	**Elective**
Pre-requisite	**Programming in Java/Python**	**L – T – P**	**0 – 0 – 2**
Stream	**Information Management & Quality Control**	**Credit**	**1**

Lab Experiments Objectives:

1. To prepare organizational data for MIS reports and dashboards.
2. To learn what data should be used to prepare MIS reports.
3. To write programs to produce MIS reports.
4. To depict data in a MIS report to support decision making.

Lab Experiments List:

1. Prepare a MIS report for HR system to depict the various grades of employee in an organization by years of service.
2. Prepare a EIS report of Sales of an organization.
3. Prepare a graphical EIS dashboard of the Sales over a period of 1 year.
4. Prepare a manufacturing MIS report of all orders fulfilled, in progress and pending for management.
5. Prepare a monthly MIS profit and loss dashboard from financial data.
6. Prepare an EIS for reporting population demographic.

Course Title:	**Distributed Computing-Lab**	**Semester VII**	
Course Code	**BTITSEL707D**	**Course Type**	**Elective**
Pre-requisite	**Programming in Java/C/C++**	**L – T – P**	**0 – 0 – 2**
Stream	**Networking**	**Credit**	**1**

Lab Experiments Objective:

1. To implement distributed systems paradigms practically to understand impact on resources and processes.

Lab Experiments List:

1. Load Balancing Algorithm.
2. Scalability in Distributed Environment.
3. Client/server using RPC/RMI.
4. Inter-process communication.
5. Election Algorithm.
6. Distributed Deadlock.
7. Name Resolution protocol.
8. Clock Synchronization algorithms.
9. Mutual Exclusion Algorithm.
10. Group Communication.
11. CORBA architecture.
12. Parallel Algorithms.
13. Message Passing Interface.

Course Title:	**Data Warehousing and Data Mining-Lab**	**Semester VII**	
Course Code	**BTITSEL707E**	**Course Type**	**Elective**
Pre-requisite	**SQL**	**L – T – P**	**0 – 0 – 2**
Stream	**Data Science**	**Credit**	**1**

Lab Experiments Objectives:

1. To be familiar with the algorithms of data mining.
2. To be acquainted with the tools and techniques used for Knowledge Discovery in Databases.
3. To be exposed to web mining and text mining.

Lab Experiments List:

1. Creation of a Data Warehouse.
2. Apriori Algorithm.
3. FP-Growth Algorithm.
4. K-means clustering.
5. One Hierarchical clustering algorithm.
6. Bayesian Classification.
7. Decision Tree.
8. Support Vector Machines.
9. Applications of classification for web mining.
10. Case Study on Text Mining or any commercial application.

Course Title:	**Project Phase – I**	**Semester VII**	
Course Code	**BTITP708**	**Course Type**	**Compulsory**
Pre-requisite	**Nil**	**L – T – P**	**0–0 – 8**
Stream	**Core**	**Credits**	**4**

The project should enable the students to combine the theoretical and practical concepts studied in his/her academics. The project work should enable the students to exhibit their ability to work in a team, develop planning and execute skills and perform analyzing and trouble shooting of their respective problem chosen for the project. The students should be able to write technical report, understand the importance of teamwork and group task. The students will get knowledge about literature survey, problem definition, its solution, and method of calculation, trouble shooting, costing, application and scope for future development.

Project work

The project work is an implementation of learned technology. The knowledge gained by studying various subjects separately supposed to utilize as a single task. A group of 03/04 students will have to work on assigned work. The topic could be a product design, specific equipment, live industrial problem etc. The project work involves experimental/theoretical/computational work. It is expected to do necessary literature survey by referring current journals belonging to Information Technology reference books and internet. After finalization of project, requisites like equipments, data, tools etc. should be arranged.

Project Activity

The project groups should interact with guide, who in turn advises the group to carry various activities regarding project work on individual and group basis. The group should discuss the progress every week in the project hours and follow further advice of the guide to continue progress. Guide should closely monitor the work and help the students from time to time. The guide should also maintain a record of continuous assessment of project work progress on weekly basis.

Phase I

1. Submission of project/problem abstract containing problem in brief, requirements, broad area, applications, approximate expenditure if required etc.
2. Problem definition in detail.
3. Literature survey.
4. Requirement analysis.
5. System analysis (Draw DFD up to level 2, at least).
6. System design, Coding/Implementation (20 to 30%).

Course Title:	**Industrial Training Assessment**	**Semester VII**	
Course Code	**BTIT709**	**Course Type**	**Compulsory**
Pre-requisite	**Nil**	**L – T – P**	**0 – 0 – 0**
Stream	**Core**	**Credits**	**2**

The students receive theoretical knowledge of the basic engineering and applied engineering in first six semesters. They have to do in plant training of four weeks at least during vacation after sixth semester. The training enables the students to expose to industry during their training, provides orientation and improves their prospects for employment. The students should prefer industrial training in the domain of Information Technology.

Training report and Assessment

During the industrial training he/she will observe layout, working environment, various equipments, tools, instruments etc. under the supervision of supervisor and engineer of the company. Students are required to submit a printed report of industrial training in the seventh semester. The report should contain information about the major field of company, particularly about the section/department where he/she have undergone the training giving the details of equipments, product, tools their detailed specification, use etc. The training report and field work done by students will be assessed by internal examiner(s) and appropriate grade will be awarded.

Course Title:	**Internet of Things**	**Semester**	**VIII**
Course Code	**BTITDE801A**	**Course Type**	**Elective**
Pre-requisite	**Microprocessor & Micro-controllers**	**L – T – P**	**3 – 0 – 0**
Stream	**Departmental**	**Credits**	**3**

Course Objectives:

1. To understand the vision of IoT.
2. To understand IoT market perspective.
3. To study the data and knowledge management and use of devices in IoT technology.
4. To understand state of the art – IoT Architecture.
5. To study the real world IoT design constraints, industrial automation and commercial building automation in IoT.

Course Outcomes:

After learning the course the students should be able:

1. To interpret the vision of IoT from a global context.
2. To determine the market perspective of IoT.
3. To compare and contrast the use of devices, gateways and data management in IoT.
4. To implement state of the art architecture in IoT.
5. To illustrate the application of IoT in industrial automation and identify real world design constraints.

Course Content:

UNIT I

M2M to IoT-The Vision-Introduction, From M2M to IoT, M2M towards IoT-the global context, A use case example, Differing characteristics.

UNIT II

M2M to IoT: A Market Perspective– Introduction, Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies, M2M to IoT. An architectural overview: Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, Standards considerations.

UNIT III

M2M and IoT Technology Fundamentals - Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service (XaaS), M2M and IoT Analytics, Knowledge Management.

UNIT IV

IoT Architecture: State of the Art, Introduction, State of the art, Architecture Reference Model - Introduction, Reference model and architecture, IoT reference model.

UNIT V

IoT Reference Architecture: Introduction, Functional view, Information view, Deployment and operational View, Other relevant architectural views. Real-World Design Constraints - Introduction, Technical design constraints-hardware is popular again, Data representation and visualization, Interaction and remote control.

UNIT VI

Industrial Automation: Service-oriented architecture-based device integration, SOCRADES: realizing the enterprise integrated Web of Things, IMC-AESOP: from the Web of Things to the Cloud of Things, Commercial Building Automation: Introduction, Case study: phase one-commercial building automation today, Case study: phase two- commercial building automation in the future.

Text Book:

1. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle,***"From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence"***, Academic Press, 1st Edition, 2014.

Reference Books:

1. Vijay Madisetti, Arshdeep Bahga, ***"Internet of Things (A Hands-on-Approach)"***, VPT, 1st Edition, 2014.
2. Francis da Costa, ***"Rethinking the Internet of Things: A Scalable Approach to Connecting Everything"***, 1st Edition, Apress Publications, 2013.

Course Title:	**E-commerce Systems**	**Semester**	**VIII**
Course Code	**BTITDE801B**	**Course Type**	**Elective**
Pre-requisite	**Nil**	**L – T – P**	**3 – 0 – 0**
Stream	**Departmental**	**Credits**	**3**

Course Objectives:

1. To learn the importance of E-commerce and its impact on business.
2. To understand the various E-commerce business models and its uses.
3. To learn the various E-commerce technologies and IT requirements for a successful E-commerce business.
4. To discover factors required for good E-commerce systems.

Course Outcomes:

After learning the course the students should be able:

1. To explain E-commerce systems construct limitations and benefits.
2. To design E-commerce applications.
3. To discuss security and IT requirements to deploy E-commerce systems.
4. To explain the critical success factors of good E-commerce applications.

Course Content:

UNIT I

Introduction to E-commerce: Meaning, Nature and scope; channels of E-commerce, Business applications of E-commerce, Traditional commerce vs. E-commerce and Business model of E-commerce: B2B, B2C, C2C, B2G and other models of E-commerce.

UNIT II

Mobile commerce: Introduction to M-Commerce, History and key benefits & limitations, Critical success factors, Wireless Application Protocol (WAP), Mobile banking. Electronic payment system: Type of payment systems: E-cash and currency servers, E-cheques, Credit card, Smart card, Electronic purses and debit cards, Operational, Credit and legal risks of e-payments, Risk management options for e-payment system, Order fulfillment for E-commerce.

UNIT III

E-commerce strategy: Overview, Strategic methods for developing E- commerce.

UNIT IV

The Four C’s of E-commerce: (Convergence, Collaborative Computing, Content Management & Call Center). Convergence: Technological Advances in Convergence: Types, Convergence and its implications, Convergence and Electronic Commerce, Collaborative Computing: Collaborative product development, contract as per CAD, Simultaneous Collaboration, Security. Content Management: Definition of content, Authoring Tools and Content Management, Content: partnership, repositories, convergence, providers, Web Traffic and Traffic Management; Content Marketing. Call Center: Definition, Need, Tasks Handled, Mode of Operation, Equipment, Strength & Weaknesses of Call Center, Customer Premises Equipment (CPE).

UNIT V

E-commerce Technologies: Relationship Between E-Commerce and Networking, Different Types of Networking for E-Commerce, Internet, Intranet and Extranet, EDI Systems.

UNIT VI

Security issues in e-commerce: Security risk of e-commerce, Type and sources of threats, Protecting the electronic commerce assets and intellectual property, Firewalls, Client server network security, Data and message security, Digital identification and electronic signature, Encryption approach to e-commerce security.

Text Books:

1. C.S.V. Murthy, ***"E-Commerce Concept-model-strategies"***, Himalaya Publication House.
2. Nidhi Dhawan, ***"E-Commerce Concepts and Applications"***, International book house Pvt. Ltd.
3. Kalkota and Whinston, ***"Frontiers of Electronic Commerce"***, Pearson publication.

Reference Books:

1. Elias M. Awad., ***"Electronic Commerce"***, PHI.
2. Joseph, ***"E-commerce"***, PHI, 2nd Edition.
3. Bhaskar Bharat, ***"Electronic Commerce - Technologies & Applications"***, TMH
4. Chris Bates, ***"Web Programming"***, Wiley publication, 3rd Edition, 2009.
5. B.V. Kumar, S.V. Subrahmanya, ***"Web Services: An Introduction"***, Tata McGraw Hill, 2008.

Course Title:	**Mobile Computing**	**Semester**	**VIII**
Course Code	**BTITSE802A**	**Course Type**	**Elective**
Pre-requisite	**Internetworking Protocols , Operating Systems**	**L – T – P**	**3 – 0 – 0**
Stream	**Software and Application Development**	**Credits**	**3**

Course Objectives:

1. To describe the basic concepts and principles in mobile computing.
2. To understand the concept of Wireless LANs, PAN, Mobile Networks, and Sensor Networks.
3. To explain the structure and components for Mobile IP and Mobility Management.
4. To understand positioning techniques and location-based services and applications.
5. To describe the important issues and concerns on security and privacy.
6. To design and implement mobile applications to realize location-aware computing.
7. To design algorithms for location estimations based on different positioning techniques and platforms.
8. To acquire the knowledge to administrate and to maintain a Wireless LAN.

Course Outcomes:

After learning the course the students should be able:

1. To describe wireless and mobile communications systems.
2. To choose an appropriate mobile system from a set of requirements.
3. To work around the weaknesses of mobile computing.
4. To interface a mobile computing system to hardware and networks.
5. To program applications on a mobile computing system and interact with servers and database systems.

Course Content:

UNIT I

Fundamental of Wireless and basics of wireless network: Digital communication, Wireless communication system and limitations, Wireless media, Frequency spectrum, Technologies in digital wireless communication, Wireless communication channel specification, Wireless network, Wireless switching technology, Wireless communication.

UNIT II

Mobile Communications and Computing: An Overview Mobile Communication, Mobile Computing, Mobile Computing Architecture, Mobile Devices, Mobile System Networks, Data Dissemination, Mobility Management, Security, Mobile Devices and Systems, Mobile Phones, Digital Music Players, Hand-held Pocket Computers, Hand-held Devices: Operating Systems, Smart Systems, Limitations of Mobile Devices, Automotive Systems.

UNIT III

GSM and other architectures: GSM-Services and System Architectures, Radio Interfaces, Protocols Localization, Calling, Handover, Security, New Data Services, modulation, Multiplexing, Controlling the medium access, Spread spectrum, Coding methods, CDMA, IMT 2000, WCDMA and CDMA 2000, 4G Networks.

UNIT IV

Mobile Network and Transport Layer: IP and Mobile IP Network Layers, Packet Delivery and Handover Management, Location Management, Registration, Tunneling and Encapsulation, Route optimization, Dynamic Host Configuration Protocol, Mobile Transport Layer, Conventional TCP/IP Transport Layer Protocol, Indirect TCP, Snooping TCP, Mobile TCP, Mobile Ad-hoc Networks (MANET), Routing and Routing Algorithms in MANET, Security in ad-hoc networks.

UNIT V

Data Dissemination and Data Synchronization in Mobile Computing: Communication Asymmetry, classification of data delivery mechanism, data dissemination broadcast models, selective tuning and indexing techniques, synchronization, synchronization software for mobile devices, synchronization protocols.

UNIT VI

Mobile Devices and Mobile Operating System: Mobile agent, Applications framework, Application server, Gateways, Service discovery, Device management, Mobile file system, Mobile Operating Systems, Characteristics, Basic functionality of Operating Systems: Window 8, iOS, Android OS.

Text Books:

1. Raj Kamal, "Mobile Computing", Oxford University Press-New Delhi, 2nd Edition.
2. Dr. Sunil kumar S. Manavi, Mahabaleshwar S. Kakkasageri, ***"Wireless and Mobile Networks, Concepts and Protocols"***, Wiley, India.

Reference Books:

1. Mark Ciampa, ***"Guide to Designing and Implementing wireless LANs"***, Thomson learning, Vikas Publishing House, 2001.
2. Ray Rischpater, ***"Wireless Web Development"***, Springer Publishing,
3. Sandeep Singhal, ***"The Wireless Application Protocol"***, Pearson Publication.
4. P.Stavronlakis, ***"Third Generation Mobile Telecommunication Systems"***, Springer Publishers.

Course Title:	**Cryptography**	**Semester**	**VIII**
Course Code	**BTITSE802B**	**Course Type**	**Elective**
Pre-requisite	**Computer Architecture & Organization**	**L – T – P**	**3 – 0 – 0**
Stream	**Infrastructure & Security Management**	**Credits**	**3**

Course Objectives:

1. To learn cryptography in information security implementation.
2. To know the methods of conventional encryption.
3. To understand the concepts of public key encryption and number theory.
4. To understand authentication and Hash functions.
5. To know the network security tools and applications.
6. To understand the system level security used.

Course Outcomes:

After learning the course the students should be able:

1. To compare and contrast a range of different cryptosystems.
2. To list and elaborate the differences between secret key and public key cryptosystems.
3. To identify the different approaches to quantifying secrecy.
4. To recognize the different modes of operation for block ciphers and their applications.
5. To explain the role of hash functions in Information Security.
6. To discuss the place of ethics in the Information Security Area.

Course Content:

UNIT I

Introduction: What is cryptology: (cryptography + cryptanalysis), Overview of cryptology: How cryptography works, how to break a cryptographic system, Classical conventional encryption, Modern conventional encryption, Public key encryption, Hashing algorithm, OSI security architecture, Cryptanalysis of classical cryptosystems, Shannon's theory.

UNIT II

Symmetric Cipher: Classical Encryption Techniques, Symmetric Cipher Model, Block Cipher principles, DES, Triple DES, Cryptanalysis of symmetric key ciphers: Differential and Linear Cryptanalysis, Block cipher design principle, The Euclidean algorithm, Finite field of form GP(p), Advance Encryption Standard (AES), AES cipher, Multiple encryption and triple DES, Stream Cipher and RC4, Placement of encryption function, Traffic confidentiality, Key distribution, Random number generation. System security: Intrusion detection, Password management, Virus countermeasure, Denial of service attack, Firewall design principles, Trusted System.

UNIT III

Public Key Cryptography: Key Management - The Discrete Logarithm Problem (DLP) and the Diffie Hellman Key Exchange algorithm, Cryptanalysis of DLP, Elliptic Curve Architecture and Cryptography : Confidentiality using Symmetric Encryption, Public Key Cryptography, RSA, Primality Testing, Factoring algorithms, Other attacks on RSA and semantic security of RSA ElGamal cryptosystems.

UNIT IV

Authentication and Hash Function: Authentication requirements, Authentication functions, Message Authentication codes, Hash functions, Security of hash functions, Hash functions: The Merkle Damgard Construction and MACs, MD5 message Digest algorithm - Secure Hash Algorithm, RIPEMD, HMAC, CMAC, Whirlpool and Comparative analysis. Digital Signatures, Authentication Protocols, Digital Signature Standard.

UNIT V

Network Security: Authentication Applications: Kerberos - X.509 Authentication Service, Electronic Mail Security - PGP - S/MIME - IP Security - Web security.

UNIT VI

System Level Security: Intrusion detection, Password management, Viruses and related Threats, Virus Counter measures, Firewall Design Principles, Trusted Systems. Cryptanalysis: Differential Cryptanalysis, Linear Cryptanalysis, Truncated differential cryptanalysis, etc. Assignments (not limited to this): including Cryptographic standards, application of cryptosystems, network security (IPSEC, VPN, Web Security), privilege management infrastructure (PMI) and Access Control, e-Commerce and Smart IC cards).

Text Book:

1. William Stallings, ***"Cryptography and Network Security - Principles and Practices"***, Prentice Hall of India, 3rd Edition, 2003.

Reference Books:

1. Atul Kahate, ***"Cryptography and Network Security"***, Tata McGraw-Hill, 2003.
2. Bruce Schneier, ***"Applied Cryptography"***, John Wiley & Sons Inc, 2001.
3. Charles B. Pfleeger, Shari Lawrence Pfleeger, ***"Security in Computing"***, Pearson Education, 3rd Edition, 2003.

Course Title:	**Information Retrieval**	**Semester**	**VIII**
Course Code	**BTITSE802C**	**Course Type**	**Elective**
Pre-requisite	**Design and Analysis of Algorithms**	**L – T – P**	**3 – 0 – 0**
Stream	**Information Management & Quality Control**	**Credits**	**3**

Course Objectives:

1. To learn the techniques used to retrieve useful information from repositories such as the Web.
2. To understand the concepts in information retrieval such as documents, queries, collections and relevance.
3. To learn approaches for efficient indexing for quick identification of candidate answer documents
4. To learn modern techniques for crawling data from the web.

Course Outcomes:

After learning the course the students should be able:

1. To apply information retrieval principles to locate relevant information in large collections of data.
2. To understand and deploy efficient techniques for the indexing of document objects that are to be retrieved.
3. To implement features of retrieval systems for web-based and other search tasks.
4. To analyze the performance of retrieval systems using test collections.
5. To make practical recommendations about deploying information retrieval systems in different search domains, including considerations for document management and querying.

Course Content

UNIT I

Introduction to the Course: Information retrieval problem, First take at building an inverted index, Processing of Boolean queries, Extended Boolean model vs. ranked retrieval. Term vocabulary and postings lists: document delineation and character sequence decoding, Determining vocabulary of terms, Faster postings list intersection via skip pointers, Positional postings and phrase queries.

UNIT II

Dictionaries, Tolerant Retrieval and Indexing: Search structures for dictionaries, Wildcard queries, Spelling correction, Phonetic correction; Index construction, Blocked sort-based indexing, Single-pass in-memory indexing, Distributed indexing, Dynamic indexing and other types; Index compression: Heaps' and Zipf's law, Dictionary compression and postings file compression.

UNIT III

Scoring and IR System Evaluation: Parametric and zone indexes, Term frequency and weighing, Vector space model for scoring, Variant tf-idf functions, Efficient scoring and ranking, Components of an IR system, Vector space scoring and query operator interaction, IR system evaluation, Standard test collections, Evaluation of unranked and ranked retrieval results, Assessing relevance, System quality and user utility; Relevance feedback and pseudo relevance feedback, Global methods for query reformulation.

UNIT IV

XML and Probabilistic Information Retrieval: Basic concepts of XML retrieval and challenges, vector space model for XML retrieval, Text-centric vs. data centric XML retrieval, Probability ranking principal, Binary independence model, Appraisal and some extensions, Language models for information retrieval, Query likelihood model, Language modeling vs. other approaches in IR.

UNIT V

Document Classification: Text classification problem, Naïve Bayes text classification, Bernoulli model, Feature selection, Evaluation of text classification; Vector space classification: Document representations and measure of relatedness in vector spaces, Rocchio classification, k nearest neighbor, Linear vs. Non-linear classifiers, Bias-variance tradeoff; Support vector machines, Extensions to SVM models, Issues in the classification of text documents, Machine learning methods in ad hoc information retrieval.

UNIT VI

Document Clustering and Matrix Decomposition: Flat clustering, Cardinality, Evaluation of clustering, K-means, Model based clustering, Hierarchical Agglomerative clustering, Singlelink and complete-link clustering, Group-average agglomerative clustering, Centroid clustering, Optimality of HAC, Divisive clustering, Cluster labeling; Matrix decompositions, Term document matrices and singular value decomposition, Low-rank approximations, Latent semantic indexing.

Web Search: Basics concepts, Web graph, Spam, Search user experience, Index size and estimation, Near-duplicates and shingling, Web crawling and indexes: Overview, Crawler architecture, DNS resolution, URL frontier, Distributing indexes and connectivity servers; Link analysis: Anchor text and web graph, Page Rank, Hubs and Authorities.

Text Books:

1. Manning, C. D., Raghavan, P., Schütze, H. ***"Introduction to Information Retrieval",*** Cambridge University Press, 2008.
2. Witten, I. H., Moffat, A., Bell, T. C. ***"Managing Gigabytes: Compressing and Indexing Documents and Images.",*** Morgan Kaufmann, 1999.
3. Grossman, D. A., ***"Information Retrieval: Algorithms and Heuristics"***, Springer, 2004.

Reference Books:

1. Baeza-Yates, R., Ribeiro-Neto, B. ***"Modern information Retrieval"***, ACM press, 1999
2. Belew, R. K. ***"Finding Out About: A Cognitive Perspective on Search Engine Technology and the WWW"***, Cambridge University Press, 2000.
3. Chakrabarti S. ***"Mining the Web: Discovering Knowledge from Hypertext Data"***, Morgan Kaufmann, 2003.
4. Manning, C. D. ***"Foundations of Statistical Natural Language Processing"***, H. Schütze (Ed.). MIT press, 1999.

Course Title:	**Network Security**	**Semester VIII**	
Course Code	**BTITSE802D**	**Course Type**	**Elective**
Pre-requisite	**Internetworking Protocols, Network Programming**	**L – T – P**	**3 – 0 – 0**
Stream	**Networks**	**Credits**	**3**

Course Objectives:

1. To understand the number theory used for network security.
2. To understand the design concept of cryptography and authentication.
3. To understand the design concepts of internet security.
4. To develop experiments on algorithm used for security.

Course Outcomes:

After learning the course the students should be able:

1. To describe network security awareness and a clear understanding of its importance.
2. To explain how threats to an organization are discovered, analyzed and dealt with.
3. To explain protocols for security services.
4. To describe network security threats and countermeasures
5. To explain network security designs using available secure solutions (such as PGP, SSL, IPSec, etc).
6. To demonstrate advanced security issues and technologies (such as DoS attack detection and containment, and anonymous communications).

Course Content

UNIT I

Model of network security, Security attacks, services and attacks, OSI security architecture, Classical encryption techniques, SDES, Block cipher Principles, DES, Strength of DES, Block cipher design principles, Block cipher mode of operation, Evaluation criteria for AES, RC4 - Differential and linear cryptanalysis, Placement of encryption function, traffic confidentiality.

UNIT II

Number Theory, Prime number, Modular arithmetic, Euclid’s algorithm, Fermat’s and Euler’s theorem, Primality, Chinese remainder theorem, Discrete logarithm, Public key cryptography and RSA Key distribution, Key management, Diffie Hellman key exchange, Elliptic curve cryptography.

UNIT III

Authentication requirement, Authentication function, MAC, Hash function, Security of hash function and MAC – SHA - HMAC – CMAC - Digital signature and authentication protocols – DSS.

UNIT IV

Security Services for E-mail-establishing keys-privacy-authentication of the source-Message Integrity-Non-repudiation-Pretty Good Privacy-S/MIME.

UNIT V

SSL/TLS Basic Protocol-computing the keys- client authentication-PKI as deployed by SSL-Attacks fixed in v3- Exportability-Encoding-Secure Electronic Transaction (SET).

UNIT VI

Firewall Design Principles- Packet Filters- Application level Gateways-Tunnels-DoS attacks-Intrusion Detection-Password Management-Malicious Software.

Text Book:

1. William Stallings, ***"Cryptography & Network Security"***, Pearson Education, 4th Edition, 2010.

Reference Books:

1. Charlie Kaufman, Radia Perlman, Mike Speciner, ***"Network Security, Private Communication in Public World"***, PHI, 2nd Edition, 2002.
2. Bruce Schneier, Neils Ferguson, ***"Practical Cryptography"***, Wiley Dreamtech India Pvt. Ltd, 1st Edition, 2003.
3. Douglas R Simson ***"Cryptography – Theory and Practice"***, CRC Press, 1st Edition, 1995.

Course Title:	**Big Data Analytics**	**Semester**	**VIII**
Course Code	**BTITSE802E**	**Course Type**	**Elective**
Pre-requisite	**Database Management Systems**	**L – T – P**	**3 – 0 – 0**
Stream	**Data Science**	**Credits**	**3**

Course Objectives:

1. To understand the concept of Big Data.
2. To learn Big Data file systems and their storage methods.
3. To learn to process Big Data information for analytics.
4. To discuss and understand Big Data implementations within large corporations like Google and Facebook.

Course Outcomes:

After learning the course the students should be able:

1. To model and implement efficient big data solutions for various application areas using appropriately selected algorithms and data structures.
2. 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.
3. To explain trade-offs in big data processing techniques.
4. To explain the Big Data Fundamentals including the evolution of Big Data, the characteristics of Big Data and the challenges introduced.
5. To apply non-relational databases techniques for storing and processing large volumes of structured and unstructured data, as well as streaming data.
6. To apply the novel architectures and platforms introduced for Big data in particular Hadoop and MapReduce.

Course Content

UNIT I

Introduction to Big Data: Introduction to Big Data, The four dimensions of Big Data: Volume, Velocity, Variety, Veracity, Drivers for Big Data, Introducing the Storage, Query Stack, Revisit useful technologies and concepts, Real-time Big Data Analytics.

UNIT II

Distributed File Systems: Hadoop Distributed File System, Google File System, Data Consistency.

UNIT III

Big Data Storage Models: Distributed Hash-table, Key-Value Storage Model (Amazon's Dynamo), Document Storage Model (Facebook's Cassandra), Graph storage models.

UNIT IV

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 NoSQL, Algorithms for detecting similar items, Recommendation systems, Data stream analysis algorithms, Clustering algorithms, Detecting frequent items.

UNIT V

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 Netfix Prize, Link Analysis with case studies of the PageRank algorithm and the Spam farm analysis, Crowd Sourcing.

UNIT VI

Big Data Issues: Privacy, Visualization, Compliance and Security, Structured vs. Unstructured Data.

Text Book:

1. Anand Rajaraman and Jeffrey Ullman, ***"Mining of Massive Datasets"***, Cambridge University Press, 2012.

Reference Books:

1. Christopher D. Manning, Prabhakar Raghavan, Hinrich Schütze, ***"An Introduction to Information Retrieval"***, Cambridge University Press, 2008.
2. Jimmy Lin and Chris Dyer, ***"Data-Intensive Text Processing with MapReduce"***, Morgan and ClayPool Publishers, 2010.

Course Title:	**User Experience Design**	**Semester**	**VIII**
Course Code	**BTITSE803A**	**Course Type**	**Elective**
Pre-requisite	**Software Engineering**	**L – T – P**	**3 – 0 – 0**
Stream	**Software and Application Development**	**Credits**	**3**

Course Objectives:

1. To understand user experience design principles
2. To understand the various elements and how the elements of user experience work together.
3. To understand strategy, structure, skeleton and scope as an element of user experience.
4. To identify business goals, user needs, content requirements.
5. To create a functional specification and an effective information design.
6. To learn to prioritize specs and requirements.
7. To architect information effectively and navigation.
8. To learn resources available to assist with User Experience Design Process.

Course Outcomes:

After learning the course the students should be able:

1. To design applications and web pages with effective and easy to use user experience.
2. To utilize tools and techniques for research and build user screens based on best practices.
3. To collect and document business, user and information specification.
4. To implement user screens and package information with ease of navigations.

Course Content:

UNIT I

UX Introduction: User Interaction with the products, Applications and services, Cognitive Model/Mental Model; Necessity of User Experience Design; Definition of User Experience (UX) Design.

UNIT II

Elements of UX Design: Core elements of User Experience, Working of elements, UX Design Process: Defining the UX Design Process and Methodology.

UNIT III

UX Design Process: Research and define: importance of research, Research methods and tools, Understanding the User needs and goals, Understanding the business goals, Deliverables of the research and define phase-Insight on User goals and business goals, Hands-on assignments and Quiz.

UNIT IV

UX Design Process: IDEATE/DESIGN - Visual design principles, Information design and data, Visualization: Interaction design, Information architecture, Wire-framing and story-boarding, UI elements and widgets, Screen design and layouts, Hands-on assignments and quiz.

UNIT V

UX Design Process: PROTOTYPE and TEST: Necessity of testing your design, Usability testing, Types of usability testing, Usability testing process, Plan for the usability tests, Prototype your design to test, Introduction of prototyping tools, Conduction and preparation of usability test results.

UNIT VI

UX Design Process: iterate/improve: Understanding the Usability test findings, Applying the Usability test feedback in improving the design. UX Design Process: Communication with implementation team UX Deliverables to be given to implementation team.

Text Books:

1. Jesse James Garrett, ***"The Elements of User Experience: User-Centered Design for the Web and Beyond"***, New Riders Publishing, 2nd Edition, 2002.
2. Steve Krug, ***"Don't Make Me Think, Revisited: A Common Sense Approach to Web Usability"***, 3rd Edition, 2014.
3. Thomas Tullis, Willaim Albert, ***"Measuring the User Experience: Collecting, Analyzing, and Presenting Usability Metrics"***, Morgan Kaufman, 1st Edition, 2008.

Reference Books:

1. Jeff Gothelf, Josh Seiden, ***"Lean UX: Applying Lean Principles to Improve User Experience"***, O'Reilly, 1st Edition, 2013.
2. Kevin Mullet, Darrell Sano, ***"Designing Visual Interfaces: Communication Oriented Techniques"***, Soft Press, 1995.
3. Wilbert O. Galitz, ***"The Essential Guide to User Interface Design: An Introduction to GUI Design Principles and Techniques"***, Wiley, 2002.

Course Title:	**Infrastructure Auditing & Implementation**	**Semester**	**VIII**
Course Code	**BTITSE803B**	**Course Type**	**Elective**
Pre-requisite	**IT Service Management**	**L – T – P**	**3 – 0 – 0**
Stream	**Infrastructure & Security Management**	**Credits**	**3**

Course Objectives:

1. To know the goals and objectives of IT audit and its role in internal control system.
2. To learn the techniques of audit planning and audit performance, gathering of audit related information and audit evidence.
3. To understand how to audit and evaluate effectiveness of the IT internal controls system.
4. To learn the fundamentals of information risk management and audit of information security.

Course Outcomes:

After learning the course the students should be able:

1. To describe the need for information security audit.
2. To define the requirements of IT risks, security and policies required for organizations.
3. To explain the mandatory items that need to be checked.

UNIT I

Fundamentals of infrastructure audit: meaning and definition, Overview, Choice of correct methods, Need, Scope and objectives.

UNIT II

Introduction to risk assessment: Entity area, strategies and policies in operation, support, External Drivers, User Interaction, Consequences-Importance of demonstrating control over network and security staffs, Risk of operator access controls over device and server settings.

UNIT III

Checklist for IT audit: Alignment with business strategy, Long term IT strategy, Short range IT plans, Information system security policy, Implementation of security policy, Information system audit guidelines, Acquisition and implementation of packaged software.

UNIT IV

Requirement identification and analysis Configuration audits: Need for an audit trail, A real-time live-network change review, Automatically verify compliance with both external best practices and internal standards.

UNIT V

Vendor selection criteria and process: Tracking the vendor selection criteria, Contracting- The issues of site licenses, Usage of open sources software, Annual maintenance contracts.

UNIT VI

Implementation: Importance of regulations and standards such as Sarbanes-Oxley, ISO 17799 and Visa's Cardholder Information Security Program (CISP), On-demand historical reports, Governance and

Cobit as a model for IT compliance. Benefits of infrastructure audit, Strong change management process.

Text Books:

1. Richard E. Cascarino, ***"Auditor's Guide to Information Systems Auditing"***, Wiley, 2007.
2. Chris Jackson, ***"Network Security Auditing"***, Cisco Press, 2010.

References:

1. www.netwrix.com
2. www.rbi.org

Course Title:	**Cyber Law and IPR**	**Semester**	**VIII**
Course Code	**BTITSE803C**	**Course Type**	**Elective**
Pre-requisite	**Nil**	**L – T – P**	**3 – 0 – 0**
Stream	**Information Management & Quality Control**	**Credits**	**3**

Course Objectives:

1. To understand cyber laws and its applicability in India.
2. To learn the basic concepts of technology and law, digital contracts, rights of netizens and E-governance. To study cyber space and the cyber laws and regulating them through relevant Acts.
3. To learn the comparative study of national and international laws keeping in view international scenario in a no-barrier world.
4. To be aware about IPR in scientific and technical community for protecting their inventions.
5. To understand IPR from a non-lawyers perspective like senior managers, administrators etc.
6. To experience practices and procedures in various government offices administering IPR Laws.

Course Outcomes:

After learning the course the students should be able:

1. To describe the cyber world and cyber law in general.
2. To explain about the various facets of cyber crimes.
3. To explain the problems arising out of online transactions and provoke them to find solutions.
4. To clarify the Intellectual Property issues in the cyber space and the growth and development of the law in this regard.
5. To educate about the regulation of cyber space at national and international level.

Course Content

UNIT I

Introduction to Cyber crimes: Definition, Cybercrime and information security, Classes of cybercrime and categories, Cyber offences, Cybercrimes with mobile and wireless devices.

UNIT II

Jurisdiction in the cyber world across the world: Cybercrime law in Asia, Cybercrime and federal laws, Legal principles on jurisdiction and jurisdictional disputes w.r.t. the internet in United States of America, Cybercrime legislation in African region, Foreign judgments in India.

UNIT III

Indian IT act: Information Technology Act, 2000(Complete including digital signature, certifying authorities and E-governance), Positive aspects, Weak areas, Amendments to the Information Technology Act, 2008. Challenges to Indian law and cyber crime scenario in India. Protection of cyber consumers in India.

UNIT IV

Emerging Electronic System: E – commerce; E – governance; Concept of Electronic Signature; Credit Cards; Secure Electronic Transactions.

UNIT V

Intellectual property Rights: Intellectual Property law basics, Types of Intellectual Property, Agencies responsible for Intellectual Property registration. International organizations, Agencies and Treaties. Increasing importance of Intellectual Property Law.

UNIT VI

Copyright issues in Cyberspace: Relevant provisions under Copyright Act, 1957, regulating copyright issues in Cyberspace; Online Software Piracy – legal issues involved; Analysis of sufficiency of provisions of Copyright Act to deals with Online Software.

Piracy: Trademark issues in Cyberspace – Domain Name; Cyber squatting as a form of Domain Name dispute; Case law.

Case studies: Highlight the cybercrimes, cyber laws and Intellectual property Rights with the help of minimum 5 cases with reference to Indian IT act for better understanding.

Text Books:

1. Herman T. Tavani, ***“Ethics & Technology, Ethical Issues in an Age of Information and Communication Technology”***, John Wiley & Sons, 3rd Edition, 2011.
2. Syed Shakil Ahmed, Reheja Rajiv, ***“A Guide to Information Technology (Cyber Laws & E-commerce)”***, Capital Law House, 2001.
3. Kamath Nandan, ***“Law Relating to Computers Internet & E-commerce (A guide to Cyber Laws & the Information Technology Act, 2000 with Rules & Notification)”***, Universal Book Traders, 2nd Edition, Reprint: 2002.

Reference Books:

1. Ahmad Tabrez, “***Cyber law , E-commerce & M-Commerce”***, A. P. H. Publishing Corporation, 2003.
2. Bakshi P.M and Suri R.K, ***“Cyber and E-commerce Laws”***, Bharat Publishing House, 1st Edition, 2002.
3. Vishwanathan Suresh T, ***“The Indian Cyber Law”***, Bharat Law House, 2nd Edition, 2001.
4. Prasad T.V.R. Satya, ***“Law Relating to Information Technology (Cyber Laws)”***, Asia Law House , 1st Edition, 2001.
5. Reed Chris, ***“Computer Law”***, 3rd Edition, Universal Law Publishing Co. Pvt. Ltd., 1996 (First Indian Reprint 2000).
6. P. Narayanan, ***“Intellectual Property (Trade Marks & the Emerging concepts of Cyber property rights (HB)"***, 3rd Edition. (HB), 2002.

Course Title:	**Optical Networks**	**Semester**	**VIII**
Course Code	**BTITSE803D**	**Course Type**	**Elective**
Pre-requisite	**Internetworking Protocols**	**L – T – P**	**3 – 0 – 0**
Stream	**Networking**	**Credits**	**3**

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 to acquire knowledge about fault and congestion management.

Course Outcomes:

The student will be able to:

1. Design a system, component or process as per needs and specification.
2. Gain knowledge on optical network architectures ranging from optical access networks to backbone optical transport networks.
3. Gain the knowledge on methodologies of optical network design optimization.
4. Explore techniques of optical network survivability.
5. Solve the Problems in the discipline of optical networks.

Course Content

UNIT I

Optical Layer: SONET/SDH: Multiplexing, CAT and LCAS, Sonnet/SDH Layers, SONET Frame Structure, SONET/SDH physical layer, Elements of a SONET/SDH infrastructure, Optical Transport Network: Hierarchy, Frame Structure, Multiplexing, Generic framing procedure Ethernet: Frame structure, Switches, Ethernet Physical layer, Carrier transport IP: Routing and forwarding, Quality of service. Multiprotocol label switching: Labels and forwarding, Quality of service, Signaling and routing, Carrier transport, Resilient packet ring: Quality of service, Node structure, Fairness storage area networks: Fiber channel.

UNIT II

WDM Network Elements: Optical line terminals, Optical line amplifiers, Optical Add/Drop Multiplexers: OADM Architectures, Reconfigurable OADMs, Optical cross connects: All-Optical OXC configurations.

UNIT III

Control and Management: Network management functions: Management framework, Information model, Management protocols. Optical layer services and interfacing, Layers within the Optical layer, Multi vendor Interoperability.

UNIT IV

Performance and Fault Management: The Impact of transparency, BER measurement, Optical trace, Alarm management, Data Communication Network (DCN) and Signaling, Policing, Optical layer overhead, Client layers. Configuration management: Equipment management, Connection management, Adaptation management. Optical Safety: Open Fiber Control protocol.

UNIT V

Protection in SONET/SDH: Point-to-Point links, Self-healing rings, Unidirectional line-switched rings, Bidirectional line-switched rings, Ring Interconnection and dual homing. Protection in the client layer: Protection in Resilient Packet Rings, Protection in Ethernet, Protection in IP, Protection in MPLS, Why Optical Layer protection: Service classes based on protection. Optical Layer protection schemes: 1+1 OMS Protection, 1:1 OMS Protection, OMS-DPRing, OMS-SPRing, 1:N Transponder Protection, 1+1 OCh Dedicated Protection, OCh-SPRing, OCH-Mesh Protection, GMPLS Protection, Interworking between layers.

UNIT VI

WDM Network Design: Cost Trade-OFFS: A detailed ring network example LTD and RWA problems, Light path topology design, Routing and wavelength assignment, Wavelength conversion. Dimensioning, Wavelength- routing networks, Statistical dimensioning models: First-passage model, Blocking model, Maximum load dimensioning models: Offline light path requests, Online RWA in rings.

Text Book:

1. Rajeev Ramaswamy, Kumar N Sivarajan, "***Optical Networks***" , Elsevier Publication, 3rd Edition, 2009.

Reference Book:

1. Uyless Black," ***Optical Networks-Third generation transport system***" Pearson Publication, 2013.

Course Title:	**Web & Text Mining**	**Semester**	**VIII**
Course Code	**BTITSE803E**	**Course Type**	**Elective**
Pre-requisite	**Data Warehouse and Data Mining**	**L – T – P**	**3 – 0 – 0**
Stream	**Data Science**	**Credits**	**3**

Course Objectives:

1. To learn the concepts of database technology evolutionary path which has led to the need for data mining and its applications.
2. To learn the essential techniques of data and text mining.
3. To understand data mining standard predictive methods to unstructured text.
4. To discuss the standard techniques of preparation and handling methods to transform that can be mined.

Course Outcomes:

After learning the course the students should be able:

1. To examine the types of the data to be mined and present a general classification of tasks and primitives to integrate a data mining system.
2. To explore DWH and OLAP and devise efficient and cost effective methods for maintaining DWHs.
3. To discover interesting patterns from large amounts of data to analyze and extract patterns to solve problems, make predictions of outcomes.
4. To comprehend the roles that data mining plays in various fields and manipulate different data mining techniques.
5. To evaluate systematically supervised and unsupervised models and algorithms w.r.t. their accuracy.

Course Content

UNIT I

Introduction to Information Retrieval: Inverted indices and Boolean queries, Query optimization, The nature of unstructured and semi-structured text.

UNIT II

Text encoding: Tokenization, Stemming, Lmmatization, Stop words, Phrases, Further optimizing indices for query processing, Proximity and phrase queries, Positional indices.

UNIT III

Index compression: Lexicon compression and postings lists compression, Gap encoding, Amma codes, Zipf's Law. Blocking. Extreme compression, Query expansion: spelling correction and synonyms. Wild-card queries, Permuterm indices, N-gram indices. Edit distance, Soundex, Language detection. Index construction. Postings size estimation, Merge sort, Dynamic indexing, Positional indexes, N-gram indexes, Real-world issues.

UNIT IV

Parametric or fielded search: Document zones, The vector space retrieval model, Scoring documents, Vector space scoring, The cosine measure, Efficiency considerations, Nearest neighbor techniques, Reduced dimensionality approximations, Random projection. Results summaries: Static and dynamic, Evaluating search engines.

User happiness, Precision, Recall, F-measure, Creating test collections: kappa measure, interjudge agreement. Relevance, approximate vector retrieval.

UNIT V

Feedback: Relevance feedback, Pseudo relevance feedback, Query expansion, Automatic thesaurus generation, Sense-based retrieval, Experimental results of performance effectiveness.

Probabilistic models for text problems, Classical probabilistic IR, Language models, Introduction to text classification, Naive Bayes models, Spam filtering, Probabilistic language models for IR, Bayesian nets for IR.

UNIT VI

Introduction to the problem: Partitioning methods, K-means clustering, Mixture of Gaussians model, Clustering versus classification, Hierarchical agglomerative clustering, Clustering terms using documents, Labelling clusters, Evaluating clustering, Text-specific issues, Reduced dimensionality/spectral methods, Latent semantic indexing (LSI), Applications to clustering and to information retrieval.

Vector space classification using hyperplanes, centroids, k Nearest Neighbors, Support Vector machine classifiers, Kernel functions, Text classification, Exploiting text-specific features, Feature selection, Evaluation of classification, Micro- and macro averaging, Comparative results.

Text Books:

1. Michael Geatz and Richard Roiger, ***"Data Mining: A Tutorial Based Primer"***, Pearson Education.
2. Thomas W. Miller, ***"Data and Text Mining: A Business Applications Approach"***, Pearson Education.
3. Pang-Ning Tan, Michael Steinbach, Vipin Kumar, ***"Introduction to Data Mining"***, Pearson Education.

Reference Books:

1. R. Baeza-Yates and B. Ribeiro-Neto, ***"Modern Information Retrieval"***, Pearson Education, 1999.
2. D.A. Grossman, O. Frieder, ***"Information Retrieval: Algorithms and Heuristics"***, Springer, 2004.
3. W. Frakes and R. Baeza-Yates, ***"Information Retrieval: Data Structures and Algorithms"***, 1st Edition, Pearson Education.

Course Title:	**Multimedia Applications**	**Semester**	**VIII**
Course Code	**BTITSE804A**	**Course Type**	**Elective**
Pre-requisite	**Nil**	**L – T – P**	**3 – 0 – 0**
Stream	**Software and Application Development**	**Credits**	**3**

Course Objectives:

1. To understand the overview of basic topics in multimedia.
2. To learn the software technologies of non-traditional interfaces.
3. To learn the development of interactive multimedia applications.

Course Outcomes:

After learning the course the students should be able:

1. To understand basic concepts related to MM including data standards, algorithms and softwares.
2. To experience development of multimedia software by utilizing existing libraries and descriptions of algorithms.
3. To demonstrate cutting-edge multimedia topics through independent study and presentations in class.

Course Content:

UNIT I

Introduction: Components of Multimedia, Multimedia and Hypermedia multimedia building blocks, Communication and information transfer model, Multimedia information systems, Application purposes of multimedia, Electronics performance support systems. Interaction Technologies and devices: Human Computer Interface, Input/output technologies, Combined I/O device, Storage technologies, Processing technologies.

UNIT II

Multimedia Authoring and data representation: Multimedia Authoring: Production, Presentation and auto authoring, Image data types, Image representation, Image acquisition, Picture display, Working with image.

UNIT III

Compression Technologies for multimedia: Need for data compression, Compression basics, Llossless and lossy compression, Image compression standards, Video compression standards, Basic audio compression standards.

UNIT IV

Text, Hypertext and Hypermedia, and Digital audio: Visual representation of text, Digital representation of characters, Formatting aspect text, Hypertext and hypermedia, Producing digital audio, Psychoacoustics, Processing sound, Representation of audio files, Digitization of sound, MIDI, Quantization and transmission of audio.

UNIT V

Designing multimedia: Development phases and teams, Analysis phase, Design phase, Development phase, Implementation phase, Evaluation and testing.

UNIT VI

Multimedia networks and communication: Multimedia in the Internet, Streaming stored audio/video, Streaming live audio/video, real-time interactive audio/video, Real-time interactive protocols: RTP, RTCP, Session Initialization protocol (SIP), H.323, SCTP. QoS: Data flow, Flow classes, Flow control, Integrated services, Differentiated services. Multimedia content management systems, Multimedia indexing, Multimedia retrieval.

Text Books:

1. Li. Z., Drew M., ***"Fundamentals of Multimedia"***, Pearson Education publishers, 2004.
2. Chow V. W. S., ***"Multimedia Technology and Applications"***, Springer.

Reference Books:

1. Banerji A., and Ghosh A.M., ***"Multimedia Technologies"***, McGraw Hill International, 2009.
2. Stamou G., and Kollias S., ***"Multimedia Contents and the Semantic Web"***, John Wiley & Sons., 2005.

Course Title:	**Ethical Hacking**	**Semester**	**VIII**
Course Code	**BTITSE804B**	**Course Type**	**Elective**
Pre-requisite	**Operating Systems**	**L – T – P**	**3 – 0 – 0**
Stream	**Infrastructure & Security Management**	**Credits**	**3**

Course Objectives:

1. To understand how intruders escalate privileges.
2. To understand Intrusion Detection, Policy Creation, Social Engineering, Buffer Overflows and different types of attacks and their protection mechanisms.
3. To learn about ethical laws and tests.

Course Outcomes:

After successful completion of the course, the student will be able:

1. To understand the core concepts related to malware, hardware and software vulnerabilities and their causes.
2. To understand ethics behind hacking and vulnerability disclosure.
3. To appreciate the Cyber Laws and impact of hacking.
4. To exploit the vulnerabilities related to computer system and networks using state of the art tools and technologies.

Course Content:

UNIT I

Types of data stolen from the organizations, Elements of Information Security, Authenticity and non-repudiation, Security challenges, Effects of hacking, Types of hacker, Ethical hacker.

UNIT II

Hacktivism - role of security and penetration tester, Penetration testing methodology, Networking and computer attacks – Malicious software (Malware), Protection against malware, Intruder attacks on networks and computers, Addressing physical security, Key loggers and Back doors.

UNIT III

Web tools for foot printing, Conducting competitive intelligence, Google hacking, Scanning, Enumeration, Trojans and backdoors, Virus and worms, Proxy and packet filtering, Denial of service, Sniffer, Social Engineering: Shoulder surfing, Dumpster Diving, Piggybacking.

UNIT IV

Physical Security: Attacks and protection, Steganography: Methods, Attacks and measures, Cryptography : Methods and types of attacks, Wireless hacking, Windows hacking, Linux hacking.

UNIT V

Routers, Firewall and Honeypots, IDS and IPS, Web filtering, Vulnerability, Penetration testing, Session hijacking, Web server, SQL Injection, Cross site scripting, Exploit writing, Buffer overflow, Reverse engineering, Email hacking, Incident handling and response, Bluetooth hacking, Mobiles phone hacking.

UNIT VI

An introduction to the particular legal, Professional and ethical issues likely to face the domain of ethical hacking, Ethical responsibilities, Professional integrity and making appropriate use of the tools and techniques associated with ethical hacking, Social Engineering, Host Reconnaissance, Session Hijacking, Hacking - Web Server, Database, Password Cracking, Network and Wireless, Trojan, Backdoor, UNIX, LINUX, Microsoft, NOVEL Server, Buffer Overflow, Denial of Service Attack, Methodical Penetration Testing.

Text Books:

1. Michael T. Simpson, Kent Backman, James E., ***"Corley, Hands-On Ethical Hacking and Network Defense"***, CENGAGE Learning, 2^{nd} Edition, 2010.
2. Patrick Engebretson, ***"The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy"***, Syngress Basics Series – Elsevier, August 4, 2011.

Reference Books:

1. Steven DeFino, Barry Kaufman, Nick Valenteen, ***"Official Certified Ethical Hacker Review Guide"***, CENGAGE Learning, 2009-11-01.
2. Whitaker, Newman, ***"Penetration Testing and Network Defense"***, Cisco Press, Indianapolis, IN, 2006.

Course Title:	**CRM & SCM**	**Semester**	**VIII**
Course Code	**BTITSE804C**	**Course Type**	**Elective**
Pre-requisite	**Enterprise Resource Planning**	**L – T – P**	**3 – 0 – 0**
Stream	**Information Management and Quality Control**	**Credits**	**3**

Course Objectives:

1. To make students understand the how IT is an enabler for SCM and CRM.
2. To understand supply chain strategy framework and supply chain strategies.
3. To comprehend the functionalities of CRM in service sector.

Course Outcomes:

After learning the course the students should be able:

1. To understand the concept of logistics and supply chain management.
2. To appreciate the importance of logistics function in overall success of any business/industrial sector.
3. To understand the interrelationship between logistics and supply chain management.
4. To understand the importance and dynamics of supply chain management in any business/industrial sector.
5. To know the world class best practices being carried out in supply chain management.
6. To understand the procurement and outsourcing strategies.
7. To understand the impact of customer relationship management in effective supply chain management.
8. To know how to measure the performance of supply chain operations.

Course Content:

UNIT I

Introduction to CRM: What is CRM? Why we need CRM? Definition of CRM, Architecture of CRM, Technology considerations of CRM, Technology components of CRM, Customer life cycle, Customer lifetime value computation, Implications of globalization on customer relationship management.

UNIT II

Introduction to e-CRM: Definition of e-CRM, Its need, Features, Framework of e-CRM, Six e's of e-CRM, CRM Vs e-CRM, Architecture of e-CRM, Implementing a technology based CRM solution.

UNIT III

Introduction to Supply Chain: What is SCM?, Why SCM? Generic types of supply chain, Major drivers of Supply chain, Supply Chain strategies, Value in Supply Chain- quality, Delivery, Flexibility, Core competencies in Supply Chain.

UNIT IV

Source management in Supply Chain: Insourcing, outsourcing, Partner selection, Sourcing strategies, Procurement strategies, Managing Inventory in Supply chain, Definition of inventories, Selective inventory control, Vendor managed inventory systems, Inventory performance measures- financial, operational & inventory turnover ratio (ITR), Transportation decisions in a Supply Chain – Transportation Strategy, Transportation selection, Mode of transportation, Transportation management system (TMS).

UNIT V

e- SCM: Information technology in Supply Chain: Typical IT solutions- EDI, Intranet, Extranet, Data Warehousing, E- commerce, E-procurement, Bar coding technology, GPS, RFID.

UNIT VI

Information Systems in Supply Chain Case Study – A live case of use of IT, Case Studies for SCM & CRM, For SCM: Mumbai Tiffinwala, For CRM: Sales Force.

Text Books:

1. Bowersox, Closs & Cooper , ***"Supply Chain & Logistic Management"***, Tata McGraw Hill 2nd Edition.
2. Paul Greenberg, ***"CRM at the speed of light"***, YMH 2nd Edition.

Reference Book:

1. Kristin Anderson and Carol Kerr, ***"Customer Relationship Management"***, Tata McGraw Hill.

Course Title:	**Wireless Networking**	**Semester**	**VIII**
Course Code	**BTITSE804D**	**Course Type**	**Elective**
Pre-requisite	**Internetworking Protocols**	**L – T – P**	**3 – 0 – 0**
Stream	**Networking**	**Credits**	**3**

Course Objectives:

1. To study the evolving wireless technologies and standards.
2. To understand the architectures of various access technologies such as 3G, 4G, WiFi etc.
3. To understand various protocols and services provided by next generation netwoks.

Course Outcomes:

After learning the course the students should be able:

1. To keep himself updated on latest wireless technologies and trends in the communication field.
2. To understand the transmission of voice and data through various networks..

Course Content:

UNIT I

Introduction, Technology and service trends of emerging Wireless technologies, The amazing growth of Mobile Communications, A little history, Mobile Communications fundamentals, Mobile data, WiFi, Bluetooth, Cable systems, Wireless migration options, Harmonization process.

UNIT II

WiFi (802.11), 802.11 Standards, WiFi protocols, Frequency allocation, Modulation and coding schemes, Network architecture, Typical WiFi configurations, Security, 802.11 Services, Hot spots, Virtual Private Networks (VPNs), Mobile VPN, VPN types, WiFi Integration with 3G/4G, Benefits of convergence of WiFi and Wireless Mobile.

UNIT III

Introduction, Universal mobile telecommunications service (UMTS), UMTS services, The UMTS air interface, Overview of the 3GPP release 1999 Network Architecture, Overview of the 3GPP Release 4 Network Architecture, Overview of the 3GPP Release 5, All-IP Network Architecture, Overview CDMA2000, TD-CDMA, TD-SCDMA, Commonality among WCDMA, CDMA2000, TD-CDMA, and TD-SCDMA.

UNIT IV

LTE Ecosystem, Standards, Radio spectrum, LTE architecture, User Equipment (UE), Enhanced Node B (eNodeB), Core network (EPC), Radio channel components, TD-LTE, Multiple Input Multiple Output, LTE scheduler, Carrier aggregation, Cell search, Cell reselection, Attach and default bearer activation, Handover (X2, S1, Inter-MME), Self-Organizing Networks (SONs), Relay cells, Heterogeneous Network (HetNET), Remote radio heads (RRH), VoLTE, LTE advanced.

UNIT V

Introduction, Standards, Generic WiMAX Architecture, Core network, Radio network, WiMAX Spectrum, Modulation, Channel structure, Mixed mode, Interference Mitigation techniques, Frequency planning, Features and applications, Security, QoS, Profiles, Origination, Handover, Femto and SON.

UNIT VI

Why VoIP?, The Basics of IP transport, VoIP challenges, H.323, The Session Initiation Protocol (SIP), Distributed architecture and media gateway control, VoIP and SS7, VoIP Quality of Service.

Text Books:

1. Clint Smith, P.E., Daniel Collins, ***"Wireless Networks: Design and Integration for LTE, EVDO, HSPA, and WiMAX"***, McGraw Hill 3rd Edition,
2. Eldad Perahia, Robert Stacey, ***"Next Generation Wireless LANs"***, Cambridge University Press, 2nd Edition.

Reference Books:

1. Yi-Bang Lin, Imrich Chlamtac, ***"Wireless and Mobile Network Architecture"***, Wiley India Edition.
2. Dipankar Ray chaudhary, Maria Gerla, ***"Emerging Wireless Technologies and the Future Mobile Internet"***, Cambridge University Press.

Course Title:	**Machine Learning**	**Semester VIII**	
Course Code	**BTITSE804E**	**Course Type**	**Elective**
Pre-requisite	**Engineering Mathematics III**	**L – T – P**	**3 – 0 – 0**
Stream	**Data Science**	**Credits**	**3**

Course Objectives:

1. To understand the basic concepts and methods of machine learning.
2. To make use of some elementary machine learning techniques in the design of computer systems.
3. To develop a broad perspective about the applicability of ML algorithms in different fields.
4. To understand the major machine learning algorithms, the problem settings and assumptions that underlies them.
5. To possess insights, concerning the relative strengths and weaknesses of various common machine learning methods.

Course Outcomes:

After learning the course the student will be able:

1. To demonstrate knowledge of the machine learning literature.
2. To describe how and why machine learning methods work.
3. To demonstrate results of parameter selection.
4. To explain relative strengths and weaknesses of different machine learning methods.
5. To select and apply appropriate machine learning methods to a selected problem.
6. To implement machine learning algorithms on real datasets.
7. To suggest ways to improve results.

Course Content:

UNIT-I

Introduction: Well-posed learning problems, Designing a Learning System, Perspectives and Issues in Machine learning, Concept Learning and General-to-specific Ordering: A concept learning task, Concept learning as Search, Finding a maximally specific hypothesis, Version Spaces and Candidate elimination algorithm, Inductive Bias.

UNIT-II

Decision Tree Learning: Decision tree learning algorithm, Hypothesis space search in decision tree Evaluating Hypothesis: Estimating Hypothesis accuracy, Basics of sampling theory, Deriving confidence intervals, Hypothesis testing, comparing learning algorithms.

UNIT-III

Bayesian Learning: Bayes theorem and concept learning, Maximum likelihood and least square error hypotheses, Minimum description length principle, Bayes optimal classifier, Gibbs algorithm, Naive Bayes classifier, Computational Learning Theory: Probably learning an approximately correct hypothesis, PAC learnability, The VC dimension, the mistake bound model for learning.

UNIT-IV

Linear Models for Regression: Linear basis function models, The Bias-Variance decomposition, Bayesian Linear Regression, Bayesian Model comparison

Kernel Methods: Constructing kernels, Radial basis function networks, Gaussian Processes

UNIT-V

Approximate Inferencing: Variational inference, Variational mixture of Gaussians, Variational linear regression, Variational logistic regression, Hidden Markov Models: Learning algorithms for HMM, the Viterbi algorithm, Linear Dynamical Systems.

UNIT-VI

Reinforcement Learning: The learning task, Q learning, Non-deterministic rewards and action, Temporal difference learning, Generalizing from examples.

Text Books:

1. Mitchell, Tom. M., *"Machine Learning"*, McGraw-Hill Education, 1st Edition, May 2013.
2. Segaran, Toby. ***"Programming Collective Intelligence- Building Smart Web 2.0 Applications"***, O'Reilly Media, August 2007.

Reference Books:

1. Miroslav, Kubat. ***"An Introduction to Machine Learning"***, Springer Publishing.
2. Bishop, C. M., ***"Pattern Recognition and Machine Learning"***, Springer Publishing.
3. Conway, Drew and White, John Myles, ***"Machine Learning for Hackers"***, O'Reilly Media, February 2012.

Course Title:	**Internet of Things Lab**	**Semester VIII**	
Course Code	**BTITDEL805A**	**Course Type**	**Elective**
Pre-requisite	**Microprocessors and Microcontrollers Lab**	**L – T – P**	**0 – 0 – 2**
Stream	**Departmental**	**Credit**	**1**

Lab Experiments Objective:

1. To implement M2M programs using ARM/Raspberry Pi boards.
2. To interface real-world devices with Internet and display data and information collected.

Lab Experiments List:

1. Write program for creating different LED patterns and use ARM/Raspberry Pi boards, on-board LEDs for checking output.
2. Write program for interfacing LEDs and push to on switch with ARM/Raspberry Pi board at different GPIO pins.
3. Write program for interfacing 16x2 LCD with ARM/Raspberry Pi board at different GPIO pins.
4. Write program to read the onboard temperature and display on cloud.

Course Title:	**E-commerce Systems Lab**	**Semester VIII**	
Course Code	**BTITDEL805B**	**Course Type**	**Elective**
Pre-requisite	**Programming in Web Technologies**	**L – T – P**	**0 – 0 – 2**
Stream	**Departmental**	**Credit**	**1**

Lab Experiments Objective:

1. To design an E-commerce website.
2. To develop the various modules for a B2C E-commerce business.
3. To program and implement various web pages and workflows to deploy a B2C ecommerce business.
4. To develop the various web forms and page panels for an ecommerce.

List of Lab Experiments:

1. Students can choose any online retail business on the B2C model of e-commerce business.
2. Creating the Website Layout for E-Commerce.
3. Inserting & Displaying the Products & Categories.
4. Creating the Shopping Cart.
5. Creating the User Registration & Login Systems.
6. Creating the Checkout System.
7. Creating the Payment Integration System.
8. Creating the Admin Panel for E-commerce.
9. Uploading the E-Commerce to Online Server.

Course Title:	**Mobile Computing - Lab**	**Semester VIII**	
Course Code	**BTITSEL806A**	**Course Type**	**Elective**
Pre-requisite	**Programming in Java**	**L – T – P**	**0 – 0 – 2**
Stream	**Software and Application Development**	**Credit**	**1**

Lab Experiments Objectives:

1. Know the components and structure of mobile application development frameworks for Android and windows OS based mobiles.
2. Understand how to work with various mobile application development frameworks.
3. Learn the basic and important design concepts and issues of development of mobile applications.
4. Understand the capabilities and limitations of mobile devices.

List of Lab Experiments:

1. Develop an application that uses GUI components, Font and Colours.
2. Develop an application that uses Layout Managers and event listeners.
3. Develop a native calculator application.
4. Write an application that draws basic graphical primitives on the screen.
5. Develop an application that makes use of database.
6. Develop an application that makes use of RSS Feed.
7. Implement an application that implements Multi threading.
8. Develop a native application that uses GPS location information.
9. Implement an application that writes data to the SD card.
10. Implement an application that creates an alert upon receiving a message.
11. Write a mobile application that creates alarm clock.

Course Title:	**Cryptography Lab**	**Semester VIII**	
Course Code	**BTITSEL806B**	**Course Type**	**Elective**
Pre-requisite	**Programming in Java/C/C++**	**L – T – P**	**0 – 0 – 2**
Stream	**Infrastructure & Security Management**	**Credit**	**1**

Lab Experiments Objectives:

1. Know the components and structure of mobile application development frameworks for Android and windows OS based mobiles.
2. Understand how to work with various mobile application development frameworks.
3. Learn the basic and important design concepts and issues of development of mobile applications.
4. Understand the capabilities and limitations of mobile devices.

List of Lab Experiments:

1. Encryption using binary/byte addition.
2. Encryption using binary Exclusive-OR (XOR).
3. Triple DES with CBC mode and Weak DES keys.
4. RSA Encryption and Factorization Attacks.
5. Attack on RSA encryption with short RSA modulus
6. Hash generation and sensitivity of hash functions to plaintext modifications.
7. Digital Signature Visualization.
8. RSA Signature.
9. Study of Attack on Digital Signature/Hash Collision.

Course Title:	**Information Retrieval- Lab**	**Semester VIII**	
Course Code	**BTITSEL806C**	**Course Type**	**Elective**
Pre-requisite	**Design and Analysis of Algorithms lab**	**L – T – P**	**0 – 0 – 2**
Stream	**Information Management & Quality Control**	**Credit**	**1**

Lab Experiments Objectives:

1. To implement various information retrieval (IR) algorithms across data and web successfully.
2. To compare results and discuss the merits and demerits of various algorithms.

Lab Experiments List:

1. Representation of a Text Document in Vector Space Model and Computing Similarity between two documents.
2. Pre-processing of a Text Document: stop word removal and stemming.
3. Construction of an Inverted Index for a given document collection comprising of at least 50 documents with a total vocabulary size of at least 1000 words.
4. Classification of a set of Text Documents into known classes (You may use any of the Classification algorithms like Naive Bayes, Max Entropy, Rochio's, Support Vector Machine). Standard Datasets will have to be used to show the results.
5. Text Document Clustering using K-means. Demonstrate with a standard dataset and compute performance measures- Purity, Precision, Recall and F-measure.
6. Crawling/ Searching the Web to collect news stories on a specific topic (based on user input). The program should have an option to limit the crawling to certain selected websites only.
7. To parse XML text, generate Web graph and compute topic specific page rank.
8. Matrix Decomposition and LSI for a standard dataset.
9. Mining Twitter to identify tweets for a specific period (and/or from a geographical location) and identify trends and named entities.
10. Implementation of PageRank on Scholarly Citation Network.

Course Title:	**Network Security - Lab**	**Semester VIII**	
Course Code	**BTITSEL806D**	**Course Type**	**Elective**
Pre-requisite	**Programming in Java / C / C++**	**L – T – P**	**0 – 0 – 2**
Stream	**Networks**	**Credit**	**1**

Lab Experiments Objectives:

1. To highlight the issues with computer and network security by giving the hands on knowledge of various things like monitoring and analyzing network traffic.
2. To install and configure different tools like Wireshark, SNORT, NMAP and Port Scanners etc.

Lab Experiments List:

1. Perform An Experiment To Grab A Banner With Telnet And Perform The Task Using Netcat Utility.
2. Perform An Experiment For Port Scanning With Nmap, Superscan Or Any Other Software.
3. Using Nmap.
4. Find Open Ports On A System.
5. Find The Machines Which Are Active.
6. Find The Version Of Remote Os On Other Systems.
7. Find The Version Of S/W Installed On Other System.
8. Perform An Experiment On Active And Passive Finger
9. Printing Using Xprobe2 and Nmap.
10. Perform an experiment to demonstrate how to sniff for Router Traffic by Using the Tool Wireshark.
11. Perform an experiment How To Use Dumpsec.
12. Perform a Wireless Audit Of An Access Point / Router And Decrypt WEP And WPA.
13. Perform an Experiment To Sniff Traffic Using Arp Poisoning.
14. Install Jcrypt Tool (Or Any Other Equivalent) And Demonstrate Asymmetric, Symmetric Cryptography Algorithm, Hash And Digital/PKI Signatures.
15. Demonstrate Intrusion Detection System (Ids) Using Any Tool e.g. Snort Or Any Other S/W.
16. Install Rootkits And Study Variety Of Options.
17. Generating Password Hashes With Openssl.
18. Setup A Honey Pot And Monitor The Honeypot On Network.

Course Title:	**Big Data Analytics - Lab**	**Semester VIII**	
Course Code	**BTITSEL806E**	**Course Type**	**Elective**
Pre-requisite	**Programming in Java / C / C++ / Python**	**L – T – P**	**0 – 0 – 2**
Stream	**Data Science**	**Credit**	**1**

Lab Experiments Objective:

1. To learn the concepts of Big data processing techniques by writing programs in Hadoop and MapReduce algorithms.

Lab Experiments List:

1. Study of Hadoop ecosystem.
2. Two programming exercises on Hadoop.
3. Two programming exercises in No SQL.
4. Implementing simple algorithms in MapReduce: Matrix multiplication, Aggregates, joins, sorting, searching.
5. Implementing any one frequent item set algorithm using MapReduce.
6. Implementing any one clustering algorithm using MapReduce.
7. Implementing any one data streaming algorithm using MapReduce.
8. Mini Project: one real life large data application to be implemented (use standard datasets available on the web).

Course Title:	**Multimedia Applications-Lab**	**Semester VIII**	
Course Code	**BTITSEL807A**	**Course Type**	**Elective**
Pre-requisite	**Programming in Java / C / Python**	**L – T – P**	**0 – 0 – 2**
Stream	**Software and Application Development**	**Credit**	**1**

Lab Experiments Objectives:

1. To write programs to edit and modify multimedia files into different formats.
2. To write programs to service multimedia information on demand through streaming.
3. To transfer multimedia data from one system to other.

Lab Experiments List:

1. Assignment on: Image editing using Photoshop (or other image editing software).
2. Audio editing using Sound Forge or Audacity (or other sound editing software).
3. Animation using Flash Video editing using Premier or Adobe.
4. Write a program to convert audio files from one format to other.
5. Write a program to convert video files from one format to other.
6. Write a program to embed multimedia files on a webpage and stream them.
7. Write programs to transfer multimedia files from one device to another.

Course Title:	**Ethical Hacking- Lab**	**Semester VIII**	
Course Code	**BTITSEL807B**	**Course Type**	**Elective**
Pre-requisite	**Operating Systems lab**	**L – T – P**	**0 – 0 – 2**
Stream	**Infrastructure & Security Management**	**Credit**	**1**

Lab Experiments Objectives:

1. To understand the different kinds of hacker attacks to information and computer systems.
2. To simulate hacker attacks.
3. To change system parameters to prevent hacker attacks.
4. To write programs to prevent attacks and make system more resilient.

Lab Experiments List:

1. Use any 2 of the following hacking tools to expose system vulnerability (Nmap, Nessus, John the Ripper, Cain & Abel, Netstumbler, SQLMap).
2. Conduct and experiment to crack a password of an Application using the Cain & Abel tool.
3. Simulate a Denial of Service attack.
4. Execute a network sniffing exercise using Wireshark.
5. Discover vulnerabilities in a web server.
6. Create a simple website and write programs protect it from hacks such as (SQL injection, DoS, Cross Site Scripting XSS, Cookie/Session Poisoning, Form Tampering, Code injection and Defacement).

Course Title:	**CRM & SCM – Lab**	**Semester VIII**	
Course Code	**BTITSEL807C**	**Course Type**	**Elective**
Pre-requisite	**Enterprise Resource Planning**	**L – T – P**	**0 – 0 – 2**
Stream	**Information Management & Quality Control**	**Credit**	**1**

Lab Experiments Objectives:

1. To understand CRM and SCM as candidates to understand ERP applications deployed in organization.
2. To demonstrate the workings of various sub functions of CRM and SCM as learned in theory.

Lab Experiments List:

Students can download any open source CRM and SCM systems available to conduct the lab assignments

1. Set up an organizations customers, sales, product/services, departments and markets in the CRM/SCM system
2. Enter data for orders, customers, products, orders, quotes, invoices, payments in the CRM/SCM
3. Generate various CRM reports and alert with all the data entered

Course Title:	**Wireless Networking – Lab**	**Semester VIII**	
Course Code	**BTITSEL807D**	**Course Type**	**Elective**
Pre-requisite	**Internetworking Protocols**	**L – T – P**	**0 – 0 – 2**
Stream	**Networking**	**Credit**	**1**

Lab Experiments Objectives:

1. To give the practical exposure on wireless networks.
2. To configure and understand real issues in maintaining wireless networks.
3. To understand administrator functions.

Lab Experiments List:

1. Wireless Component and Media Identification.
2. Install a WLAN Adapter Card.
3. Wireless Mathematics.
4. Topology Design with Cisco Network Designer (CND).
5. Configuring Basic AP Settings.
6. Resetting the Bridge.
7. Antenna Setup.
8. Wireless Attacks and Countermeasures.
9. WLAN Design.
10. Site Survey Active Mode.

Course Title:	**Machine Learning – Lab**	**Semester VIII**	
Course Code	**BTITSEL807E**	**Course Type**	**Elective**
Pre-requisite	**Engineering Mathematics**	**L – T – P**	**0 – 0 – 2**
Stream	**Data Science**	**Credit**	**1**

Lab Experiments Objective:

1. To implement various machine learning techniques to solve problems.

Lab Experiments List:

1. Learn the data preprocessing steps to start a machine learning method for a practical.
2. Solve a stated problem using the simple linear regression method.
3. Use the multiple linear regression method for a stated issue.
4. Implement a polynomial regression solution.
5. Use the support vector regression to implement a ML solution.
6. Solve a stated problem using the decision tree regression method.
7. Implement a random forest regression solution.
8. Implement a reinforcement learning program to demonstrate ML concepts.

Course Title:	**Project Phase - II**	**Semester VIII**	
Course Code	**BTITP808**	**Course Type**	**Mandatory**
Pre-requisite	**Nil**	**L – T – P**	**0 – 0 – 12**
Stream	**Core**	**Credits**	**5**

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.

Dr. Babasaheb Ambedkar Technological University
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Detailed Syllabus
for
Second Year, Third Year and Final Year
B. Tech. Programme in Information Technology

Effective from
Academic Year 2018-19
Approved in the 11th meeting of Academic Council dated 8th June, 2018

Teaching and Evaluation Scheme Second Year B. Tech. (Information Technology)

Sr. No.	Code	Course title	Weekly Teaching hours			Evaluation Scheme			Credit	Total Hours
			L	T	P	MSE	CA	ESE		
Semester III										
1	BTBSC301	Engineering Mathematics III	3	1	-	20	20	60	4	4
2	BTESC302	Switching Theory and Logic Design	2	1	-	20	20	60	3	3
3	BTITC303	Object Oriented Paradigm with C++	2	1	-	20	20	60	3	3
4	BTCOC304	Computer Architecture and Organization	2	1	-	20	20	60	3	3
5	BTBSCOE305A BTHSMCOE305B BTITOE305C BTITOE305D	**Elective I** A) Advanced Engineering Chemistry B) Interpersonal Communication Skills and Self Development for Engineers C) Programming in Java D) Introduction to Web Technology	1	1	-	20	20	60	2	2
6	BTHM306	Basic Human Rights	2	-	-	-	50	-	Audit	2
7	BTESCL307	Switching Theory and Logic Design Lab	-	-	2	-	60	40	1	2
8	BTITL308	Object Oriented Paradigm with C++ Lab	-	-	4	-	60	40	2	4
9	BTITL309	Programming Lab (Python)	-	-	4	-	60	40	2	4
10	BTITOEL310	**Elective I Lab** A) Advanced Engineering Chemistry Lab B) Interpersonal Communication Skills and Self Development for Engineers Lab C) Programming in Java Lab D) Introduction to Web Technology Lab	-	-	2	-	60	40	1	2
11	BTITF311	Field Training / Internship/Industrial Training Evaluation	-	-	-	-	-	100	1	-
		Total	**12**	**5**	**12**	**100**	**390**	**560**	**22**	**29**
Semester IV										
1	BTITC401	Microprocessors and Microcontrollers	2	1	-	20	20	60	3	3
2	BTITC402	Data Structures and Applications	3	1	-	20	20	60	4	4
3	BTITC403	Discrete Structures and Applications	2	1	-	20	20	60	3	3
4	BTITC404	Internetworking Protocols	2	1	-	20	20	60	3	3
5	BTBSCOE405A BTHMOE405B BTXXOE405C	**Elective II** A) Physics of Engineering Materials B) Organizational Behavior C) Development Engineering	2	1	-	20	20	60	3	3
6	BTXX406	Product Design Engineering	2	-	-	20	20	60	2	2
7	BTITL407	Microprocessors and Micro-controllers Lab	-	-	2	-	60	40	1	2
8	BTITL408	Data Structures and Applications Lab	-	-	4	-	60	40	2	4
9	BTITL409	Internetworking Protocols Lab	-	-	2	-	60	40	1	2
10	BTITF410	Field Training / Internship/Industrial Training (minimum 4 weeks which can be completed partially in third semester and fourth semester or at one time.)						100	To be evaluated in V Semester	-
		Total	**13**	**5**	**8**	**120**	**300**	**580**	**22**	**26**

Programme Objectives:

The program educational objectives for the B. Tech. programme in Information Technology describes accomplishments that graduates are expected to attain within the four years of graduation. Graduates will be able to apply their expertise to contemporary problem solving, be engaged professionally, and have continued to learn and adapt, and have contributed to their organizations through leadership and teamwork. More specifically, the objectives are:

1. PEO1: To enable graduates gain strong skills for employment in multidisciplinary domains driven by IT
2. PEO2: To enable graduates to pursue higher education and research
3. PEO3: To enable graduates to develop entrepreneurship and leadership skills
4. PEO4: To enable graduates to contribute to the society in accordance with highest standards of ethics
5. PEO5: To develop breakthrough solutions enabling transformations in a rapidly changing IT world

Programme Outcomes:

The graduates of this programme will be able to demonstrate:

1. PO1: An Understanding of IT architecture, software and hardware concepts, functionalities and applications
2. PO2: An Ability to design, develop and test computer programs involving various algorithms, methodology and programming languages
3. PO3: Competency of business domains and functional processes that employ IT systems and applications
4. PO4: Practical use of communication protocols and their applications in the field of Internet and World Wide Web
5. PO5: Sound understanding of fundamentals of computer as the central enabling platform for information management in 21st century
6. PO6: An Ability to develop, integrate, maintain and innovate software applications deployed in various multi-disciplinary domains
7. PO7: Thought leadership to design and implement practical solutions for global industry needs.
8. PO8: Acumen to embrace and adopt futuristic IT technological developments
9. PO9: Sound knowledge of entrepreneurship traits to succeed
10. PO10: Adoption of practices that are ethical ensuring transparency and accountability
11. PO11: Capability to provide solutions that are socially empowering and environment friendly
12. PO12: Effective communication and collaboration techniques with stakeholders to achieve best results

Course Title:	**Engineering Mathematics – III**	**Semester III**	
Course Code	**BTBSC301**	**Course Type**	**Compulsory**
Prerequisite	**MATH201**	**L – T – P**	**3 – 1 – 0**
Stream	**Basic Science**	**Credits**	**4**

Course Objectives:

1. To provide in depth knowledge of complex numbers
2. To find the solution of differential equations
3. To find an in-depth knowledge of Fourier series analysis of periodic function

Course Outcomes:

After learning the course the students should be able:

1. To develop an ability to use characteristics of complex numbers in problem pertaining to electric circuits
2. To develop an acquaintance with the method of finding solution of differential equations
3. To develop an in depth knowledge of vector differentiation and vector integration
4. To develop Fourier series expansion of different periodic functions

Course Content:

UNIT I

Laplace Transform

Definition – conditions for existence ; Transforms of elementary functions ; Properties of Laplace transforms - Linearity property, first shifting property, second shifting property, transforms of functions multiplied by t^n, scale change property, transforms of functions divided by t, transforms of integral of functions, transforms of derivatives ; Evaluation of integrals by using Laplace transform ; Transforms of some special functions- periodic function, Heaviside-unit step function, Dirac delta function.

UNIT II

Inverse Laplace Transform

Introductory remarks ; Inverse transforms of some elementary functions ; General methods of finding inverse transforms ; Partial fraction method and Convolution Theorem for finding inverse Laplace transforms ; Applications to find the solutions of linear differential equations and simultaneous linear differential equations with constant coefficients.

UNIT III

Fourier Transform

Definitions – integral transforms ; Fourier integral theorem (without proof) ; Fourier sine and cosine integrals ; Complex form of Fourier integrals ; Fourier sine and cosine transforms ; Properties of Fourier transforms ; Parseval's identity for Fourier Transforms.

UNIT IV

Partial Differential Equations and Their Applications

Formation of Partial differential equations by eliminating arbitrary constants and functions; Equations solvable by direct integration; Linear equations of first order (Lagrange's linear equations); Method of separation of variables – applications to find solutions of one dimensional heat flow equation $\left(\frac{\partial u}{\partial t}=c^2\frac{\partial^2 u}{\partial x^2}\right)$, and two dimensional heat flow equation (i.e. Laplace equation : $\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial y^2}=0$).

UNIT V

Functions of Complex Variables (Differential calculus)

Limit and continuity of f(z); Derivative of f(z) ; Analytic functions; Cauchy- Riemann equations in Cartesian and polar forms; Harmonic functions in Cartesian form; Mapping: Translation, magnification and rotation, inversion and reflection , bilinear transformation; Conformal mapping.

UNIT VI

Functions of Complex Variables (Integral calculus)

Cauchy's integral theorem; Cauchy's integral formula; Residues; Cauchy's residue theorem (All theorems without proofs).

Text Books:

1. B. S. Grewal, ***"Higher Engineering Mathematics"***, Khanna Publishers, New Delhi.
2. H. K. Das, Er. RajnishVerma, ***"Higher Engineering Mathematics"***, S. Chand & CO. Pvt. Ltd., New Delhi.
3. Dr. B. B. Singh, **"A course in Engineering Mathematics (Volume-III)"**, Synergy Knowledge ware, Mumbai.
4. B. V. Ramana, ***"Higher Engineering Mathematics"***, Tata McGraw-Hill Publications, New Delhi.

Reference Books:

1. Erwin Kreyszig, ***"Advanced Engineering Mathematics"***, John Wiley & Sons, New York.
2. Peter O' Neil, ***"A Text Book of Engineering Mathematics"***, Thomson Asia Pvt. Ltd., Singapore.
3. C. R. Wylie, L. C. Barrett, ***"Advanced Engineering Mathematics"***, Tata McGraw-Hill Publishing Company Ltd., New Delhi.
4. C. R. Wylie & L. C. Barrett, ***"Integral Transforms and their Engineering Applications"***, Synergy Knowledge ware, Mumbai.
5. I. N. Sneddon, ***"Integral Transforms"***, Tata McGraw-Hill, New York.

General Instructions:

1. The tutorial classes in Engineering Mathematics-III are to be conducted batch wise. 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.

Course Title:	**Switching Theory and Logic Design**	**Semester III**	
Course Code	**BTESC302**	**Course Type**	**Compulsory**
Prerequisite	**Nil**	**L – T – P**	**2 – 1 – 0**
Stream	**Core**	**Credits**	**3**

Course Objectives:

1. To learn numbering systems used in digital world and its representation, arithmetic operations, error detection and correction methods.
2. To learn Boolean algebra, logic gates, logic families, realization of Boolean expressions and minimization techniques.
3. To study the sequential logic circuits design used in synchronous and asynchronous modes.
4. To describe various programmable logic devices.

Course Outcomes:

After learning the course the students should be able to:

1. Illustrate theory of Boolean algebra and the underlying features of various numbering systems.
2. Design various combinational & sequential logic circuits.
3. Demonstrate working of flip-flop.

Course Content:

UNIT I

Number Systems and Codes: Number systems: Binary, Octal, Hexadecimal number systems, Binary arithmetic, Codes: Binary code, Excess-3 code, Gray code, Error detection and correction codes.

UNIT II

Boolean algebra and Logic Functions: Boolean algebra: Postulates and theorems, Logic functions, Minimization of Boolean functions using algebra, Karnaugh map and Quine – McClusky methods, Realization using logic gates.

UNIT III

Classification of logic families, Characteristics of digital ICs- Speed of operation, power dissipation, figure of merit, fan in, fan out, current and voltage parameters, noise immunity, operating temperatures and power supply requirements, TTL logic, Operation of TTL NAND gate, active pull up, wired AND, open collector output, unconnected inputs, Tri-State logic, CMOS logic, CMOS inverter, NAND, NOR gates, unconnected inputs, wired logic, open drain output, Interfacing CMOS and TTL.

UNIT IV

Combinational Functions: Realizing logical expressions using different logic gates, Design of combinational circuits using combinational IC's, Realization of adders and subtractors, Design of code converters, Comparators and decoders, Design of multiplexers, Demultiplexers.

UNIT V

Introduction to Sequential Circuits: Moore and mealy machines, Introduction to flip-flops like SR, JK, D and T with truth tables, Logic diagrams and timing relationships, Conversion of flip-flops, Excitation table, State tables, Realization of state stables.

UNIT VI

Programmable Logic Devices: Semiconductor memories, RAM, ROM, EPROM, EEPROM, NVRAM, SRAM, DRAM, PLA, PAL, Memory System design.

Text Books:

1. M. M. Mano, ***"Digital Logic and Computer Design"***, Prentice Hall of India Publication, 4th Edition, 2006.
2. R.P. Jain, ***"Modern Digital Electronics"***, Tata McGraw Hill Publication, 4th Edition, 2010.

Reference Books:

1. D. P. Leach, A. P. Malvino, G. Saha, ***"Digital Principles and Applications"***, Tata McGraw Hill Publication, 8th Edition, 1993.
2. Comer, ***"Digital Logic & State Machine Design"***, Oxford Universities Press, 3rd Edition, 2014.

Course Title:	**Object Oriented Paradigm with C++**	**Semester III**	
Course Code	**BTITC303**	**Course Type**	**Compulsory**
Prerequisite	**ICT106**	**L – T – P**	**2 – 1 – 0**
Stream	**Core**	**Credits**	**3**

Course Objectives:

1. This course focuses on principles of object oriented programming paradigm. The course also includes practice of writing programs in C++ and Java

Course Outcomes:

After learning the course, the students should be able:

1. To draw the control flow of a program.
2. To understand the storage concepts in a simple program.
3. To program using basic concepts of OO languages i.e. objects, encapsulation, data hiding etc.
4. To program using advanced concepts of OO languages i.e. associations, packages, interfaces, exception handling etc.
5. To work with functional, Logic programming paradigms.

Course Content:

UNIT I

Elements of computer systems, DOS commands and Linux environment, Language processors, Algorithms, Flowcharts, Object-Oriented Programming Paradigm: Benefits, Applications, Object-Oriented Systems Development, Object-Oriented Analysis: Static and dynamic modeling, Object-Oriented Design: Class design and algorithm.

UNIT II

Beginning with C++: Tokens, Data types, Operators, Expressions, and Control structures, Array, Functions, Structures and Unions, Class and Objects, specifying a class, Defining member functions, Private member functions, Static data and member functions, Arrays of objects, Friend functions.

UNIT III

Constructors and Destructors: Constructor, Parameterized constructors, Multiple constructors in a class, Copy constructors, Dynamic constructors, Destructor. Programming for class diagram and relationship.

UNIT IV

Inheritance: Single inheritance, Multilevel inheritance, Multiple inheritance, Hierarchical inheritance, Hybrid inheritance, Virtual base classes, Abstract classes.

UNIT V

Polymorphism: Operator overloading, Function overloading, Virtual functions, pure virtual functions, Abstract class, Working with Files: Classes for file stream operations and I/O stream operation, Opening and closing a file, Detecting end-of-file, More about Open(): File Modes, Sequential input and output operations.

UNIT VI

Exception Handling: Fundamentals, Types of exceptions, Catching exceptions, Multiple catching, Nested try statements, Uncaught exceptions, Throw and throws, Built-in exceptions, Creating exception subclasses, Using exceptions.

Text Books:

1. Robert Lafore, ***"Object Oriented Programming in C++"***, Pearson Education, 4th Edition, 2008.
2. E. Balagurusamy, ***"Object Oriented Programming with C++"***, Tata McGraw Hill Publication, 6th Edition, 2013.

Reference Books:

1. J. R. Hubbard, ***"Programming with C++: Schaum's Outlines"***, Tata McGraw-Hill publication, 2005.
2. P. J. Deitel, H.M.Deitel, ***"C++ How to Program"***, Pearson Education, 9th Edition, 2016.

Course Title:	**Computer Architecture and Organization**	**Semester III**	
Course Code	**BTCOC304**	**Course Type**	**Compulsory**
Prerequisite	**Nil**	**L – T – P**	**2 – 1 – 0**
Stream	**Core**	**Credits**	**3**

Course Objectives:

1. To understand the structure, functions and characteristics of computer systems.
2. To learn basics of Parallel Computer Architecture.
3. To study hierarchical memory system including cache memories and virtual memory.
4. To identify input / output devices and their data transfer mechanism.

Course Outcomes:

After learning the course, the students should be able:

1. To identify components of a computer system, including CPU, memory, and input/output units.
2. To explain instruction types, its execution and interrupt mechanism.
3. To illustrate numerical and character representations in digital logic and floating point arithmetic.

Course Content:

UNIT I

Introduction: Concept of computer organization and architecture, Fundamental unit, Computer function and interconnection, CPU structure and function.

UNIT II

Instruction Sets: Characteristics, Types of operands, Types of operations, Assembly language, Addressing modes, Instruction format, Types of instruction, Instruction execution, Machine state and processor status, Structure of program, Introduction to RISC and CISC architecture.

UNIT III

Computer Arithmetic: The arithmetic and logic Unit, Integer representation, Integer arithmetic, Floating point representation, Floating point arithmetic, Introduction of arithmetic co-processor.

UNIT IV

Memory Organization: Internal Memory: Semiconductor main memory, Error correction, Advanced DRAM organization, Virtual memory systems and cache memory systems, External Memory: Organization and characteristics of magnetic disk, Magnetic tape, Optical memory, RAID, Memory controllers.

UNIT V

Control Unit: Control unit operation: Micro-operations, Control of the processor, Hardwired implementation, Micro-programmed Control Unit, Basic concepts, Micro-instruction sequencing, Micro-instruction execution, Applications of micro-programming.

UNIT VI

Input/ Output Organization: External devices, I/O module, Programmed I/O, Interrupt driven I/O, Direct memory access, I/O channels and processors, External interface.

Instruction pipe-lining: Concepts, Parallel processing: Multiple processor organization, Symmetric multiprocessor, Cache coherence and the MESI protocol.

Text Books:

1. William Stalling, ***"Computer Organization and Architecture: Designing for Performance"***, 8th Edition, Prentice Hall Publication, 2009.
2. Hayes, ***"Computer Architecture and Organization"***, 3rd Edition, McGraw-Hill Publication, 2012.
3. Zaky, ***"Computer Organization"***, 5th Edition, McGraw-Hill Publication, 2011.

Reference Books:

1. Morgan and Hennessy and Patterson, ***"Computer Architecture: A Quantitative Approach"***, 4th Edition, Kaufman Publication, 2007.
2. Morris Mano, ***"Computer System Architecture"***, 3rd Edition, Pearson Education India, 2007.
3. Mostafa Abd-El-Barr, Hesham El-Rewini, ***"Fundamentals of Computer Organization and Architecture"***, 1st Edition, Wiley Publication, 2004.
4. Miles J. Murdocca, Vincent P. Heuring, ***"Computer Architecture and Organization: An Integrated Approach"***, 1st Edition, Wiley Publication, 2007.

Course Title:	**Advanced Engineering Chemistry**	**Semester III**	
Course Code	**BTBSCOE305A**	**Course Type**	**Elective**
Prerequisite	**CHM103**	**L – T – P**	**1 – 1 – 0**
Stream	**Basic Science**	**Credits**	**2**

Course Objectives:

1. To introduce this subject of Advanced Engineering Chemistry.
2. To impart the basic and advanced knowledge to the students.
3. To understand, remember and capable to explain and apply this knowledge in the field of Engineering/ Technology.

Course Outcomes:

After learning the course, the students should be able:

1. To classify and explain various types of Corrosion and should apply methods to minimize the rate of Corrosion.
2. To apply concepts of Photochemical and Thermal reactions.
3. To explain basic concepts of Polymers, Polymerization.
4. To determine molecular weight of High-Polymer.
5. To apply the basic techniques in Chemistry and capable to explain concept of Solvent Extraction.
6. To explain concept of Thermo Gravimetric Analysis (TGA).

Course Content:

UNIT I

Corrosion and its Control:
Introduction, Fundamental reason, Electrochemical Corrosion, Direct Chemical Corrosion, Factors affecting the rate of corrosion, types of corrosion-Galvanic, Pitting Corrosion, Stress corrosion, methods to minimize the corrosion- Proper design, Cathodic and Anodic protection.

UNIT II

Photochemical and Thermal Reactions
Introduction, Laws of Photochemistry, Measurement of absorbed intensity, Quantum yield or efficiency, Jablonski Diagram, Photosynthesis reaction of Hydrogen Bromide, Brief discussion on Thermal Reactions- Cope Rearrangement.

UNIT III

Polymers
Introduction, Nomenclature of polymers, types of polymerisation, molecular weight determination by osmotic pressure and viscosity method. Plastic and its classification, Constituents of Plastic, Moulding of plastic by Injection method.

UNIT IV

Reaction Mechanism and Reaction Intermediates
Introduction of reaction mechanism, Brief introduction of reactivity of substrate (Inductive effect,

Mesomeric effect, Electromeric Effect, Hyperconjugative effect), Bond fission: Homolytic and Heterolytic bond fission, Reaction Intermediates: Carbocation(Structure, Stability and applications), Carbanion (Structure, Stability and applications).

Rearrangement reactions:

Intramolecular Rearrangement: Isomerisation, Beckmann Rearrangement, Benzidine Rearrangement
Intermolecular Rearrangement: Orton Rearrangement, Diazoamino Rearrangement

UNIT V

Spectroscopy

Brief introduction to spectroscopy, UV – Visible Spectroscopy: Laws of absorption, instrumentation and application. IR spectroscopy: introduction, theory, instrumentation and application. Brief discussion on NMR Spectroscopy, AAS (Atomic Absorption Spectroscopy)

UNIT VI

Instrumental Methods of Analysis

Introduction to Chromatography, Types of Chromatography (Adsorption and partition chromatography), Thin Layer Chromatography, Gas Chromatography – introduction, theory, instrumentation. Brief discussion of Thermo gravimetric analysis (TGA).

Text Books:

1. Bhal and Bhal, ***"Advance Organic Chemistry"***, S. Chand & Company, New Delhi, 1995.
2. Jain P.C & Jain Monica, ***"Engineering Chemistry"***, Dhanpat Rai & Sons, New Delhi, 1992.
3. Bhal & Tuli, ***"Text book of Physical Chemistry",*** S. Chand & Company, New Delhi, 1995.
4. Chatwal Anand, **"Instrumental Methods of Analysis"**, Himalaya Publication.
5. Rakesh K. Parashar, V.K. Ahluwalia, "***Text Book of Organic Chemistry***".

Reference Books:

1. Finar I.L., ***"Organic Chemistry (Vol. I & II)"***, Longman Gr. Ltd & English Language Book Society, London.
2. Barrow G.M., ***"Physical Chemistry"***, McGraw-Hill Publication, New Delhi.
3. Shikha Agarwal, ***"Engineering Chemistry- Fundamentals and Applications"***, Cambridge Publishers, 2015.
4. O. G. Palanna, ***"Engineering Chemistry"***, Tata McGraw-Hill Publication, New Delhi.
5. WILEY, ***"Engineering Chemistry"***, Wiley India, New Delhi, 2014.
6. Willard, Dean, Merrit, ***"Instrumental Methods of Analysis"***, McGraw - Hill.
7. Glasstone, ***"Physical Chemistry"***.
8. Peter Atkins, ***"Physical Chemistry"***, W.H. Freeman & Co. 9^{th} Edition, 2009.

Course Title:	**Interpersonal Communication Skills and Self Development for Engineers**	**Semester III**	
Course Code	**BTHSMCOE305B**	**Course Type**	**Elective**
Prerequisite	**HS202**	**L – T – P**	**1 – 1 – 0**
Stream	**Humanities, Social Science and Management**	**Credits**	**2**

Course Objectives:

1. To build the skills like team building so that they can work efficiently in groups.
2. To provide knowledge of conflict management while working in large organizations.
3. To develop management skills required in routine work environment.
4. To polish the personality of the learners in order to make them good leaders and employees.

Course Outcomes:

1. Learners will acquire interpersonal communication skills.
2. Learners will develop the ability to work independently.
3. Learners will develop the qualities like self-discipline, self-criticism and self-management.
4. Learners will have the qualities of time management and discipline.

UNIT I

Development of Proficiency in English

Speaking skills, Feedback & questioning technique, Objectivity in argument (Both one on one and in groups), 5 Ws & 1 H & 7 Cs for effective Communication, Imbibing Etiquettes and manners, Study of different pictorial expressions of non-verbal communication and their analysis

UNIT II

Self Management

Self Management, Self Evaluation, Self discipline, Self criticism, Recognition of one's own limits and deficiencies, dependency, etc.

Self Awareness, Self Management, Identifying one's strengths and weaknesses, Planning & Goal setting, Managing self-emotions, ego, pride,- Leadership & Team Dynamics

UNIT III

Time Management Techniques

Practice by game playing and other learning strategies to achieve the set targets Time Management Concept, Attendance, Discipline & Punctuality, Acting in time, Quality /Productive time.

UNIT IV

Motivation/ Inspiration

Ability to shape and direct working methods according to self-defined criteria, Ability to think for oneself, Apply oneself to a task independently with self-motivation,

Motivation techniques: Motivation techniques based on needs and field situations

UNIT V

Interpersonal Skills Development

Positive Relationship, Positive Attitudes, Empathies: comprehending others' opinions, points of views, and face them with understanding, Mutuality, Trust, Emotional Bonding, Handling Situations (Interview), Importance of interpersonal skills

UNIT VI

Effective Computing Skills

Designing an effective Presentation: Contents, appearance, themes in a presentation, Tone and Language in a presentation, Role and Importance of different tools for effective presentation

Reference books:

1. Mitra, Barun, ***"Personality Development and Soft Skills"***, Oxford University Press, 2016.
2. Ramesh, Gopalswamy, ***"The Ace of Soft Skills: Attitude, Communication and Etiquette for Success"***, Pearson Education, 2013.
3. Covey, Stephen R., ***"Seven Habits of Highly Effective People: Powerful Lessons in Personal Change"***.
4. Osenberg Marshall B., ***"Nonviolent Communication: A Language of Life"***.

Course Title:	**Programming in Java**	**Semester III**	
Course Code	**BTITOE305C**	**Course Type**	**Elective**
Prerequisite	**ICT106**	**L – T – P**	**1 – 1 – 0**
Stream	**Professional Core**	**Credits**	**2**

Course Objectives:

1. Understand fundamentals of programming such as variables, conditional and iterative execution, methods, etc.
2. Understand fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries, etc.
3. Be able to use the Java SDK environment to create, debug and run simple Java programs.

Course Outcomes:

After learning the course, the students should be able to:

1. Know the structure and model of the Java programming language.
2. Use the Java programming language for various programming technologies.
3. Develop software in the Java programming language (application).

UNIT I

Introduction to Java

Fundamentals of Object-oriented Programming, Evolution of Java, Overview of Java Language: Data types in Java, Operators and expressions, Decision Making and Branching: Control Statements such as If Else, Do statement, For statement, The Else if ladder, Jumps in loops, Labelled loops, While repetition statement, Switch statement, Break and continue statement, Arrays, Strings and Vectors: Creating one dimensional and multidimensional array, Strings, Vectors, Wrapper classes, Enumerated types, Annotations.

UNIT II

Object Oriented Programming

Classes , Objects And Methods: Defining class , Methods, Creating objects , Accessing Class members, Static Methods , Finalize Methods, Visibility Control, Method overloading, Method Overriding, Recursion. Interfaces, Constructors and finalizes Methods.

UNIT III

Packages and Applet Programming

Java API Packages, Using System Packages, Naming conventions, Creating Packages and Jar Files, Accessing and using a package, Hiding Classes, Applet Programming.

UNIT IV

Multithreading

Creating threads, Extending Thread Class, Stopping and Blocking a thread, Life cycle of a thread, Using thread method, Thread exceptions, Implementing the Run able interface, Interthread communication.

Managing Errors and Exceptions: Types of errors, Exceptions, Syntax of exception handling code, Multiple catch statements, Throwing your own exception, Using exceptions for debugging.

UNIT V

Graphics Programming

The Graphics class, Lines and Rectangles, Circles, Arc and ellipses, Polygons, Drawing Bar charts, AWT Package and Swings.

UNIT VI

Managing Files & I/O Handling

Files and Streams, Stream classes, Byte Stream Classes , Character Stream Classes, Using Streams, Reading / writing bytes and characters , Interactive Input and Output, Other Stream classes.

Text Books

1. E. Balagurusamy, ***"Programming with Java – A Primer"***, Tata – McGraw-Hill Publication, 4th Edition, 2010.
2. Steven Holzner et al. ***"Java 2 Programming"***, Black Book, Dreamtech Press, 2009.

Reference Books

1. H.M. Deitel, P.J. Deitel, ***"Java - How to Program"***, PHI Publication, 6th Edition, 2005.
2. Bruce Eckel, ***"Thinking in Java"***, PHI Publication.
3. Patric Naughton, Michael Morrison, ***"The Java Handbook"***, McGraw Hill Publication.
4. Tim Lindholm, Frank Yellin, Bill Joy, Kathi Walrath, ***"The Java Virtual Machine Specification"***, Addison Wesley Publication.

Course Title:	**Introduction to Web Technology**	**Semester III**	
Course Code	**BTITOE305D**	**Course Type**	**Elective**
Prerequisite	**Nil**	**L – T – P**	**1 – 1– 0**
Stream	**Professional Core**	**Credits**	**2**

Course Objectives:

1. Overview of modern Web technologies.
2. To use different web scripting technology.
3. To understand web hosting, server type, debugging, and performance driven application development.
4. To understand user interface and awareness of real-world knowledge.

Course Outcomes:

1. To understand World Wide Web and latest trends in web-development.
2. Real world knowledge of design and development.
3. Design and development of web application with all industrial standards.
4. Awareness of web hosting, server type, debugging.

UNIT I

Introduction to World Wide Web, Features of web, HTTP, Web Servers, Introduction to Scripting Language, Browser, Integrated Development Environment.

UNIT II

HTML: Introduction to HTML, Basics of HTML, Formatting and fonts, Commenting code, HTML heading, Block element, Inline element, Comment, Attributes, Hyperlink, Lists, Tables, Images, Forms, Meta tags, Character entities, Frames sets.

UNIT III

Advance HTML: Overview and features of HTML5, Includes External File, Responsive Layout with Media Queries, Marquee, Semantic Tags, HTML Symbol, URL Encode, Cashing, Video Tags, Audio Tags, Image Maps.

UNIT IV

CSS: Introduction To CSS, Selector, Basic Syntax And Structure, Padding, Margin, Manipulating Texts, Display, Height, Width, Border, Color, Fonts, Positioning Using CSS, Overview And Features Of CSS3.

UNIT V

PHP: Introduction to PHP, Features of PHP, Basics of PHP, Syntax, Variable, Printing Output, Array, String, Function, Data types, Operator, Loops, Conditional Statement, Introduction To Advance PHP, Form Processing, Files, PHP Cookies, PHP Sessions, Constant, PHP Magic Function, PHP Global Variable, Error Handling, Exception, Connection with Database, Curd Operation in PHP.

UNIT VI

Web Hosting, Debugging and Unit Testing, Browser Compatibility.

Text Book

1. Snehal Joglekar, ***"HTML and CSS- Web Technologies"***, Nirali Prakashan, 2013.

Reference Books

1. Thomas Powell, ***"HTML & CSS: The Complete Reference"***, 5th Edition, McGraw Hill Publication.
2. Steven Holzner, ***"PHP: The Complete Reference"***, 1st Edition, McGraw Hill Publication.

Course Title:	**Basic Human Rights**	**Semester III**	
Course Code	**BTHM306**	**Course Type**	**Audit**
Prerequisite	**Nil**	**L – T – P**	**2 – 0 – 0**
Stream	**Humanities, Social Science and Management**	**Credits**	**Audit**

Course Objectives:

1. To work for ensuring that basic human rights are respected everywhere.
2. To cooperate to avoid compromising on human rights for economic or political expediency.
3. To recognize democratic institutions as a fundamental human right.
4. To work towards the sovereignty and self-determination of entities with historical, cultural and ecological identity.
5. To actively engage with the Government of India and other countries to promote human rights education.
6. To bring diplomatic and commercial pressures on regimes that violates human rights, to ensure that they respect the basic rights of their citizens.
7. To keep the interests of disempowered communities foremost in all dealings with countries in which human rights violations occur.
8. To develop a more distinctive and effective role for the International Court of Justice in the field of human rights.
9. To promote a culture for educating the citizenry that cultivation and promotion of human rights culture is the sine qua non for the smooth functioning of the organs of a democratic State and for the kind of development that results into overall development of the society.
10. To train the young men and women for facing the challenges of the pluralistic society and the rising conflicts and tensions in the name of particularistic loyalties to caste, religion, region and culture.
11. To study the effect of draconian laws and unlawful use of State’s machinery and force by the enforcement agencies.

Course Outcomes:

After learning the course, the students should be able to:

1. Appreciate the importance of the values of human rights.
2. Strengthen respect for human rights and fundamental freedoms and respect others caste, religion, region and culture.
3. Know about regional, national, state, and local law that reinforces international human rights law.
4. Understand being able to use global, regional, national, and local human rights instruments and mechanisms for the protection of human rights.
5. Be aware of rights as Indian citizen.
6. Understand the importance of groups and communities in the society.
7. Realize the philosophical and cultural basis and historical perspectives of human rights.
8. Make students aware of their responsibilities towards the nation.

Course Content:

UNIT I

Introduction: Magna Carta, English bill of rights, American/French declaration, Universal declaration of human rights: Background, Content and relevance, Theories/Justification/Perspectives on Human Rights, Natural, Moral, Legal and human rights, Natural rights, Positivist, Liberal, Marxist, Feminist, Asian perspectives.

UNIT II

Debates: Universality of rights, Rights vs. duties, Individual vs. group rights, Civil and political rights vs. social, The notion of rights in various religious traditions (Hindu, Muslim, Buddhist traditions), Western Influence (especially the impact of the British rule), National freedom movement, The roles of Gandhi, Ambedkar and Nehru.

UNIT III

Constitutional provisions (especially fundamental rights vs. directive principles of state policy and emergency), Intergovernmental Organization, The United Nations (study of specific UN agencies related to human rights), Regional instruments.

UNIT IV

International NGO - Amnesty international: It's working and impact on India, Case studies of selected national NGOs, Case studies of selected regional NGOs, The government: Role of some of its agencies including the army, Police and paramilitary forces.

UNIT V

National Human Rights Commission of India - Background, Structure and functioning, International humanitarian law, International refugee law, The judiciary including public interest litigation, The medical profession and human rights, The role of the media in human rights.

UNIT VI

Some Issues in Human Rights : Violence and terrorism, Women's rights, Child rights, Dalit rights, Minority rights, Tribal rights, Refugee rights, Capital punishment, Euthanasia, Rights of the elderly, Gay Rights.

Text Books

1. D. D. Basu, V. R. Manohar, B. P. Banerjee, S.A. Khan, ***"Introduction to the Constitution of India"***, 20th Edition, Lexis Nexis Butterworths publication, 2008.
2. A. R. Desai, ***"Violation of Democratic Rights in India"***, Bombay Popular Prakashan.

Reference Books:

1. M. Mohanty, P. N. Mukherji, O. Tornquist, ***"People's Rights: Social Movements and the State in the Third World"***, New Delhi, Sage Publications, 1998.
2. Nanda, P. Ved, J. R. Scarritt, G. W. Shepherd, ***"Global Human Rights: Public Policies Comparative Measures and NGO Strategies"***, Boulder Westview Press Inc., 1981.
3. Nirmal, J. Chiranjivi, ***"Human Rights in India: Historical, Social and Political Perspectives"***, New Delhi, Oxford University Press, 2000.
4. Kothari, Smitu, Harsh Sethi, ***"Rethinking Human Rights: Challenges for Theory and Action"***, Lokayan, Delhi, 1991.
5. A. J. M. Milne, ***"Human Rights and Human Diversity: An Essay in the Philosophy of Human Rights"***, New York State University of New York Press, 1986.

Course Title:	**Switching Theory and Logic Design Lab**	**Semester III**	
Course Code	**BTESCL307**	**Course Type**	**Compulsory**
Prerequisite	**Nil**	**L – T – P**	**0 – 0 – 2**
Stream	**Core**	**Credits**	**1**

Lab Experiments Objective:

1. Implement Flip-Flops, Multiplexer and De-multiplexer, Counters and arithmetic operations

Lab Experiments List:

1. Study of basic and Universal gates
2. Implementation of Boolean functions using Gates
3. Implementation of following code conversions:
    a) Binary to gray
    b) Gray to binary
    c) Excess –3 to BCD
    d) BCD to Excess –3.
4. Implementation of half adder, full adder
5. Implementation of half subtractor, full subtractor
6. Implementation of K-map examples
7. Implementation of Quine- McClusky examples
8. Implementation of Multiplexer and Demultiplexer
9. Implementation of BCD adder using 4 bit adder IC
10. Study of flip flops:
    a) RS flip-flop
    b) D flip-flop
    c) T flip-flop
    d) J-K flip-flop

Course Title:	**Object Oriented Paradigm with C++ Lab**	**Semester III**	
Course Code	**BTITL308**	**Course Type**	**Compulsory**
Prerequisite	**Nil**	**L – T – P**	**0 – 0 – 4**
Stream	**Core**	**Credits**	**2**

Lab Experiments Objective:

1. Programming using C++

Lab Experiments List:

1. Raising a number n to a power p is the same as multiplying n by itself p times. Write a function called power () that takes a double value for n and an int value for p, and returns the result as double value. Use a default argument of 2 for p, so that if this argument is omitted, the number will be squared. Write a main () function that gets values from the user to test this function.

2. A point on the two-dimensional plane can be represented by two numbers: an X coordinate and a Y coordinate. For example, (4,5) represents point 4 units to the right of the origin along the X axis and 5 units up the Y axis. The sum of two points can be defined as a new point whose X coordinate is the sum of the X coordinates of the points and whose Y coordinate is the sum of their Y coordinates. Write a program that uses a structure called point to model a point. Define three points, and have the user input values to two of them. Then set the third point equal to the sum of the other two, and display the value of the new point. Interaction with the program might look like this:

   Enter coordinates for P1: 3 4
   Enter coordinates for P2: 5 7
   Coordinates of P1 + P2 are: 8, 11

   Create the equivalent of a four-function calculator. The program should request the user to enter a number, an operator, and another number. It should then carry out the specified arithmetical operation: adding, subtracting, multiplying, or dividing the two numbers. (It should use a switch statement to select the operation). Finally, it should display the result. When it finishes the calculation, the program should ask if the user wants to do another calculation. The response can be Y or N. Some sample interaction with the program might look like this:

   Enter first number, operator, second number: 10/ 3
   Answer = 3.333333
   Do another (Y/ N)? Y
   Enter first number, operator, second number 12 + 100
   Answer = 112
   Do another (Y/ N)? N

3. A phone number, such as (212) 767-8900, can be thought of as having three parts: the area code (212), the exchange (767) and the number (8900). Write a program that uses a structure to store

these three parts of a phone number separately. Call the structure phone. Create two structure variables of type phone. Initialize one, and have the user input a number for the other one. Then display both numbers. The interchange might look like this:

Enter your area code, exchange, and number: 415 555 1212

My number is (212) 767-8900

Your number is (415) 555-1212

Create two classes DM and DB which store the value of distances. DM stores distances in meters and centimeters and DB in feet and inches. Write a program that can read values for the class objects and add one object of DM with another object of DB. Use a friend function to carry out the addition operation. The object that stores the results maybe a DM object or DB object, depending on the units in which the results are required. The display should be in the format of feet and inches or meters and centimeters depending on the object on display.

4. Create a class rational which represents a numerical value by two double values- NUMERATOR and DENOMINATOR. Include the following public member Functions: constructor with no arguments (de-fault), constructor with two arguments, void reduce () that reduces the rational number by eliminating the highest common factor between the numerator and denominator.

   Overload + operator to add two rational numbers

   Overload - operator to enable input through cin

   Overload * operator to enable output through cout

   Write a main ( ) to test all the functions in the class.

5. Consider the following class definition:

```
class father {
protected age;
public;
father (int x) {age = x;}
virtual void iam()
{
cout<<“I AM THE FATHER ” ;
cout << “My age is : ” <<age<< endl;}
};
```

   Derive the two classes son and daughter from the above class and for each, define iam () to write similar but appropriate messages. You should also define suitable constructors for these classes. Now, write a main() that creates objects of the three classes and then calls iam ( ) for them. Declare pointer to father. Successively, assign addresses of objects of the two derived classes to this pointer and in each case, call iam () through the pointer to demonstrate polymorphism in action.

6. Write a program that creates a binary file by reading the data for the students from the terminal. The data of each student consist of roll number, name (a string of 30 or lesser number of characters) and marks.

7. A hospital wants to create a database regarding its indoor patients. The information to store include

Name of the patient
Date of admission
Disease
Date of discharge

Create a structure to store the date (year, month and date as its members). Create a base class to store the above information. The member function should include functions to enter information and display a list of all the patients in the database. Create a derived class to store the age of the patients. List the information about all the patients to store the age of the patients. List the information about all the pediatric patients (less than twelve years in age).

8. Imagine a tollbooth with a class called toll Booth. The two data items are a type Unsigned Int to hold the total number of cars, and a type double to hold the total amount of money collected. A constructor initializes both these to 0. A member function called payingCar ( ) increments the car total and adds 0.50 to the cash total. Another function called nopayCar( ), increments the car total but adds nothing to the cash total. Finally, a member function called display() displays the two totals i.e. total cars and total cash. Include a program to test this class. This program should allow the user to push one key to count a paying car, and another to count a nonpaying car. Pushing the ESC key should cause the program to print out the total cars and total cash and then exit.

Course Title:	**Programming Lab (Python)**	**Semester III**	
Course Code	**BTITL309**	**Course Type**	**Compulsory**
Prerequisite	**Nil**	**L – T – P**	**0 – 0 – 4**
Stream	**Core**	**Credits**	**2**

Lab Experiments Objective:

1. To learn Python programming

Lab Experiments List:

1. Program to find the union of two lists.
2. Program to find the intersection of two lists.
3. Program to remove the “i” th occurrence of the given word in a list where words repeat.
4. Program to remove all tuples in a list of tuples with the USN outside the given range.
5. Program to count the occurrences of each word in a given string sentence.
6. Program to check if a substring is present in a given string.
7. Program to map two lists into a dictionary.
8. Program to count the frequency of words appearing in a string using a dictionary.
9. Program to create a dictionary with key as first character and value as words starting with that character.
10. Program to find the length of a list using recursion.
11. Program to read a file and capitalize the first letter of every word in the file.
12. Program to read the contents of a file in reverse order.
13. Program to create a class in which one method accepts a string from the user and another prints it.
14. Program to create a class and get all possible subsets from a set of distinct integers.

Course Title:	**Advanced Engineering Chemistry Lab**	**Semester III**	
Course Code	**BTITOEL310**	**Course Type**	**Elective**
Prerequisite	**Nil**	**L – T – P**	**0 – 0 – 2**
Stream	**Basic Science**	**Credits**	**1**

List of Experiments: (Perform any 8 – 9 Experiments)

1. To determine λmax of given solutions.
2. To Verify Beer's Lambert's law.
3. Experiments on Paper and Thin Layer Chromatography. (two experiments)
4. Determination of rate of corrosion of metal.
5. Experiments related with Organic Chemistry. (three experiments)
6. Experiments on pH metry.
7. Experiments on Conductometry.
8. Experiments on Flame Photometry.
9. Experiments on Solvent Extraction.
10. Estimation of Metals from Solution/ Alloys. (two experiments)
11. Synthesis of materials by various techniques. (two experiments)

Reference Books:

1. A. Sethi, "***Systematic experiments in Chemistry***", New Age International Publication, New Delhi.
2. A. I. Vogel, "***Practical Inorganic Chemistry"***, ELBS Publication.
3. S. S. Dara, ***"Practical in Engineering Chemistry"***.
4. A. I. Vogel, "***Practical Organic Chemistry***", ELBS Publication.

Course Title:	**Interpersonal Communication Skills and Self Development for Engineers Lab**	**Semester III**	
Course Code	**BTITOEL310**	**Course Type**	**Elective**
Prerequisite	**Nil**	**L – T – P**	**0 – 0 – 2**
Stream	**Humanities, Social Science and Management**	**Credits**	**1**

List of Experiments:

1. General etiquettes and manners
2. Team building and group dynamics
3. Presentation Skills
4. Conducting meetings
5. Leadership Development
6. Skills in dealing with difficult people/situations
7. Persuasive writing
8. Negotiation skills
9. Conflict Resolution
10. Y-O-U-R-N-M-A-M-E Activity

Course Title:	**Programming in Java Lab**	**Semester III**	
Course Code	**BTITOEL310C**	**Course Type**	**Elective**
Prerequisite	**Nil**	**L – T – P**	**0 – 0 – 2**
Stream	**Professional Core**	**Credits**	**1**

Lab Experiments Objective:

1. To learn Java Programming

Lab Experiment Lists:

1. To create simple application to access data base using JDBC.
2. To read and write the files.
3. To implement polymorphism and method overriding in java.
4. To write programs implementing exception handling.
5. To write programs to illustrate interfaces in java.
6. To write programs to create package in java.
7. To design multi threaded programs in java.
8. To write programs to manipulate strings.
9. To write programs to draw various shapes using java applets.

Course Title:	**Introduction to Web Technology Lab**	**Semester III**	
Course Code	**BTITOEL310D**	**Course Type**	**Elective**
Prerequisite	**Nil**	**L – T – P**	**0 – 0 – 2**
Stream	**Professional Core**	**Credits**	**1**

Lab Experiments List:

1. Download XAMPP or WAMPP server, IDE, browsers to run HTML program
2. Develop page to display fruits list with different color with heading on top of the page and link each fruit with fruit description page
3. Develop using semantic element, page having menu bar in header section
4. Develop user personal info form using HTML5 input control and decorate with CSS
5. Develop responsive page layout using media queries
6. Write a PHP program to print list of user info using array
7. Write a PHP program to fetch user info from MYSQL database
8. Write a PHP program to perform crud operation
9. Write a PHP function to check palindrome string
10. Write a PHP program using for loop to add all the integers between 0 and 30 and display the total
11. Create a script to construct the pyramid of asterisk ('*') using nested for loop
12. Write a program to calculate factorial of a number using for loop
13. Write a program which will count the specific characters in the text
14. Debug web site using developer tools, inspect element

Course Title:	**Microprocessors and Microcontrollers**	**Semester IV**	
Course Code	**BTITC401**	**Course Type**	**Compulsory**
Prerequisite	**BTCOC304**	**L – T – P**	**2– 1 – 0**
Stream	**Core**	**Credits**	**3**

Course Objectives:

1. To understand 8086 microprocessor Architecture.
2. To understand design aspects of I/O and Memory Interfacing circuits.
3. To acquaint with instruction set and logic required to build assembly language programs.
4. To learn micro-controller architecture, its instruction set and interfaces.

Course Outcomes:

After learning the course the students should be able:

1. To design and implement programs on 8086 microprocessor.
2. To design I/O circuits and Memory Interfacing circuits.
3. To exhibit knowhow on micro-controller interfaces & programming.
4. To experiment with MCS51 and PIC18 micro-controller.

Course Content:

UNIT I

Intel 8086/8088 Microprocessor Family: Architecture and organization of 8086/8088 microprocessor family, Instruction set, Assembly language programming, Introduction to mixed language programming using C and Assembly language, 8086 family minimum and maximum mode operation, Timing diagram for 8086 family, Detailed study of maximum mode connection: Study of 8288 bus controller, 8086 interrupt structure.

UNIT II

8086 Instruction Set and Programming: Addressing modes, Instruction Set, ALP, Mixed language programming, Stacks, Strings, Procedures, Macros, Timers, Counters and delay, Programming examples using DOS and BIOS Interrupts, Device drivers programming.

UNIT III

8086 Interrupt System: 8086 Interrupt structure, Types and applications: Study of Interrupt Controller 8259A and Interrupt Priority Management using 8259A.

UNIT IV

Memory System Design and I/O Interfacing: Interfacing SRAM, ROM and DRAM to 8086, Address decoding and Timing Considerations, I/O interfacing in 8086: Serial communication interface includes Synchronous and Asynchronous, Protocols, Parallel communication interface includes I/O Mapped I/O, Memory Mapped I/O, and Handshaking Signals, 8087 Math Co-processor: Study of architecture of 8087, Floating point coprocessor, Data types supported by 8087, Host and coprocessor interface, Assembly language Programming for 8086 - 8087 based systems.

UNIT V

Intel MCS 51 Family: Introduction to Single chip microcontrollers of Intel MCS 51 family, Architectural and operational features, Instruction set, CPU timing and machine cycles, Interrupt structure and priorities, Internal Timer / counters, Serial interface, Connection of external memory, Power saving modes, Interfacing of 8051 with EPROM, Programming for EPROM versions, 8051 variation.

UNIT VI

Introduction to the PIC18 Microcontroller: Overview of the PIC18 MCU, The PIC18 Memory Organization, The PIC18 CPU Register, The PIC18 Pipelining, PIC18 Instruction Format, Addressing Modes, A Sample of PIC18 Instruction, Overview of the 8-Bit MCU Market.

Text Books:

1. Douglas Hall, ***"Microprocessors and Interfacing: Programming and Hardware"***, Tata McGraw-Hill, 2nd Edition.
2. Han-Way Huan, ***"An Introduction to Software and Hardware Interfacing"***, Delmar Cengage Learning, 2nd Edition, 2006.

Reference Books:

1. Peter Norton, ***"IBM PC, Assembly Language programming"***, BPB publication.
2. John Uffenback, ***"8086/8088 Interfacing, Programming and Design"***, Prentice Hall of India Publication.
3. A. K. Ray, K. M. Bhurchandi, ***"Advanced Microprocessors and Peripherals"***, Tata McGraw Hill, 2000.
4. John Uffenback**, *"8086/8088 Interfacing, Programming and Design",*** Prentice Hall of India Publication.

Course Title:	**Data Structures and Applications**	**Semester IV**	
Course Code	**BTITC402**	**Course Type**	**Compulsory**
Prerequisite	**BTITC303**	**L – T – P**	**3 – 1 – 0**
Stream	**Core**	**Credits**	**4**

Course Objectives:

1. To assess how the choice of data structures and algorithm design methods affects the performance of programs.
2. To choose the appropriate data structure and algorithm design method for a specified application.
3. To solve problems using data structures such as linear lists, stacks, queues, hash tables, binary trees, heaps, tournament trees, binary search trees, and graphs and writing programs for these solutions.
4. To solve problems using algorithm design methods such as the greedy method, divide and conquer, dynamic programming, backtracking, branch and bound and writing programs for these solutions.

Course Outcomes:

After learning the course, the students should be able:

1. To write neat code by selecting appropriate data structure and demonstrate a working solution for a given problem.
2. To think of all possible inputs to an application and handle all possible errors properly.
3. To analyze clearly different possible solutions to a program and select the most efficient one.
4. To write an application requiring an effort of at least 1000 lines of code to demonstrate a good working solution.
5. To demonstrate the ability to write reusable code and abstract data types in C, using object-based way of thinking.

Course Content:

UNIT I

Introduction to Data Structures and Analysis of Algorithms: Need of data structures, Types of data structures, Recursion, ADT (Abstract Data Types), Basics of algorithm, Analysis of algorithm through time complexity and space complexity, Asymptotic notations, Pseudo code analysis, Recurrence relations and solving recurrences using substitution, Recursion tree and master method.

UNIT II

Stack and Queue: Stack: Representation, Stack operation, Application. Queue: Representation, Queue operation, Circular and priority queue, Applications.

UNIT III

Linked list: Operation on linked list, Linked stacks and Queues, Array implementation of linked list, Linked list using dynamic variable, doubly linked list, Circular linked list.

UNIT IV

Binary Tree: Basic tree concept, Binary tree operations, Binary tree representation, Binary tree traversals, Binary search tree and operations, Balanced tree: AVL trees and operations, Applications of binary trees, implementing priority queue using binary heap data structure.

UNIT V

Graphs: Basics concepts of graphs, Representation of graphs, Graph traversals BFS and DFS, Minimum spanning tree algorithms: Kruskal's algorithm and Prim's algorithm, Applications of graphs.

UNIT VI

Searching Techniques and Hashing: Linear search and binary search, Hashing: Direct-address tables, Hash tables, Open addressing, Perfect Hashing, Sorting techniques: Various sorting methods and their time complexity analysis: Insertion sort, Selection sort, Merge sort, Quick sort, Heap sort.

Text Books:

1. E. Horowitz, D. Mehta, S. Sahni, ***"Fundamentals of Data Structures in C++"***, Silicon Press, 2nd Edition, 2008.
2. R.S. Bichkar, ***"Programming with C and Data structures"***, Universities Press, 1st Edition, 2014.

Reference Books:

1. Goodrich, Tamassia, "***Data Structures and Algorithm in Java***", Wiley publication, 6th Edition, 2014.
2. T. H. Cormen, C. E. Leiserson, R. L. Rivest, C. Stein, "***Introduction to Algorithms***", MIT Press, 3rd Edition, 2009.
3. Y. Langsam, M. J. Augenstein and A. M. Tanenbaum, "***Data structures using Java***", Pearson Education, 2003.
4. J. Murach, "***Murach's Java Programming***", Shroff Publishers, 4th Edition, 2012.
5. V. Goyal, L. Goyal, P. Kumar, "***A Simplified Approach to Data Structures***", Shroff Publishers, 1st Edition, 2014.

Course Title:	**Discrete Structures and Applications**	**Semester IV**	
Course Code	**BTITC403**	**Course Type**	**Compulsory**
Prerequisite	**Nil**	**L – T – P**	**2 – 1 – 0**
Stream	**Core**	**Credits**	**3**

Course Objectives:

1. To develop a foundation of set theory concepts, notation and applications.
2. To inculcate the habit of logical and mathematical thinking and its application to computer science and IT.
3. Understand logic, basic counting principles, relations, induction, sequences and summations.
4. To be able to present a coherent and mathematically accurate argument.
5. To understand the theory of graphs and algebraic structures and their applications.

Course Outcomes:

After learning the course the students should be able:

1. To perform operations on various discrete structures such as sets functions, relations, and sequences.
2. To solve problems using counting techniques, permutation and combination, recursion and generating functions
3. To construct and verify correctness of a Boolean expression using K-Maps and truth tables.
4. To use graphs as tools to visualize and simplify Problems.
5. To solve problems using algebraic structures (Rings, Monoids and Groups).

Course Content:

UNIT I

The Foundations: Sets theory and its applications sets, Set operations, Laws of set theory, Power sets, Partitions, Multi-sets, Cardinality, Principle of inclusion and exclusion, Algebra of sets and duality, Applications of sets: Problems on set operations and principle of inclusion-exclusion, Logics and proofs, Propositional logic, Propositional equivalences, Propositional algebra, Basic logical operations, De Morgan's laws, Predicates and quantifiers, Nested quantifiers, Rules of inference, Proof methods and strategy, Applications of logic: Translating English statements into propositions, Boolean searches in web pages, Bit operations.

UNIT II

Induction, Sequences and Summations: Induction and recursion: Mathematical induction, Strong induction, Recursive definitions, Re-cursive algorithms, Applications: Proofs using mathematical induction, Program correctness, Well formed formula, Functions, Sequences and summations, Definition and types of functions: Injective, subjective and bijective , Composition, Identity and inverse of function, Re-cursively defined functions, Applications of functions, Job scheduling problem, Countability of rational numbers.

UNIT III

Basic Counting Principles: Permutations, Combinations, Binomial coefficients, Generalized permutations and combinations, Combinations and permutations with repetition, Generating permutations and combinations, Recurrence relation, Solving linear recurrence relations with constant coefficients, Applications of counting principles, Pigeonhole principle and its applications.

Relations: Properties of binary relations, Closure of relations, Warshall's algorithm, Equivalence relations and partitions, Partial ordering relations and lattice application of relations: N-ary relations and their applications, Databases and relations.

UNIT V

Graph Theory: Basic terminology, Multi graphs and weighted graphs, Paths and circuits, Shortest path in weighted graph, Hamiltonian and Euler paths and circuits, Factors of a graph, Shortest path algorithm, Traveling salesman problem, Transport networks, Special types of graphs and applications: Job assignment, LAN, Interconnection networks for parallel computation, Mesh networks, Graph coloring and applications.

UNIT VI

Algebraic Structures: Algebraic systems, Groups, Semi groups, Monoid, Subgroups, Permutation groups, Codes and group codes, Isomorphism and automorphisms, Homomorphism, Fermat's little theorem, Polynomial rings, Applications of groups.

Text Books:

1. K. H. Rosen, ***"Discrete Mathematics and Its Applications"***, Tata McGraw Hill Publication, 7^{th} Edition, 2012.
2. J. P. Tremblay, R. Manohar, ***"Discrete Mathematical Structures with Applications to Computer Science"***, 1^{st} Edition, McGraw Hill Publication, 2001.

Reference Books:

1. B. Kolman, R. Busby, S. Ross, ***"Discrete Mathematical Structures"***, Pearson Education, 6^{th} Edition, 2009.
2. R. K. Bisht, H. S. Dhami, ***"Discrete Mathematics"***, Oxford University Press, 2015.

Course Title:	**Internetworking Protocols**	**Semester IV**	
Course Code	**BTITC404**	**Course Type**	**Compulsory**
Prerequisite	**Nil**	**L – T – P**	**2 – 1 – 0**
Stream	**Core**	**Credits**	**3**

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:

After learning the course, the students should be able:

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 Content:

UNIT I

Introduction and Underlying Technologies : ARPANET, Birth of the Internet, Transmission Control Protocol/Internetworking Protocol (TCP/IP) , MILNET , CSNET , NSFNET ,ANSNET, The Internet Today ,World Wide Web, Time Line, Growth of the Internet, Protocols and Standards, Standards Organizations: Internet Standards Internet Administration.

The OSI Model and the TCP/IP Protocol Suite:

Protocol Layers: Hierarchy Services, The OSI Model: Layered Architecture , Layer-to-Layer Communication, Encapsulation, Layers in the OSI Model, TCP/IP Protocol Suite: Comparison between OSI and TCP/IP Protocol Suite, Layers in the TCP/IP Protocol Suite, Addressing: Physical Addresses, Logical Addresses, Port Addresses, Application-Specific Addresses, Wired Local Area Networks: IEEE Standards, Frame Format, Addressing, Ethernet Evolution, Standard Ethernet, Fast Ethernet, Gigabit Ethernet, Ten-Gigabit Ethernet.

UNIT II

Wireless LANS: IEEE, MAC Sublayer, Addressing Mechanism, Bluetooth, Point-to-Point WANS, DSL Technology, Cable Modem, ATM, Connecting devices: Repeaters, Bridges and Routers.

Introduction to Network Layer: Switching: Packet Switching, Circuit Switching, Packet Switching at Network Layer, Network Layer Services, Other Network Layer Issues.

IPv4 Addresses, Address Space Notation, Range of Addresses, Operations, Classful Addressing: Classes, Classes And Blocks, Two-Level Addressing, Three-Level Addressing: Subnetting, Supernetting, Classless Addressing: Variable-Length Blocks, Two-Level Addressing, Block Allocation, Special Addresses: Special Blocks, Special Addresses in Each block, NAT, Address Translation, Translation Table.

UNIT III

Delivery and Forwarding of IP Packets: Delivery: Direct Delivery, Indirect Delivery, Forwarding: Forwarding Based on Destination Address, Forwarding Based on Label, Structure of a Router: Components.

Internet Protocol Version 4(IPv4): Datagrams, Fragmentation, Maximum Transfer Unit (MTU), Fields Related to Fragmentation, Options: Format, Option Types, Checksum: Checksum Calculation at the Sender, Checksum Calculation at the Receiver, Checksum in the IP Packet, IP PACKAGE : Header-Adding Module, Processing Module, Queues, Routing Table, Forwarding Module, MTU Table, Fragmentation Module, Reassembly Table, Reassembly Module

Address Resolution Protocol (ARP): Address Mapping: Static Mapping, Dynamic Mapping, The ARP Protocol: Packet Format, Encapsulation, Operation, Proxy ARP, ARP Package: Cache Table, Queues, Output Module, Input Module, Cache-Control Module.

UNIT IV

Internet Control Message Protocol (ICMP): Messages: Message Format, Error Reporting Messages, Query Messages, Checksum, Debugging Tools: Ping, Traceroute, ICMP Package: Input Module, Output Module.

Unicast Routing Protocols (RIP, OSPF, and BGP), Static versus Dynamic Routing Tables, Routing Protocol, Intra- And Inter-Domain Routing, Distance Vector Routing :Bellman-Ford Algorithm, Distance Vector Routing Algorithm, Count to Infinity, RIP: RIP Message Format, Requests and Responses Timers in RIP, RIP Version, Encapsulation , Link State Routing: Building Routing Tables, OSPF, Areas, Metric Types of Links, Graphical Representation OSPF Packets, Link State Update Packet, Other Packets, Encapsulation, Path Vector Routing: Reachability , Routing Tables, BGP: Types of Autonomous Systems, Path Attributes, BGP Sessions, External and Internal BGP, Types of Packets, Packet Format, Encapsulation.

UNIT V

Introduction to Transport Layer: Transport-Layer Services: Process-to-Process communication, Addressing: Port Numbers, Encapsulation and Decapsulation , Multiplexing and Demultiplexing, Flow Control, Error Control , Combination of Flow and Error Control, Congestion Control, Connectionless and Connection-Oriented Services.

User Datagram Protocol (UDP): User Datagram, UDP Services: Process-to-Process Communication, Connectionless Services, Flow Control, Error Control, Congestion Control, Encapsulation and Decapsulation, Queuing, Multiplexing and Demultiplexing, Comparison between UDP and Generic Simple Protocol, UDP Applications: UDP Features, Typical Applications, UDP Package: Control-Block Table, Input Queues, Control-Block Module, Input Module, Output Module.

UNIT VI

Transmission Control Protocol (TCP): TCP Services: Process-to-Process Communication, Stream Delivery Service, Full-Duplex Communication, Multiplexing and Demultiplexing, Connection-Oriented Service, Reliable Service. TCP Features: Numbering System, Flow Control, Error Control, Congestion Control, Segment: Format, Encapsulation, A TCP Connection: Connection Establishment, Data Transfer, Connection Termination, Connection Reset, State Transition Diagram, Scenarios ,Windows in TCP ,Send Window, Receive Window, Flow Control : Opening and Closing Windows, Shrinking of

Windows, Silly Window Syndrome, Error Control :Checksum, Acknowledgment, Retransmission, Out-of-Order Segments, Data Transfer in TCP, Some Scenarios, Congestion Control : Congestion Window, Congestion Policy, TCP Timers: Retransmission Timer, Persistence Timer, Keepalive Timer, Time-Wait Timer, TCP Package: Transmission Control Blocks (TCBs), Timers, Main Module, Input Processing Module, Output Processing Module.

Text Books:

1. Douglas E. Comer, ***"Internetworking with TCP/IP: Principles, Protocols and Architecture"***, Volume 1, 6th Edition, PHI publication, 2013.
2. Behrouz A. Forouzan, ***"TCP-IP Protocol Suite"***, 4th Edition, McGraw Hill publication, 2010.

Reference Books:

1. Comer, ***"Internetworking with TCP-IP"***, Volume 3, 5th Edition, Pearson publication, 2013.
2. W. Richard Stevens, ***"UNIX Network Programming: Interprocess Communications"***, Volume 2, 2nd Edition, PHI publication, 1999.
3. William Stalling, ***"SNMP, SNMPv2, SNMPv3, and RMON 1 and 2"***, 2nd Edition, Pearson education publication, 2001.
4. Hunt Craig, ***"TCP-IP Network Administration"***, 3rd Edition, O'Reilly publication, 2002.
5. Loshin, Harwurt, ***"TCP-IP Cleanly Explained"***, BPB publication.

Course Title:	**Physics of Engineering Materials**	**Semester III**	
Course Code	**BTBSCOE405A**	**Course Type**	**Elective**
Prerequisite	**PHY203**	**L – T – P**	**1 – 1 – 0**
Stream	**Basic Science**	**Credits**	**2**

Course Objectives:

1. To impart the basic and advanced knowledge to the students.
2. To understand, remember and capable to explain and apply this knowledge in the field of Engineering/ Technology.

Course Outcomes:

After learning the course, the students should be able:

1. To explain the concepts of Crystallography, X -rays, Conducting Materials, Magnetic Materials.

Course Content:

UNIT I

Crystallography: Crystal directions and planes, Diatomic Crystal (CsCl, NaCl, Diamond, BaTiO3) Crystal imperfection, Point defects, Line defects, Surface and Volume defects, Structure properties relationship, structure determination by X-ray diffraction.

UNIT II

Magnetic Materials: Origin of magnetization using atomic theory, classification of magnetic materials and properties, Langevin's theory of Dia, Para and ferromagnetism, Soft and Hard magnetic materials and their uses, Domain theory of ferromagnetism, Hysteresis loss, Ant ferromagnetic and Ferromagnetic materials, Ferrites and Garnets, magnetic bubbles, magnetic recording.

UNIT III

Conducting and Superconducting Materials: Band theory of solids, Classical free electron theory of metals, Quantum free electron theory, Density of energy states and carrier concentration, Fermi energy, Temperature and Fermi energy distribution, Superconductivity, Factor affecting Superconductivity, Meissner effect, Type-I and Type-II superconductors, BCS theory, Josephson effect, High temperature superconductors, Application of superconductors (Cryotron, magnetic levitation)

UNIT IV

Semiconducting Materials: Band structure of semiconductor, Charge carrier concentration, Fermi level and temperature, Electrical conductivity, Hall effect in semiconductors, P-N junction diode, Preparation of single crystals, LED, Photovoltaic Cell

UNIT V

Dielectric Materials: Dielectric constant and polarizability, types of polarization, temperature and frequency dependences of Dielectric parameter, internal fields in solids, Clausius-Mosotti equation, dielectric loss, dielectric breakdown, ferroelectric, pyroelectric and piezoelectric materials, applications of dielectric materials

UNIT VI

Nano Materials: Introduction and properties, synthesis of nanomaterials, Carbon Nano Tubes, Characterization techniques of nanomaterials- SEM, TEM, EDAX, FMR, XRD. Applications of nanomaterials.

Text Books:

1. C. Kittle, ***"Introduction to Solid state Physics"***.
2. C. M. Srivastava, C. Srinivasan, ***"Science of Engineering Materials and Carbon Nanotubes"***.
3. A. J. Dekker, ***"Solid State Physics"***.

Reference Books:

1. V. Raghavan, ***"Material Science and Engineering"***.
2. A. J. Dekker, ***"Electrical Engineering Materials"***.

Course Title:	**Organizational Behavior**	**Semester IV**	
Course Code	**BTHMOE405B**	**Course Type**	**Elective**
Pre-requisite	**Nil**	**L – T – P**	**2 – 1 – 0**
Stream	**Humanities, Social Science and Management**	**Credits**	**3**

Course Objectives:

1. To explore the organization as a micro-social system - a medium to facilitate and improve the interpersonal relationships in the context of organizational functioning.

Course Outcomes:

1. Students will become more self aware and will have identified areas of development for long term effectiveness.
2. Students will understand the role that individuals play collectively to perform in organizations.

Course Content:

UNIT I

Introduction to Organizational Behavior: Definition of organization and behavior, Historical Development of OB, Human relations movement, Impact of technology on organizational behavior.

Organizational Design: Key factors in organizational design, Types of organizational design, Need and significance of a sound organizational design, Organizational Structures - traditional and contemporary structures.

UNIT II

Organizational 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, Organizational Communication - Tool and Techniques, Johari window transactional analysis, Lateral thinking, Brain storming, Delphi technique, Power of grapevine and other informal communication techniques.

UNIT III

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 behavior, 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 IV

Foundations of Individual Behavior: Factors affecting individual behavior - personal, environmental and organizational, 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

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.

UNIT V

Work Related Attitudes, Values and Perception: Meaning and definitions, Factors influencing perception Social and Person perception, When perception fails, Perception and OB.

Organizational Outcomes: Power and Politics, Power - Dynamics, Sources and Tactics, Politics - Essence, Types of political activities, Ethics of power and politics.

UNIT VI

Conflicts and Negotiations, Nature of conflict, Functional and Dysfunctional conflict, Conflict resolution and negotiations, Managing conflict during change initiatives.

Stress: Meaning and definition, Work stress model, Sources of stress, Stress Management - Individual and organizational strategies, Impact of stress on performance.

Text books:

1. Uma Sekaran, ***"Organization Behaviors"***, McGraw Hill Company, New Delhi, 2011.
2. LM Prasad, ***"Organization Behavior"***, S. Chand and Co. Ltd, New Delhi, 2008.
3. Nair, Banerjee, Agarwal, ***"Organization Behavior"***, Prgathi Prakashan, New Delhi, 2006.

Reference books:

1. Rosy Joshi and Sashi K Gupta, ***"Organization Behaviors"***. Kalyani publishers, New Delhi, 2005.
2. S.S. Khanka, ***"Organization Behavior"***, S. Chand and Co. Ltd, New Delhi, 2008.
3. Fred Luthans, ***"Organizational Behavior",*** McGraw Hill Book Co., 2005.

Course Title:	**Development Engineering**	**Semester IV**	
Course Code	**BTXXOE405C**	**Course Type**	**Elective**
Pre-requisite	**Nil**	**L – T – P**	**2 – 1 – 0**
Stream	**Interdisciplinary**	**Credits**	**3**

Course Objectives:

1. Development Engineering prepares students to develop, pilot, and evaluate technological interventions designed to improve human and economic development within complex, low-resource settings.
2. Students can include topics related to the application of technology to address the needs of people living in poverty.

Course Outcomes:

After learning the course, the students should be able:

1. To understand the core disciplines issues in development.
2. To understand certifications.
3. To understand the planning of developing of rural areas.

Course Content:

UNIT I

Introduction to Development Engineering: Introduction to development engineering, need of development engineering, core disciplines and concept, major issues in development, urban development, rural development, socioeconomic development, scientific social research, formulation of research problem, field work and data collection, report drafting.

UNIT II

Design of Sustainable Communities: Concept and development of sustainable communities, Sustainable design principles, Building regulations, Codes and standards – ANSI, ASTM, ASHRAE, Approval process, Green buildings – green building techniques-energy solutions, Site solutions, Exterior and interior solutions, Certification – BREEAM, GRIHA, NAHB, LEED, IGBC.

UNIT III

Town/City Planning: Town Planning, History of town planning in India, Characteristics of city/town, Town planning at national, Regional and local levels, Planning standards, Master plan, Site layout and development, Zoning and density control, Green belt, Slum redevelopment, Smart city planning, Introduction to city planning, Infrastructure elements of smart city planning, Dimensions of smart cities global standards and performance benchmark, Smart solutions e-governance, Waste management, Water management, Energy management, Urban mobility, Citizen services, Other services such as telemedication and education, Trade facilitation, Skill development, GIS for Planning.

UNIT IV

Planning and Development of Rural Areas: District administration, District Planning, Introduction to various sectors of rural areas such as drinking water, Waste water treatment, Electricity, Public transport, Irrigation, Sanitation and cooking energy, Issues and challenges associated with these sectors, People's participation and role in development of rural areas, Various schemes and policies floated by state and central government – phases in the schemes; life cycle costing of these schemes.

UNIT V

GeoInformatics for Planning and Development: Introduction to GeoInformatics, Advantages, Benefits and limitations, Interdisciplinary applications, Data extraction, Use of GeoInformatics for planning, Mapping and preparation of layouts.

UNIT VI

Development aspects: Urban and Rural: Planning and designing of a model town / city and using Auto-CAD and/or GIS, Visit to a village or small town – The project will be carried out in groups, Problem faced by the villagers pertaining to various sectors or existing schemes, Define the need, method, Tools and techniques for development, Deliver technology based solution.

Text Books

1. Chand M. and Purr U.K., ***"Regional Planning in India"***, Allied Publisher, New Delhi, 1983.
2. Kaiser E. J., et.al, ***"Urban Land use Planning"***, 4th Edition Urbana, University of Illinois Press.
3. Sundaram K. V., ***"Geography Planning"***, Concept Publishing Co., New Delhi.
4. Ayyar C.P.V., ***"Town Planning in Early South India"***, Mittal Publications, Delhi.
5. Reeder, Hoboken, ***"Guide to green building rating systems"***, John Wiley and Sons Inc.
6. Longley, et.al, ***"Geographic Information Systems and Science"***, John Wiley and Sons, New York.
7. Desai V., ***"Rural Development of India"***, Himalaya Publishing House, Mumbai.
8. Rau S. K., ***"Global Search for Rural Development"***, NIRD, Hyderabad.

Reference Books:

1. Institute of Town Planners, India, Ministry of Urban Affairs and Employment, Government of India, New Delhi, UDPFI Guidelines, 1996.
2. Miles R. Simon, 1970, ***"Metropolitan Problems"***, Methuen Publications, Canada.
3. B.I.S., 1980, ***"National Building Code of India"***, ISI, New Delhi.
4. ANSI/ASHRAE/USGBC/IES Standard 189.1, Standard for the Design of High – Performance Green Buildings Except Low-Rise Residential Buildings.
5. ASHRAE Standard 90.1, Energy Standard for Buildings Except Low-Rise Residential Buildings.

Course Title:	**Product Design Engineering**	**Semester IV**	
Course Code	**BTXX406**	**Course Type**	**Compulsory**
Prerequisite	**Nil**	**L – T – P**	**2 – 0 – 0**
Stream	**Interdisciplinary**	**Credits**	**2**

Course Outcomes:

After completing this programme, participants will be able to:

1. Create simple mechanical designs.
2. Create documents for knowledge sharing.
3. Manage own work to meet requirements.
4. Work effectively with colleagues.
5. Maintain a healthy, safe and secure working environment.
6. Provide data/information in standard formats.
7. Develop their knowledge, skills and competence.

Course Content:

UNIT I

Creating simple products and modules Document Creation and Knowledge Sharing

UNIT II

Self and work Management

UNIT III

Team Work and Communication

UNIT IV

Managing Health and Safety

UNIT V

Data and Information Management

UNIT VI

Learning and Self Development

Course Title:	**Microprocessors and Microcontrollers Lab**	**Semester IV**	
Course Code	**BTITL407**	**Course Type**	**Compulsory**
Prerequisite	**Nil**	**L – T – P**	**0 – 0 – 2**
Stream	**Core**	**Credits**	**1**

Lab Experiments Objective:

1. To learn assembly language.
2. To program microprocessor and microcontroller for arithmetic operations.
3. To interface microprocessor and microcontroller with I/O devices.

Lab Experiments List:

1. 8085 and 8086 kit familiarization and basic experiments
2. Arithmetic operation of 16 bit binary numbers
3. Programming exercise: sorting, searching and string
4. Interfacing with A/D and D/A converters
5. Interfacing with stepper motors
6. Keyboard interfacing to 8086
7. 8255 interface to 8086
8. Assembly language programming of 8051
9. Timer programming of 8051, using interrupts
10. LCD interfacing to 8051 – project

Course Title:	**Data Structures and Applications Lab**	**Semester IV**	
Course Code	**BTITL408**	**Course Type**	**Compulsory**
Prerequisite	**BTITL308**	**L – T – P**	**0 – 0 – 4**
Stream	**Core**	**Credits**	**2**

Lab Experiments Objective:

1. To implement all linear and non-linear data structures in C++/Java.

Lab Experiments List:

1. To implement a character stack data type and use it to reverse a string
2. To implement an integer stack data type that grows on demand
3. To write a program using appropriate stacks for evaluating an infix expression with parenthesis
4. To write a program, using a queue data type, to simulate a bank where customers are served on a first-come-first-serve basis
5. To write one program for each of the following operations with singly linked lists:
   - Concatenate two linked list and create third one
   - Free all nodes in a linked list
   - Reverse a linked list

   Given two linked list, create a third list which is set-intersection of the elements in the two.
6. To delete every third element from the linked list
7. To copy a given linked list into another (new) list
8. To implement a queue using a doubly linked list
9. To write the following recursive functions for a singly-linked NULL-terminated list: insert(), traverse(), search()

Course Title:	**Internetworking Protocols Lab**	**Semester IV**	
Course Code	**BTITL409**	**Course Type**	**Compulsory**
Prerequisite	**Nil**	**L – T – P**	**0 – 0 – 2**
Stream	**Core**	**Credits**	**1**

Lab Experiments List:

1. Conversion of IP addresses
   (e.g. I/P: 10.24.164.254 O/P: 00001010.00011000.10000000.11111110 and I/P:binary dotted O/P: decimal dotted)
2. Introduction to Wireshark
3. Wireshark Lab: Ethernet and ARP
4. Wireshark Lab: IP
5. Wireshark Lab: ICMP, study of ping and traceroute command
6. Wireshark Lab: UDP
7. Wireshark Lab: TCP
8. Study of ftp, telnet tools and network configuration files
9. DHCP server configuration
10. Socket programming for UDP and TCP

Teaching and Evaluation Scheme Third Year B. Tech. (Information Technology)

Sr. No	Code	Course title	Weekly Teaching hours			Evaluation Scheme			Credit	Total Hours
			L	T	P	MSE	CA	ESE		
Semester V										
1	BTITC501	Database Management Systems	3	-	-	20	20	60	3	3
2	BTITC502	Design and Analysis of Algorithms	3	-	-	20	20	60	3	3
3	BTITC503	Software Engineering	3	-	-	20	20	60	3	3
4	BTITOE504	Open/Departmental Elective - Group 1	3	-	-	20	20	60	3	3
5	BTITSE505	Stream Elective - Group 1	3	-	-	20	20	60	3	3
6	BTITS506	Seminar	-	2	-	-	-	50	2	2
7	BTITL507	Programming Lab – Minor (R Programming)	-	-	2	-	25	25	1	2
8	BTHM508	Constitutions of India/ Essence of Indian Traditional Knowledge	-	-	-	-	-	-	-	Audit
9	BTITL509	Database Management Systems Lab	-	-	2	-	25	25	1	2
10	BTITL510	Design and Analysis of Algorithms Lab	-	-	2	-	25	25	1	2
Summary of Semester Assessment Marks, Credit & Hours			**15**	**2**	**6**	**100**	**175**	**425**	**20**	**23**
Semester VI										
1	BTITC601	Operating Systems	3	-	-	20	20	60	3	3
2	BTITC602	Compiler Construction	3	-	-	20	20	60	3	3
3	BTITC603	Object Oriented Software and Web Engineering	3	-	-	20	20	60	3	3
4	BTITOE604	Open/Departmental Elective Group 2	3	-	-	20	20	60	3	3
5	BTITSE605	Stream Elective - Group 2	3	-	-	20	20	60	3	3
6	BTITL606	Programming Lab – Major (Web Technologies)	-	-	4		25	25	2	4
7	BTITL607	Operating Systems Lab	-	-	2	-	25	25	1	2
8	BTITL608	Object Oriented Software and Web Engineering Lab	-	-	2	-	25	25	1	2
9	BTITSEL609	Departmental Elective - Group 2 Lab	-	-	2	-	25	25	1	2
Summary of Semester Assessment Marks, Credit & Hours			**15**	**-**	**10**	**100**	**200**	**400**	**20**	**25**

List of Open/Departmental Electives – Group 1

Sr. No.	Course Code	Title of the Course	Prerequisite
1	BTITOE504A	Graph Theory	Nil
2	BTITOE504B	Human Computer Interaction	Nil
3	BTITOE504C	Probability and Queuing Theory	Engineering Mathematics III

List of Stream Electives – Group 1

Sr. No.	Course Code	Title of the Course	Prerequisite
1	BTIT SE505A	Embedded Systems	Microprocessors and Microcontrollers
2	BTIT SE505B	IT Service Management	Nil
3	BTIT SE505C	Information Storage Management	Computer Architecture &Organization
4	BTIT SE505D	Network Management	Internetworking Protocols
5	BTIT SE505E	Data Visualisation	Database Management Systems

List of Open/Departmental Electives – Group 2

Sr. No.	Course Code	Title of the Course	Prerequisite
1	BTITOE604A	Enterprise Resource Planning	Database Management Systems
2	BTITOE604B	Decision Support System	Database Management Systems
3	BTITOE604C	Software Project Management	Software Engineering

List of Stream Electives – Group 2

Sr. No.	Course Code	Title of the Course	Prerequisite
1	BTITSE605A	Software Testing	Software Engineering
2	BTITSE605B	Data Storage Technologies & Networks	Internetworking Protocols, Operating Systems
3	BTITSE605C	Service Oriented Architecture	Nil
4	BTITSE605D	Network Programming	Internetworking Protocols, Operating Systems
5	BTITSE605E	Advanced Database Technology	Database Management Systems

Course Title:	**Database Management Systems**	**Semester V**	
Course Code	**BTITC501**	**Course Type**	**Mandatory**
Pre-requisite	**Nil**	**L – T – P**	**3 – 0 – 0**
Stream	**Core**	**Credits**	**3**

Course Objectives:

1. To understand architecture and functioning of database management systems.
2. To learn relational mode.
3. To use structured query language (SQL) and its syntax, transactions, database recovery and techniques for query optimization.
4. To acquaint with various normalization forms and query processing.
5. To learn indexing methods.

Course Outcomes:

After learning the course the students should be able:

1. To explain need of database management.
2. To design and implement a database schema for a given problem-domain.
3. To normalize a database.
4. To create and query a database using SQL DML/DDL commands, stored procedures and functions.
5. To declare and enforce integrity constraints on a database.
6. To illustrate understanding of indexing methods.

Course Content:

UNIT I

Introduction: Basic concepts, Advantages of DBMS over file-processing systems, Data abstraction, Data models and data independence, Components of DBMS and overall structure of DBMS, Data modeling, Entity, Attributes, Relationships, Constraints, Keys E-R diagrams, Components of E-R Model.

UNIT II

Relational Model: Basic concepts, Attributes and domains, Concept of integrity and referential constraints, Schema diagram. Relational query languages, Relational Algebra and Relational Calculus: Tuple relational and domain relational calculus.

UNIT III

Structured Query Language-I: Introduction, Characteristics and advantages, Data types and literals, DDL, Tables: creating, modifying, deleting, Views: creating, dropping, Updation using views, DML, Operators, SQL DML queries, SELECT query and clauses.

UNIT IV

Structured Query Language- II: Set operations, Predicates and joins, Set membership, Tuple variables, Set comparison, Ordering of tuples, Aggregate functions, Nested queries, Database modification using SQL Insert, Update and Delete queries, Dynamic and embedded SQL and concept of stored procedures, Query-by-example.

UNIT V

Relational Database Design: Notion of normalized relations, Functional dependency, Decomposition and properties of decomposition, Normalization using functional dependency, Multi-valued dependency and join dependency. Storage and File Systems: Secondary storage, RAID, File organization, Indices, Static and dynamic hashing, B-Trees and B+ Trees.

UNIT VI

Query Processing and Transaction Management: Measures of query cost, Selection operation, Sorting and join operation, Transaction concept, Components of transaction management, Concurrency and recovery sys-tem, Different concurrency control protocols such as timestamps and locking, Validation, Multiple granularity, Deadlock handling, Different crash recovery methods such as log-based recovery, Shadow-paging, Buffer management and Remote backup system.

Text Books

1. Abraham Silberschatz, Henry F. Korth, and S. Sudarshan, ***"Database System Concepts"***, , McGraw Hill Education, 6th Edition, 2011.
2. Ramez Elmasri and Shamkant B. Navathe, ***"Fundamental Database Systems"***, Pearson Education, 7th Edition, 2015.
3. Raghu Ramkrishnan, Johannes Gehrke, ***"Database Management Systems"***, McGraw Hill Education, 3rd Edition, 2007.

Reference Books:

1. Carlos Coronel, Steven Morris ***"Database systems: Design Implementation and Management"***, Cengage Learning Press, 11th Edition, 2014.
2. J. Murach, ***"Murach's MySQL"***, Shroff Publication, 2nd Edition, 2016.
3. J. Murach, ***"Murach's Oracle SQL and PL/SQL: Works with All Versions Through 11g"***, Shroff Publication, 2008.

Course Title:	**Design and Analysis of Algorithms**	**Semester V**	
Course Code	**BTITC502**	**Course Type**	**Mandatory**
Pre-requisite	**Data Structures**	**L – T – P**	**3 – 0 – 0**
Stream	**Core**	**Credits**	**3**

Course Objectives:

1. To learn fundamentals of algorithms design techniques.
2. To understand basic knowledge of computational complexity, approximation and randomized algorithms, selection of the best algorithm to solve a problem.
3. To analyze the performance of algorithms, to compare algorithms with respect to time and space complexity.
4. To develop proficiency in problem solving and programming.

Course Outcomes:

After learning the course the students should be able:

1. Develop efficient algorithms for simple computational tasks.
2. Gain understanding of concepts of time and space complexity, worst case, average case and best case complexities and the big-O notation.
3. Design standard algorithms such as sorting, searching, and problems involving graphs.
4. Compute complexity measures of algorithms, including recursive algorithms using recurrence relations.

Course Content:

UNIT I

Introduction: Instruction counts, Growth functions, Necessity of time and space analysis of algorithms, Order notations (O, Θ, Ω notations), Problem instance size, frequently occurring recurrence relations in analysis of algorithms.

UNIT II

Design Techniques-I: Divide and Conquer: Binary search, finding maximum and minimum, Merge sort, Quick sort, Strassen's matrix multiplication. Greedy Algorithms: Knapsack problem, Job sequencing with deadlines, optimal storage on tapes, Optimal merge pattern, Single source shortest paths.

UNIT III

Design Techniques-II: Dynamic Programming: Multistage graphs, All pairs shortest paths, 0/1 Knapsack, Travelling salesman problem.

UNIT IV

Design Techniques: Backtracking: 8-Queens Problems, Sum of subsets, Graph coloring. Branch-and-bound: Least cost (LC) search, Control abstractions for LC search, FIFO branch and bound, LC branch and bound.

UNIT V

Selected Algorithms from Various Areas: Graph Theory, Elementary Algorithms: DFS, BFS, Topological Sort, Minimum spanning trees (Kruskal and Prim's algorithms), Shortest Paths: Single source shortest paths, all pairs shortest paths, String Matching: The naive string-matching algorithm, The Robin-Karp algorithm, The Knuth-Morris-Pratt algorithm.

UNIT VI

Complexity Theory: Lower-bound arguments, NP-completeness: Introduction to NP-Complete, Reducibility (SAT, Independent Set, 3VC, Subset Sum and Partition, Hamiltonian Circuit).

Text Books:

1. Thomas Cormen, Charles Leiserson, Ronald Rivest and Cliford Stein, ***"Introduction to Algorithms"***, MIT Press, 3rd Edition, 2009.
2. E. Horowitz, S. Sahni and S. Rajsekaran, ***"Computer Algorithms"***, Silicon Press, 2nd Edition, 2008.

Reference Books:

1. B. K. Joshi, ***"Data Structures and Algorithms in C++"***, Tata McGraw Hill Education, 2010.
2. G. T. Heineman, Gary Pollice, Stanley Selkow, ***"Algorithms in a Nutshell"***, Shroff Publication, 1st Edition, 2008.
3. Kyle Loudon, ***"Mastering Algorithms with C"***, Shroff Publication, 1st Edition, 2008.

Course Title:	**Software Engineering**	**Semester V**	
Course Code	**BTITC503**	**Course Type**	**Core**
Pre-requisite	**Nil**	**L – T – P**	**3 – 0 – 0**
Stream	**Core**	**Credits**	**3**

Course Objectives:

1. To understand software lifecycle development models.
2. To understand and apply software requirements engineering techniques, software design principles, modeling and software testing techniques.
3. To understand the use of metrics in software engineering.
4. To understand software project management.

Course Outcomes:

After learning the course the students should be able:

1. To use the techniques, skills, and modern engineering tools necessary for engineering practice.
2. To design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
3. To identify, formulate and solve engineering problems.

Course Content:

UNIT I

Software Development Process: Software crisis and myths, Software process and development: Generic view of process, Software life cycle and models, Analysis and comparison of varies models, an agile view of process.

UNIT II

Requirement Engineering: Requirements engineering tasks, Initiating requirement engineering process, Eliciting requirement, developing use-cases, Building the analysis model, Negotiating and validating requirement, Building the analysis model.

UNIT III

System Design Overview: Design process and design quality, Design concepts, Design model, Pattern based software design, Architectural design, User interface design. UML: Different methods: Rambaugh / Booch / Jakobsons, Need for standardization. Developing diagrams in UML (Use CASE, Class, Interaction, State diagrams) CASE TOOLS.

UNIT IV

Validation and Testing: Strategic approach to Software testing, Strategic issues, Test strategies for conventional software, Validation testing, System testing, Debugging. White box testing and Black box testing.

UNIT V

Web Engineering: WebApps engineering layers, Web engineering processes planning for web engineering projects, Project management issue for web engineering. Metrics, Requirement analysis, Analysis models for web engineering design for WebApps, testing for WebApps.

UNIT VI

Planning and Management of Project: Project management, Metrics for process and projects, Estimation, Project scheduling, Risk management, Importance of software quality and measurements software engineering techniques for quality assurance, and Change management. ISO 9000 and CMM/PCMM.

Text Books

1. Roger S. Pressman, "***Software Engineering***", Tata McGraw-Hill, 6th Edition, 2006.
2. G. Booch, J. Rambaugh, and I. Jacobson, ***"The Unified Modeling Language User Guide"***,
3. Addison Wesley, 2nd Edition, 2005.

Reference Books:

1. Shari Pfleeger, ***"Software Engineering"***, Pearson Education, 3rd Edition, 2008.
2. Ian Sommerville, ***"Software Engineering"***, Pearson Higher Education, 10th Edition, 2016.
3. Pankaj Jalote, ***"An Integrated Approach to Software Engineering"***, Springer New York, 2nd
4. Edition, 2013.

Course Title:	**Graph Theory**	**Semester V**	
Course Code	**BTITOE504A**	**Course Type**	**Elective**
Pre-requisite	**Discrete Structures and Applications**	**L – T – P**	**3 – 0 – 0**
Stream	**Departmental Elective**	**Credits**	**3**

Course Content:

UNIT I

Basics – Graphs, degree sequences, distance in graphs, complete, regular and bipartite graphs, basic properties.

UNIT II

Structure and Symmetry – Cut vertices, bridges and blocks, automorphism groups, reconstruction problem.

UNIT III

Trees and connectivity – Properties of trees, Arboricity, vertex and edge connectivity, Mengers theorem

UNIT IV

Eulerian and Hamiltonian graphs – Characterization of Eulerian graphs -Sufficient conditions for Hamiltonian graphs.

UNIT V

Colouring and planar graphs – vertex and edge colouring, perfect graphs, planar graphs, Euler's theorem, Kuratowski's theorem, Colouring of planar graphs, Crossing number and thickness.

UNIT VI

Matching, factors, decomposition and domination. Extremal Graph theory – Turan's theorem, Ramsay's theorem, Szemeredi's 97 regularity lemma, applications.

Text Books:

1. J. A. Bondy, U. S. R. Murthy, ***"Graph Theory"***, Springer Verlag, 2008.
2. D. B. West, ***"Introduction to Graph Theory"***, PHI, 2004.

Reference Books:

1. R. Diestel , ***"Graph Theory"***, Springer Verlag (Free Download available), 2003.

Course Title:	**Human Computer Interaction**	**Semester V**	
Course Code	**BTITOE504B**	**Course Type**	**Elective**
Pre-requisite	**Nil**	**L – T – P**	**3 – 0 – 0**
Stream	**Departmental**	**Credits**	**3**

Course Content:

UNIT I

Introduction: The human, The computer, The interaction, Paradigms, Usability of Interactive Systems, Guidelines, Principles, and Theories.

UNIT II

Design Process- Interaction design basics, HCI in the software process, Design rules, Implementation support, Evaluation techniques, Universal design, User support.

UNIT III

Models and Theories0 Cognitive models, Socio-organizational issues and stakeholder requirements, Communication and collaboration models, Task analysis, Dialogue notations and design, Models of the system, Modeling rich interaction.

UNIT IV

Interaction Styles- Direct Manipulation and Virtual Environments, Menu Selection, Form Filling and Dialog Boxes, Command and Natural Languages, Interaction Devices, Collaboration and Social Media Participation.

UNIT V

Design Issues- Quality of Service, Balancing Function and Fashion, User Documentation and Online Help, Information Search, Information Visualization.

UNIT VI

Outside the Box- Group ware, Ubiquitous computing and augmented realities, Hypertext, multimedia, and the World Wide Web

Text Books:

1. Alan Dix, Janet Finlay, ***"Human Computer Interaction"***, Pearson Education, 2004.
2. Ben Shneiderman, ***"Designing the User Interface - Strategies for Effective Human Computer Interaction"***, Pearson Education, 2010.

Reference Books:

1. M. B. Rosson, J. M. Carroll ***"Usability Engineering: Scenario-Based Development of Human-Computer Interaction"***, Elsevier, 2002.
2. Alan Cooper, ***"The Essentials of Interaction Design"***, Wiley Publishing, 2007.
3. Nielsen, J. Morgan Kaufmann, San Francisco, ***"Usability Engineering"***, 1993.
4. Heim, S., ***"The Resonant Interface: HCI Foundations for Interaction Design"***, Addison-Wesley, 2007.

Course Title:	**Probability and Queuing Theory**	**Semester V**	
Course Code	**BTITOE504C**	**Course Type**	**Elective**
Pre-requisite	**Engineering Mathematics-III**	**L – T – P**	**3 – 0 – 0**
Stream	**Departmental Elective**	**Credits**	**3**

Course Objectives:

1. Be through with probability concepts.
2. To acquire knowledge on Probability Distributions.
3. Get exposed to the testing of hypothesis using distributions.
4. Gain strong knowledge inn principles of Queuing theory.
5. Get exposed to Discrete time Markov chain.

Course Outcomes:

1. To acquire analytical ability in solving mathematical problems as applied to the respective branches of engineering.

Course Content:

UNIT I

Random Variables: Review of probability concepts, Types of Events, Axioms, Conditional probability, Multiplication theorem, Applications.

Discrete and continuous Random Variables – Discrete case, Probability Mass function, Cumulative distribution function, Applications, Characteristics of random variables – Continuous case, Probability density function, Cumulative distribution function, Applications, Expectation, Variance, Expectation, Variance, Moment Generating Function, Functions of Random Variable (One dimensional only)
Chebychev‟s Inequality – (Statement only). Applications of Chebychev's Inequality.

UNIT II

THEORETICAL DISTRIBUTIONS:
Discrete Probability distribution: Binomial distribution – MGF, Mean, Variance, Applications of Binomial distribution, Fitting a Binomial distribution, Poisson distribution – MGF, Mean, Variance, Applications of Poisson distribution, Fitting a Poisson distribution, Geometric distribution – MGF, Mean, Variance, Memoryless Property , Applications of Geometric distribution, Continuous Probability Distributions: Uniform distribution – MGF, Mean, Variance & Applications, Exponential Distribution - MGF, Mean, Variance, Memoryless Property Applications of Exponential distribution, Normal distribution – Mean, Variance, Standard Normal distribution and Applications of Normal distribution

UNIT III

Testing of Hypothesis:
Introduction to Sampling Distributions, Population and Sample, Null Hypothesis and Alternative Hypothesis, Single and Two Tailed Test.
Testing of Hypothesis, Level of Significance, Critical Region, Procedure for Testing of Hypothesis
Large Sample Test- Test For Single Proportion, Two Sample Proportions.

Large Sample Test- Test For Single Mean, Two Sample Means.
Small Sample Tests – „t‟ Test For a Single Mean „t‟ Test For The Difference Of Means, Paired „t‟ Test
F Test – Test of Significance of the Difference between Two Population Variances.
Chi Square Test for Goodness of Fit, Independence of Attributes.

UNIT IV

Queuing Theory: Introduction to Markovian queuing models.
Single Server Model with Infinite system capacity, Characteristics of the Model (M/M/1): (∞/FIFO) Problems on Model (M/M/1): (∞/FIFO), Problems on Model (M/M/1): (∞/FIFO), Single Server Model with Finite System Capacity, Characteristics of the Model (M/M/1): (K/FIFO), Problems on Model (M/M/1): (K/FIFO).

UNIT V

Markov Chains:
Introduction to Stochastic process, Markov process, Markov chain one step & n-step Transition Probability, TPM and Applications, Chapman Kolmogorov theorem (Statement only), Applications on Chapman Kolmogorov theorem.

UNIT VI

MARKOV CHAINS: Transition probability- Applications, Classification of states of a Markov chain, Classification of states of a Markov chain – Applications.

Text Books:

1. Veerarajan T., ***"Probability, Statistics and Random Processes"***, Tata McGraw Hill, 1st Reprint 2004.
2. S.C. Gupta and V.K. Kapoor, ***"Fundamentals of Mathematical Statistics"***, Sultan Chand & Sons, 9th extensively revised Eition,1999

Reference Books:

1. Trivedi K S, ***" Probability and Statistics with reliability, Queueing and Computer Science Applications***", Prentice Hall of India, New Delhi, 1984
2. Gross.D, Harris.C.M. , ***"Fundamentals of Queuing Theory"***, John Wiley and Sons, 1985.
3. Allen.A.O., ***"Probability Statistics and Queuing Theory"***, Academic Press, 1981

Course Title:	**Embedded Systems**	**Semester V**	
Course Code	**BTITSE505A**	**Course Type**	**Elective**
Pre-requisite	**Microprocessor & Microcontroller**	**L – T – P**	**3 – 0 – 0**
Stream	**Software Application and Development**	**Credits**	**3**

Course Objectives:

1. To understand the fundamental concepts in Embedded Systems.
2. To learn Real Time Operating Systems.
3. To get acquainted with hardware & interfaces.
4. To know Embedded System Design Techniques.

Course Outcomes:

After learning the course the students should be able:

1. To demonstrate & explain embedded systems hardware & software components.
2. To define embedded systems using real time operating system – VxWorks/ μCOS II RTOS.
3. To design & develop embedded applications using C language.
4. To apply design techniques in real-life application.

Course Content:

UNIT I

Introduction: Introduction to embedded systems-hardware and software components, Types, Examples, Characteristics, Challenges in embedded computing system design, Embedded sys-tem design processes, Introduction to IC technology.

UNIT II

Analysis and Design of Embedded System: Software engineering practices in the embedded systems, Software develop process, Interprocess communication and synchronization of process, Task and threads, Programme language, Program concept and embedded programming in C, Software components-Interpreter, Compiler, Assembler, Cross assembler.

UNIT III

OS for Embedded Systems: Introduction to real time theory, Operating system services, Real time operating system concepts, Basic design using a RTOS, Introduction to RTOS programming tools Micro C/OSII and VxWorks.

UNIT IV

Hardware for Embedded Systems: Hardware components, SOC, Processors, CPU, Types of memory, Memory management, I/O devices and interfacing, Parallel I/O interface, Blind counting synchronization and busy waiting, Parallel port interfacing with switches, Keypads and display unit, Memory and high speed interfacing, Interfacing of data acquisition systems, Interfacing of controllers, Serial communication interface, Implementation of above using C language.

UNIT V

Performance Issues of an Embedded System: CPU performance, CPU power consumption, Analysis and optimization of CPU power consumption program execution time, Analysis and optimization of energy and power, Analysis of program size, Hardware accelerators.

UNIT VI

Design Examples and Case Studies: Personal Digital Assistants, Set Top Boxes, Ink Jet Printers, Digital thermometer, Case Studies of digital camera, Smart card, Case study of coding for sending application layer byte stream on TCP/IP network using RTOS VxWorks.

Text Books

1. Raj Kamal, ***"Embedded Systems Architecture, and Programming"***, TMH Publication, 3rd Edition, 2015.
2. Iyer, Gupta, ***"Embedded Real Time Systems Programming"***, TMH Publication, 2003.

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.

Course Title:	**IT Service Management**	**Semester V**	
Course Code	**BTITSE505B**	**Course Type**	**Elective**
Pre-requisite	**Nil**	**L – T – P**	**3 – 0 – 0**
Stream	**Infrastructure & Security Management**	**Credits**	**3**

Course Objectives:

1. To introduce practical implementation of Information Technology Service Management (ITSM).
2. To understand how an integrated ITSM framework can be utilized to achieve IT business integration, cost reductions and increased productivity.
3. To learn the best practices of ITSM methodology.

Course Outcomes:

After learning the course the students should be able:

1. To identify IT services as a means to provide functionality and value to customers.
2. To describe the needs and targets of the different stakeholders (service providers, customers, suppliers/partners) in the services value chain.
3. To demonstrate the value of a service management framework.
4. To explain the service management processes for given customers.
5. To select the appropriate tools to support a given designed service management solution.

Course Content:

UNIT I

IT Infrastructure: Introduction, Challenges in IT Infrastructure Management, Design Issues of IT Organizations and IT Infrastructure, IT System Management Process, IT Service Management Process, Information System Design Process.

UNIT II

Service Delivery Process: Service Level Management, Financial Management, IT Service Continuity Management, Capacity Management & Availability Management.

UNIT III

Service Support Process: Configuration Management, Incident Management, Problem Management, Change Management & Release Management.

UNIT IV

Storage Management: Storage, Backup, Archive and Retrieve, Disaster Recovery, Space Management, Database and Application Protection and Data Retention.

UNIT V

Security Management: Computer Security, Internet Security, Physical Security, Identity Management, Access Control System and Intrusion Detection.

UNIT VI

Case Studies on how IT Service Management and ITIL processes make IT efficient and save cost for organizations.

Text Books

1. Phalguni Gupta, Surya Prakash & Umarani Jayaraman, ***"IT Infrastructure & Its Management"***, Tata McGraw-Hill Education.

Reference Books:

1. W. Ronald Hudson, Ralph C. G. Haas, Waheed Uddin, ***"Infrastructure Management: Integrating Design, Construction, Maintenance, Rehabilitation, and Renovation"***, McGraw-Hill, 1997.
2. Anita Sengar, ***"IT Infrastructure Management"***, S.K. Kataria and Sons, 2nd Edition, 2009.

Course Title:	**Information Storage Management**	**Semester V**	
Course Code	**BTITSE505C**	**Course Type**	**Elective**
Pre-requisite	**Computer Architecture & Organization**	**L – T – P**	**3 – 0 – 0**
Stream	**Information Management & Quality Control**	**Credits**	**3**

Course Objectives:

1. To evaluate storage architecture; understand logical and physical components of storage Infrastructure including storage subsystems.
2. To describe storage networking technologies such as FC-SAN, NAS, IP-SAN and data archival solution –CAS.
3. To identify different storage virtualization technologies and their benefits.
4. To understand and articulate business continuity solutions including, backup and recovery technologies, and local and remote replication solutions.
5. To define information security, and storage security domains and Identify parameters of managing and monitoring storage infrastructure and describe common storage management activities and solutions.

Course Outcomes:

After learning the course the students should be able:

1. To describe and apply storage technologies.
2. To identify leading storage technologies that provide cost-effective IT solutions for medium to large scale businesses and data centers.
3. To describe important storage technologies' features such as availability, replication, scalability and performance.
4. To design, analyze and manage clusters of resources.

Course Content:

UNIT I

Introduction to Information Storage Management - Intelligent Storage System (ISS) and its components Implementation of ISS as high-end and midrange storage-arrays. Direct Attached -Storage - Introduction to SCSI.

UNIT II

Introduction to parallel SCSI, SCSI Command Model – Storage Area Networks - Fiber Channel Connectivity, Login types, Topologies.

UNIT III

Storage networking technologies: Network-Attached Storage- General purpose servers vs. NAS Devices - Benefits of NAS, NAS File I/O – NAS Components, Implementation, File Sharing protocols, I/O operations – IPSAN-ISCSI, Components of ISCSI- Content-Addressed Storage.

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, offsite 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. EMC Corporation, ***"Information Storage and Management"***, Wiley India, 1st Edition, 2009.

Reference Books:

1. IBM, ***"Introduction to Storage Area Networks and System Networking"***, 5th edition, November 2012.
2. Robert Spalding, ***"Storage Networks: The Complete Reference"***, Tata McGraw Hill, Osborne, 6th reprint 2003.
3. Marc Farley, ***"Building Storage Networks"***, Tata McGraw Hill, Osborne, 1st Edition, 2001.
4. Tom Clark, ***"Designing Storage Area Networks -A Practical Reference for Implementing Fiber Channel and IP SANs",*** Tata McGraw Hill 2003, 2nd edition.

Course Title:	**Network Management**	**Semester V**	
Course Code	**BTITSE505D**	**Course Type**	**Elective**
Pre-requisite	**Internetworking Protocols**	**L – T – P**	**3 – 0 – 0**
Stream	**Network**	**Credits**	**3**

Course Objectives:

1. To understand the principles of network management, different standards and protocols used in managing complex networks.
2. To understand the automation of network management operations and making use of readily available network management systems.

Course Outcomes:

After learning the course the students should be able:

1. To acquire the knowledge about network management standards (OSI and TCP/IP).
2. To acquire the knowledge about various network management tools and the skill to use them in monitoring a network.
3. To analyze the challenges faced by Network managers.
4. To evaluate various commercial network management systems and open network management systems.
5. To analyze and interpret the data provided by an NMS and take suitable actions.

Course Content:

UNIT I

Data communication and network management overview: Analogy of Telephone Network Management, Communications protocols and Standards, Case Histories of Networking and Management, Challenges of Information Technology Managers, Network Management: Goals, Organization, and Functions, Network and System Management, Network Management System Platform, Current Status and future of Network Management.

UNIT II

SNMPV1 network management, Managed network: Organization and Information Models. Managed network: Case Histories and Examples, The History of SNMP Management, The SNMP Model, The Organization Model, System Overview, The Information Model.

UNIT III

SNMPV1 Network Management: Communication and Functional Models, The SNMP Communication Model, Functional model. SNMP MANAGEMENT: SNMPv2 Major Changes in SNMPv2, SNMPv2 System architecture, SNMPv2 Structure of Management Information, The SNMPv2 Management Information Base, SNMPv2 Protocol, Compatibility with SNMPv1.

SNMP MANAGEMENT: RMON: What is Remote Monitoring? , RMON SMI and MIB, RMON1, RMON2, ATM Remote Monitoring, A Case Study of Internet Traffic Using RMON

UNIT IV

Telecommunication management network: Why TMN? , Operations Systems, TMN Conceptual Model, TMN Standards, TMN Architecture, TMN Management Service Architecture, An Integrated View of TMN, Implementation Issues.

UNIT V

Network management tools and systems: Network Management Tools, Network Statistics Measurement Systems, History of Enterprise Management, Network Management systems, Commercial Network management Systems, System Management and Enterprise Management Solutions.

UNIT VI

Web-Based Management: NMS with Web Interface and Web-Based Management, Web Interface to SNMP Management, Embedded Web-Based Management, Desktop management Interface, Web-Based Enterprise Management, WBEM: Windows Management Instrumentation, Java management Extensions, Management of a Storage Area Network , Future Directions. Case Studies:

Text Books:

1. Mani Subrahmanian, ***"Network Management Principles and Practice"***, Pearson Education, 2nd Edition, 2010.

Reference Books:

1. Morris, ***"Network management"***, Pearson Education, 1st Edition, 2008.
2. Mark Burges, ***"Principles of Network System Administration"***, Wiley DreamTech, 1st Edition, 2008.

Course Title:	**Data Visualisation**	**Semester V**	
Course Code	**BTITSE505E**	**Course Type**	**Elective**
Pre-requisite	**Database Management Systems**	**L – T – P**	**3 – 0 – 0**
Stream	**Data Science**	**Credits**	**3**

Course Objectives:

1. Learn and understand the importance of data visualization.
2. Learn what is user experience in data visualization and its importance.
3. Learn about basic and advance chart types used in data visualization.
4. Learn the psychology of visualization with Gestalt Principles.

Course Outcomes:

After learning the course the student will be able:

1. Get a solid understanding of how people work in data visualization project.

Course Content:

UNIT I

The seven stages of Data Visualization: Why data display requires planning, An example, Iteration and Combination, Principles.

Getting Started with Processing: Sketching with processing, Example and Distributing your work, Examples and references, Functions, Sketching and Scripting

Mapping: Drawing a Map, Locations on map, Data on Map, Using your own data, Next step.

UNIT II

Time series:

Milk, Tea, and Coffee (Acquire and parse), Cleaning the table(Filter and Mine), A simple plot(Represent and refine), Labeling the current data set(Refine and Interact), Drawing Axis labels(Refine), Choosing a proper representation(Represent and refine), Using rollovers to Highlights points(Interact), Ways to connect points(refine), Text labels as tabbed panes(Interact), Interpolation between data sets(Interact).

UNIT III

Connections and Correlations:

Changing data sources, Problem statement, Preprocessing, Using the processed data(Acquire, Parse Filter and Mine), Displaying the results(Represent), Returning to the questions(Refine), Sophisticated sorting: Using salary as a Tiebreaker(Mine), Moving to multiple days(Interact), Smoothing out Interaction(Refine), Deployment Consideration(Acquire, Parse, filter).

UNIT IV

Scatterplot Maps: ++Preprocessing, Loading the data(Acquire and Parse), Drawing a scatterplot of Zip codes(Mine and represent), Highlighting Points while typing(Refine and Interact), Show the currently selected points(refine), Progressively Dimming and Brightening points(Refine), Zooming In (Interact),Changing How Points are Drawn when Zooming (Refine), Development issues(Acquire and Refine)

UNIT V

Trees, Hierarchies, and Recursion: Using recursion to build a Directory Tree, Using a Queue to Load Asynchronously (Interact), An improving the TreeMaps Display (Refine), Flying through files(Interact).

Networks and Graphs: A simple graph Demo, A more complicated Graph, Approaching Network Problem, Advanced graph example, Mining additional example.

UNIT VI

Acquiring Data:Where to find data, Tools for Acquiring data from Internet, Loading files for use with processing, Loading text data, Dealing with files and folders, Listing files in folders, Asynchronous Image download, Using openStream() As a bridge to Java, Dealing with Byte arrays, Advanced web techniques, Using Databases, Dealing with large number of files.

Parsing Data**:** Levels of efforts, Tools for gathering clues, Text is Best, Text Markup language, Regular expressions(regexps), Grammars and BNF Notations, Compressed Data, Vectors and Geometry, Binary data formats, Advanced detective work.

Text Books:

1. Ben Fry, ***"Visualizing Data: Exploring and Explaining data with Processing Environment"***, Shroff/O'Reilly Media, 2016

Reference Books:

1. Scott Murray, ***"Interactive Data Visualization for the web"***, Shroff/O'Reilly Media, 2016.
2. Julia Steele, Noah Lliinsky, ***"Designing Data Visualizations"***, Shroff/O'Reilly Media, 2012.
3. Kyran Dale, ***"Data Visualization with Python and JavaScript: Scrape, Clean, Explore & Transform your data"***, Shroff/O'Reilly Media, 2016.
4. Julia Steele, Noah Lliinsky, ***"Beautiful Visualization"***, Shroff/O'Reilly Media, 2016.

Course Title:	**Seminar**	**Semester V**	
Course Code	**BTITS506**	**Course Type**	**Mandatory**
Pre-requisite	**Nil**	**L – T – P**	**0 – 2 – 0**
Stream	**Core**	**Credits**	**2**

Seminar topic is included to enable the students to apply their knowledge to understand advanced technologies, designs etc. Literature survey may help to select such topics which are invaluable to an engineer in an Information Technology industry. It will encourage students to develop their presentation skills, good communication skills and skills of collecting the correct information regarding the technical topic.

The students will be able to deliver seminar with useful information. He/she should under-stand the technologies, designs and skills of writing technical report, to do literature survey and to attempt the queries from examiner.

Course Title:	**Programming Lab – Minor(R programming)**	**Semester V**	
Course Code	**BTITL507**	**Course Type**	**Mandatory**
Pre-requisite	**Nil**	**L – T – P**	**0 – 0 – 2**
Stream	**Core**	**Credits**	**1**

Lab Experiments Objective:

1. To learn R programming.

Lab Experiments List:

1. Download R programming language SDK and setup to run programs.
2. Develop and write a program to declare R variables, constants, operators and reserved words and understand the operator precedence.
3. Write a program to declare and understand the functioning of all the decision and loop constructs like If-Else, While, Break-Next and Repeat.
4. Execute all R functions.
5. Execute program to demonstrate Vectors, Matrix, data frame and factor.
6. Execute programs to test R Objects and Class.
7. Write a program to use and display various graphs and charts in R.
8. Execute programs to use plot in R.

Course Title:	**Database Management Systems Lab**	**Semester V**	
Course Code	**BTITL509**	**Course Type**	**Mandatory**
Pre-requisite	**Nil**	**L – T – P**	**0 – 0 – 2**
Stream	**Core**	**Credits**	**1**

Lab Experiments Objective:

1. To design a database adopting the principles of relational database model.
2. To practice and master DDL and DML through SQL.
3. To learn building efficient queries to interact with a database.

Lab Experiments List:

1. Creation of databases and use of SQL commands (DDL, DML and DCL).
2. Suitable exercises to practice SQL commands may be given for Insert, Update and Delete.
3. Write SQL procedure for an application which uses exception handling.
4. Write SQL procedure for an application with cursors.
5. Write SQL for implementing Nested Queries.
6. Write SQL for implementing Join Queries.
7. Write a DBMS program to prepare reports for an application using functions.
8. Write SQL block containing triggers.
9. Write SQL block containing stored procedures.
10. Develop a menu driven, GUI-based database application in any one of the domains such as Banking, Billing, Library management, Payroll, Insurance, Inventory, Healthcare etc. integrating all the features specified in the above exercises.

Course Title:	**Design and Analysis of Algorithms Lab**	**Semester V**	
Course Code	**BTITL510**	**Course Type**	**Mandatory**
Pre-requisite	**Nil**	**L – T – P**	**0 – 0 – 2**
Stream	**Core**	**Credits**	**1**

Lab Experiments Objective:

1. To design and develop various algorithms and analyze its efficiency to a specific problem.

Lab Experiments List:

1. Sort a given set of n integer elements using Quick Sort method and compute its time complexity. Run the program for varied values of n and record the time taken to sort. Plot a graph of the time taken versus non graph sheet. The elements can be read from a file or can be generated using the random number generator. Demonstrate how the divide and conquer method works along with its time complexity analysis: worst case, average case and best case.
2. Implement the 0/1 Knapsack problem using (a) Dynamic Programming method (b) Greedy method.
3. From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm. Write the program.
4. Find Minimum Cost Spanning Tree of a given connected undirected graph using Kruskal's algorithm. Use Union-Find algorithms in your program.
5. Find Minimum Cost Spanning Tree of a given connected undirected graph using Prim's algorithm.
6. Write programs to (a) Implement All-Pairs Shortest Paths problem using Floyd's algorithm
7. (b) Implement Travelling Sales Person problem using Dynamic programming.
8. Design and implement a program to find a subset of a given set S = Sl, S2,.....,Sn of n positive integers whose SUM is equal to a given positive integer d. For example, if S = 1, 2, 5, 6, 8 and d = 9, there are two solutions 1, 2,6and 1, 8. Display a suitable message, if the given problem instance doesn't have a solution.
9. Design and implement a program to find all Hamiltonian Cycles in a connected undirected Graph G of n vertices using backtracking principle.

Course Title:	**Operating Systems**	**Semester VI**	
Course Code	**BTITC601**	**Course Type**	**Mandatory**
Pre-requisite	**Nil**	**L – T – P**	**3 – 0 – 0**
Stream	**Core**	**Credits**	**3**

Course Objectives:

1. To study the basic concepts and functions of operating systems.
2. To understand the structure and functions of OS.
3. To learn about Processes, Threads and Scheduling algorithms.
4. To understand the principles of concurrency and Deadlocks.
5. To learn various memory management schemes.
6. To study I/O management and File systems.

Course Outcomes:

After learning the course the students should be able:

1. To design various Scheduling algorithms.
2. To apply the principles of concurrency.
3. To design deadlock, prevention and avoidance algorithms.
4. To compare and contrast various memory management schemes.
5. To design and Implement a prototype file systems.

Course Content:

UNIT I

Operating System Structures: Definition, Types of operating system, Real time operating system, System components, Sys-tem services, Systems calls, System programs, System structure, Virtual machines, System design and implementation.

UNIT II

Processes and CPU scheduling: Process concept, Process scheduling, Operation on a process, Co-operating processes, Threads, Interprocess communication, Scheduling criteria, Scheduling algorithms, Multiple-processor scheduling, Real-time scheduling, Scheduling algorithms and performance evaluation.

UNIT III

Process Synchronization: The critical-section problem, Critical regions, Synchronization hardware, Semaphores, Classical problems of synchronization, Monitors.

UNIT IV

Deadlocks: Systems model, Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock, Combined approach to deadlock handling.

UNIT V

Memory Management and Virtual Memory: Logical versus physical address space, Swapping, Contiguous allocation, Paging, Segmentation with paging, Demand paging, Page replacement algorithms, Thrashing.

UNIT VI

File Management: File system and secondary storage devices, Real-time operating systems.

Text Books

1. A. Silberschatz, P. Galvin, ***"Operating System Concepts"***, Wiley Publication, 9th Edition, 2013.
2. A. S. Tanenbaum, H. Bos, ***"Modern Operating Systems"***, Pearson Education, 4th Edition, 2015.

Reference Books:

1. D.M. Dhamdhere, ***"Systems Programming and Operating Systems"***, Tata McGraw Hill Publication, 2nd Edition, 2001.
2. G. Nutt, ***"Operating Systems Concepts"***, Addison Wesley Publication, 3rd Edition.
3. H. M. Deitel, ***"An Introduction to Operating Systems"***, Addison Wesley Publication, 1990.

Course Title:	**Compiler Construction**	**Semester VI**	
Course Code	**BTITC602**	**Course Type**	**Elective**
Pre-requisite	**Data Structures**	**L – T – P**	**3 – 0 – 0**
Stream	**Core**	**Credits**	**3**

Course Objectives:

1. To introduce the major concept areas of language translation and compiler design.
2. To develop an awareness of the function and complexity of modern compilers.
3. To provide practical, hands on experience in compiler design.

Course Outcomes:

After learning the course the students should be able:

1. To understand the major concept areas of language translation and compiler design.
2. To develop an awareness of the function and complexity of compilers.
3. To identify the similarities and differences among various parsing techniques and grammar transformation techniques.

Course Content:

UNIT I

Introduction to Compiling and Lexical Analysis: Definition, analysis of the source program, the phases of a compiler, the grouping of phases, Compiler-Construction tools, The role of the Lexical analyzer, Input buffering, Specification of Tokens, A Language for Specifying Lexical Analyzers, Design of a Lexical Analyzer generator.

UNIT II

Syntax Analysis: The role of the Parser, Context-free grammars, Writing a Grammar, Top-Down Parsing, Bottom- Up Parsing, Operator-precedence Parsing, LR-Parsers, Using Ambiguous Grammars, Parser Generators.

UNIT III

Syntax-Directed Translation: Definitions, Construction of Syntax Trees, Bottom-Up Evaluation of S-Attributed definitions, Top-Down Translation, Bottom-Up Evaluation of Inherited attributes.

UNIT IV

Intermediate Code Generation: Intermediate Languages, Declarations, Assignment Statements, Boolean Expressions, Case Statements, Back patching, Procedure Calls.

UNIT V

Code Generation: Issues in the Design of a Code Generator, The target Machine, Run-Time Storage Management, Basic Blocks and Flow Graphs, Next-Use Information, Simple Code Generator, Register allocation and Assignment, The DAG Representation of Basic Blocks, Generating Code from DAGs, Dynamic Programming, Code-Generation Algorithm, Code-Generators.

UNIT VI

Code Optimization: Peephole optimization, principal sources of optimization, introduction to Global data flow analysis.

Text Books:

1. Aho, Sethi, Ullman, ***"Compilers-Tools and Techniques"***, Pearson, 2nd Edition, 2011.
2. Tremblay, Sorenson, ***"Theory and Practice of Compiler Writing"***, McGraw Hill Publication.
3. Hopcroft, ***"Introduction to Automata Theory, Languages and Computation"***, Pearson Publication.

Reference Books:

1. Paul G. Sorenson, ***"Compiler Writing"***, Tata McGraw Hill.
2. Robin Hunter, ***"The Essence of Compilers"***, Pearson Publication, 1998.

Course Title:	**Object Oriented Software and Web Engineering**	**Semester VI**	
Course Code	**BTITC603**	**Course Type**	**Mandatory**
Pre-requisite	**Object Oriented Paradigm with C++**	**L – T – P**	**3 – 0 – 0**
Stream	**Core**	**Credits**	**3**

Course Objectives:

1. To learn the concept of Object Oriented Software Development Process.
2. To get acquainted with UML Diagrams.
3. To understand Object Oriented Analysis Processes.
4. Understand the characteristics of web application.
5. Learn to Model web applications.
6. Be aware of Systematic methods.
7. Be familiar with the testing techniques for web applications.

Course Outcomes:

After learning the course the students should be able:

1. To understand Object Oriented Software Development Process.
2. To gain exposure to Object Oriented Methodologies & UML Diagrams.
3. To apply Object Oriented Analysis Processes for projects.
4. Apply the characteristics of web applications.
5. Model web applications.
6. Design web applications.
7. Test web applications.

Course Content:

UNIT I

Object Basics, Object oriented philosophy, objects, classes, attributes, object behavior and methods, encapsulation and information hiding, class hierarchy, polymorphism, object relationships and associations, aggregations and object containment, case study, object identity, persistence.. Object oriented systems development life cycle: Software development process, building high quality software, use- case driven approach, reusability.

UNIT II

Object Oriented Methodologies: Rumbaugh et al.’s object modeling technique, Booch methodology, Jacobson et al methodologies, patterns, frameworks, and the unified approach. Unified modeling language: Static and dynamic models, UML diagrams, UML class diagrams, use-case diagrams, UML dynamic modeling, packages, UML extensibility and UML Meta model.

UNIT III

Object Oriented Analysis Process: Business object analysis, use-case driven object oriented analysis, business process modeling, use-case model, developing effective documentation, case study. Classification: Classification theory, noun phrase approach, common class patterns approach, use-case driven approach, classes, responsibilities, and collaborators, naming classes.

UNIT IV

Identifying Object Relationships, Attributes and Methods: Association, super-subclass relationships, a-part of relationships, case study, class responsibility, Defining attributes for vianet bank objects, object responsibility, defining methods for vianet bank objects Design process and design axioms: Corollaries, design patterns.

Designing Classes: UML object constraint languages, designing classes, class visibility, refining attributes for the vianet bank objects, designing methods and protocols, designing methods for the vianet bank objects, packages and managing classes. Designing access layer, Designing view layer, macro level process.

UNIT V

Introduction to Web Engineering and requirement engineering: Motivation, Categories of Web Applications, Characteristics of Web Applications, Product-related Characteristics, Usage related Characteristics, Development-related Characteristic, Evolution of web engineering – Requirements Engineering Activities RE Specifics in Web Engineering, Principles for RE of Web Applications, Adapting RE Methods to Web Application Development, Requirement Types, Notations, Tools.

Web Application Architecture and Modelling Web Applications: Introduction- Categorizing Architectures, Specifics of Web Application Architectures, Components of a Generic Web Application Architecture, Layered Architectures, 2-Layer Architectures, N-Layer Architectures Data-aspect Architectures, Database-centric Architectures, Architectures for Web Document Management, Architectures for Multimedia Data Modeling Specifics in Web Engineering, Levels, Aspects, Phases Customization, Modeling Requirements, Hypertext Modeling, Hypertext Structure Modeling Concepts, Access Modeling Concepts, Relation to Content Modeling, Presentation Modeling, Relation to Hypertext Modeling, Customization Modeling, Relation to Content, Hypertext, and Presentation Modeling

UNIT VI

Web Application Design: Introduction, Web Design from an Evolutionary Perspective, Information Design, Software Design: A Programming Activity, Merging Information Design and Software Design, Problems and Restrictions in Integrated Web Design, A Proposed Structural Approach, Presentation Design, Presentation of Nodes and Meshes, Device-independent Development, Approaches, Inter action Design, User Interaction User Interface Organization, Navigation Design, Designing a Link Representation, Designing Link Internals, Navigation and Orientation, Structured Dialog for Complex Activities, Interplay with Technology and Architecture, Functional Design.

Testing Web Applications: Introduction, Fundamentals, Terminology, Quality Characteristics, Test Objectives, Test Levels, Role of the Tester, Test Specifics in Web Engineering, Test Approaches, Conventional Approaches, Agile Approaches, Test Scheme, Three Test Dimensions, Applying the Scheme to Web Applications, Test Methods and Techniques, Link Testing, Browser Testing, Usability

Testing, Load, Stress, and Continuous Testing, Testing Security, Test-driven Development, Test Automation.

Web Project Management: Understanding Scope, Refining Framework Activities, Building a Web Team, Managing Risk, Developing a Schedule, Managing Quality, Managing Change, Tracking the Project, Introduction to node JS – web sockets.

Text Books

1. Ali Bahrami, ***"Object Oriented Systems Development using the Unified Modeling Language"***, McGraw Hill, Reprint, 2009.
2. Craig Larman, ***"Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development"***, Pearson Education, 3rd Edition, 2005.
3. Gerti Kappel, Birgit Proll, ***"Web Engineering"***, John Wiley and Sons Ltd, 2006.
4. Roger S. Pressman, David Lowe, ***"Web Engineering"***, Tata McGraw Hill Publication, 2007.
5. Guy W. Lecky-Thompson, ***"Web Programming"***, Cengage Learning, 2008.

Reference Books:

1. Bernd Oestereich, ***"Developing Software with UML, Object-Oriented Analysis and Design in Practice"***, Addison-Wesley, 2000.
2. James Rumbaugh, Ivar Jacobson, Grady Booch, ***"The Unified Modeling Language Reference Manual"***, Addision Wesley, 2nd Edition, 2005
3. Simon Bennett, Steve Mc Robb and Ray Farmer, ***"Object Oriented Systems Analysis and Design Using UML"***, McGraw Hill Education, 4th Edition, 2010.
4. Erich Gamma, and Richard Helm, Ralph Johnson, John Vlissides, ***"Design Patterns: Elements of Reusable Object-Oriented Software"***, Addison-Wesley, 1995.
5. Chris Bates, **"Web Programming: Building Internet Applications"**, Third Edition, Wiley India Edition, 2007.
6. John Paul Mueller, **"Web Development with Microsoft Visual Studio 2005"**,Wiley Dream tech, 2006.

Course Title:	**Enterprise Resource Planning**	**Semester VI**	
Course Code	**BTITOE604A**	**Course Type**	**Elective**
Pre-requisite	**Nil**	**L – T – P**	**3 – 0 – 0**
Stream	**Departmental**	**Credits**	**3**

Course Objectives:

1. To introduce to enterprise systems and show how organizations use enterprise systems to run their operations more efficiently and effectively.
2. To learn about the critical success factors and implementation strategies that lead to enterprise system success.
3. To learn about the informational, knowledge, and decision-making opportunities afforded by enterprise systems.
4. To examine typical Enterprise Systems modules: materials management (MM), supply chain management (SCM), customer relationship management (CRM), financials, projects, human resource management (HRM).

Course Outcomes:

After learning the course the students should be able:

1. To demonstrate a good understanding of basic issues in Enterprise Systems.
2. To explain the scope of common Enterprise Systems (e.g., MM, SCM, CRM, HRM, procurement).
3. To explain the challenges associated with implementing enterprise systems and their impacts on organizations.
4. To describe the selection, acquisition and implementation of enterprise systems.
5. To use one of the popular ERP packages to support business operations and decision-making.
6. To communicate and assess an organization’s readiness for enterprise system implementation with a professional approach in written form.
7. To demonstrate an ability to work independently and in a group.

Course Content:

UNIT I

Enterprise Resource Planning: Introduction, Disadvantages of non-ERP systems, What Is ERP? Need of ERP, Advantage of ERP, Risks of ERP, Growth of ERP.

UNIT II

ERP Modules: Finance, Production Planning, Control and Management, Sales and Distribution, Human Resource Management, Inventory Control System, Quality Management, Plant Maintenance.

UNIT III

ERP Implementation: ERP Implementation (Transition) strategies, ERP Implementation Life Cycle, Implementation Methodologies, Evaluation and selection of ERP package, ERP Project Team: Vendors, Employees, Consultants, Training & Education, Project management & Monitoring, Post Implementation Activities, Operation & maintenance of ERP system, Measuring the Performance of ERP System, Success & failure factors of an ERP, Implementation.

UNIT IV

ERP Market and Vendors: ERP Marketplace and Marketplace Dynamics, Comparison of Current ERP Packages and Vendors, like; SAP, Oracle, PeopleSoft, BAAN etc.

UNIT V

ERP and related technologies: Business Process Re-Engineering (BPR), Information Systems -Management Information, System (MIS), Decision Support System (DSS), Executive Support System (ESS) Data Warehousing, Data Mining, On-Line Analytical Processing (OLAP), Supply Chain Management, Customer Relationship Management

UNIT VI

ERP Case Studies: ERP systems implemented in – for example :TISCO, SKF Automotive Bearings Co. Ltd, Qualcomm CDMA, California, Post Implementation review of ERP packages – in, Manufacturing, Services and Others Organizations, Customization of ERP for different types of Industries.

Text Books

1. Alexis Leon, ***"ERP Demystified"***, TMH New Delhi, 2nd Edition.
2. V. K. Garg & N. K. Venkita Krishnan, ***"ERP Ware: ERP Implementation Framework"***, PHI.

Reference Books:

1. V. K. Garg & N. K. Venkita Krishna, ***"ERP Concepts & Planning"***, PHI, 2nd Edition.

Course Title:	**Decision Support Systems**	**Semester VI**	
Course Code	**BTITOE604B**	**Course Type**	**Elective**
Pre-requisite	**Database Management Systems**	**L – T – P**	**3 – 0 – 0**
Stream	**Departmental**	**Credits**	**3**

Course Objectives:

1. To select appropriate modeling techniques for supporting semi-structured business decision making.
2. To identify and select appropriate decision support systems for generating innovative business solutions.
3. To design and implement decision support systems for generating innovative business solutions.

Course Outcomes:

After learning the course the students should be able:

1. To recognize the relationship between business information needs and decision making.
2. To appraise the general nature and range of decision support systems.
3. To appraise issues related to the development of DSS.
4. To select appropriate modeling techniques.
5. To analyze, design and implement a DSS.

Course Content:

UNIT I

Basic Concepts: Decision making systems, Modeling and support, Basics and definition Systems models, Modeling process, Decision making, Intelligence phase, Design phase Choice phase, Evaluation, Implementation phase, Alternative decision making models, Decision support systems, Decision makers, Case applications.

UNIT II

Decision Support System Development: Decision support system development, Basics, Life cycle, Methodologies, Prototype, Technology levels and tools, Development platforms, Tool selection, Developing DSS, Enterprise systems, Concepts and definition, Evolution of information systems, Information needs, Characteristics and capabilities, Comparing and integrating EIS and DSS, EIS data access, Data warehouse, OLAP, Multidimensional analysis, Presentation and the Web, Including soft information enterprise on systems, Organizational DSS, Supply and value chains, Decision support, Supply chain problems and solutions, Computerized systems. MRP, ERP, SCM, Frontline decision support systems.

UNIT III

Knowledge Management: Organizational learning and memory, Knowledge management, Development Methods, Technologies and tools, Success , Knowledge management and artificial intelligence, Electronic Document Management, Knowledge Acquisition and Validation, Knowledge Engineering – Scope, Acquisition Methods, Interviews, Tracking Methods, Observation and other Methods, Grid Analysis, Machine Learning, Rule Induction, Case-Based Reasoning, Neural Computing, Intelligent Agents, Selection of an appropriate Knowledge Acquisition Methods, Multiple Experts, Validation and

Verification of the Knowledge Base-Analysis, Coding, Documenting, and Diagramming, Numeric and Documented.

UNIT IV

Knowledge Acquisition, Knowledge Acquisition and the Internet/Intranets, Knowledge Representation Basics, Representation in Logic and other Schemas, Semantic Networks, Production Rules, Frames, Multiple Knowledge Representation, Experimental Knowledge Representations, Representing Uncertainty. Intelligent System Development: Inference Techniques, Reasoning in Artificial Intelligence, Inference with Rules, Inference Tree, Inference with Frames, Model Based and Case Based Reasoning, Explanation and Meta Knowledge, Inference with Uncertainty, Representing Uncertainty, Probabilities and Related Approaches, Theory of Certainty, Approximate Reasoning using Fuzzy Logic

UNIT V

Intelligent Systems Development, Prototyping, Project Initialization, System Analysis and Design, Software Classification, Building Expert Systems with Tools, Shells and Environments, Software Selection, Hardware, Rapid Prototyping and a Demonstration Prototype, System Development, Implementation, Post Implementation.

UNIT VI

Management Support Systems: Implementing and Integrating Management Support Systems, Implementation, Major Issues, Strategies, System Integration, Generic Models MSS, DSS–ES, Integrating EIS, DSS and ES, Global Integration, Intelligent DSS, Intelligent Modeling and Model Management, Examples of Integrated Systems, Problems and Issues in Integration.

Text Books

1. Efrain Turban and Jay E. Aronson, “***Decision Support Systems and Intelligent Systems”***, Pearson Education, 6th Edition,2001.

Reference Books:

1. Ganesh Natarajan and Sandhya Shekhar, ***“Knowledge Management Enabling Business Growth”***, Tata McGraw Hill, 2002.
2. George M. Marakas, ***“Decision Support System”***, Prentice Hall, India, 2003.
3. Efrem A. Mallach, ***“Decision Support and Data Warehouse Systems”***, Tata McGraw, Hill, 2002.
4. Kimiz Dalkir, ***“Knowledge Management: Theory and Practice”***, Elsevier Science, 2005.
5. Becerra Fernandez and Laidener, ***“Knowledge Management: An Evolutionary View”***, PHI, 2009.

Course Title:	**Software Project Management**	**Semester VI**	
Course Code	**BTITOE604C**	**Course Type**	**Elective**
Pre-requisite	**Software Engineering**	**L – T – P**	**3 – 0 – 0**
Stream	**Departmental**	**Credits**	**3**

UNIT I

Project Evaluation and Planning - Activities in Software Project Management, Overview of Project Planning, Stepwise planning, contract management, Software processes and process models.

UNIT II

Cost Benefit Analysis, Cash Flow Forecasting, Cost-Benefit Evaluation Techniques, Risk Evaluation. Project costing, COCOMO 2, Staffing pattern, Effect of schedule compression, Putnam's equation, Capers Jones estimating rules of thumb, Project Sequencing and Scheduling Activities, Scheduling resources, Critical path analysis, Network Planning, Risk Management, Nature and Types of Risks, Managing Risks, Hazard Identification, Hazard Analysis, Risk Planning and Control, PERT and Monte Carlo Simulation techniques.

UNIT III

Monitoring And Control- Collecting Data, Visualizing Progress, Cost Monitoring, review techniques, project termination review, Earned Value analysis, Change Control

UNIT IV

Software Configuration Management (SCM), Managing Contracts, Types Of Contracts, Stages In Contract Placement, Typical Terms of A Contract, Contract Management and Acceptance.

UNIT V

Quality Management and People Management- Introduction, Understanding Behavior, Organizational Behaviour, Selecting The Right Person For The Job, Motivation, The Oldman – Hackman Job Characteristics Model , Working in Groups, Organization and team structures, Decision Making, Leadership, Organizational Structures, Stress, Health and Safety. ISO and CMMI models, Testing, and Software reliability, test automation.

UNIT VI

Overview of project management tools.

Text Books:

1. Bob Hughes, Mike Cotterell, ***"Software Project Management"***, Tata McGraw Hill, 2009.

Reference Books:

2. Royce, ***"Software Project Management"***, Pearson Education, 2005.
3. Robert K. Wysocki, ***"Effective Software Project Management"***, Wiley, 2006.

Course Title:	**Software Testing**	**Semester VI**	
Course Code	**BTITSE605A**	**Course Type**	**Elective**
Pre-requisite	**Software Engineering**	**L – T – P**	**3 – 0 – 0**
Stream	**Software Application & Development**	**Credits**	**3**

Course Objectives:

1. To study fundamental concepts in software testing, including software testing objectives, processes, criteria, strategies, and methods.
2. To learn planning of a test project, designing test cases and test data, conducting test operations, managing software problems and defects, and generating a test report.
3. To develop an understanding of the meaning and importance of quality in relation to software systems and the software development process.
4. To study issues and techniques for implementing and managing software quality assurance processes and procedures.

Course Outcomes:

After learning the course the students should be able:

1. To apply software testing knowledge and its processes to software applications.
2. To identify various software testing problems.
3. To solve software testing problems by designing and selecting software test models, criteria, strategies and methods.
4. To apply the techniques learned to improve the quality of software development.
5. To prepare a software quality plan for a software project.

Course Content:

UNIT I

Principles of Testing Software development life cycle model: Phases of software project, Quality, Quality assurance and quality control, Testing, Verification and validation, Process models to represent various phases, Life cycle models, Software testing life cycle.

UNIT II

White Box Testing (WBT) and Black Box Testing: Static testing, Structural testing, Challenges in WBT. Black box testing: Black box testing process.

UNIT III

Integration Testing: Definition, As a type of testing: Top-down integration, Bottom-up integration, Bi-directional integration, System integration, Choosing integration method, As a phase of testing, Scenario testing: System scenarios, Use case scenarios, Defect bash.

UNIT IV

System and Acceptance Testing, Functional Vs non Functional, Functional system testing, Non-functional system testing, Acceptance testing.

UNIT V

Performance testing, Regression testing, Internationalization testing, Adhoc testing. Factors governing performance of testing, Methodology, tools and process for performance testing. Regression Testing: Introduction, Types of Regression testing, Regression testing process. Adhoc testing: Introduction, Buddy testing, Pair testing, exploratory testing, Iterative testing, Agile and Extreme testing, XP work flow, Defect seeding.

UNIT VI

Testing Object Oriented Software: Introduction, Comparison of object oriented and procedural software, Sys-tem testing example, Unit testing of classes, Tools for testing object oriented software, Testing web applications.

Text Books

1. Srinivasan Desikan, Gopalaswamy Ramesh, ***"Software Testing: Principles and Practices"***, Pearson publication, 2nd Edition, 2006.

Reference Books:

1. Loise Tamres, ***"Introducing Software Testing"***, Pearson publication, 2002.
2. Boris Beizer, ***"Software Testing Techniques"***, Dreamtech press, 2nd Edition, 2014

Course Title:	**Data Storage Technologies & Networks**	**Semester VI**	
Course Code	**BTITSE605B**	**Course Type**	**Elective**
Pre-requisite	**Internetworking Protocols,, Operating Systems**	**L – T – P**	**3 – 0 – 0**
Stream	**Infrastructure & Security Management**	**Credits**	**3**

Course Objectives:

1. To gain knowledge and understand the design of a Data Centre.
2. To understand the best practice of design in the Data Centre.
3. To learn the options in the running of an efficient Data Centre.
4. To understand the value of data to a business, Information Lifecycle.
5. To understand the challenges in data storage and data management.
6. To learn solutions available for data storage.

Course Outcomes:

After learning the course the students should be able:

1. To explain the design of a data center and storage requirements.
2. To discuss the various types of storage and their properties.
3. To explain physical and virtualization of storage.
4. To explain the backup, archiving with regard to recovery and business continuity.

Course Content:

UNIT I

DATA CENTRE: Introduction, Site Selection and Environmental Considerations, Hierarchical or Layered Architecture, Architect Roles, Goals and Skills, Architecture Precursors.

UNIT II

DATA CENTRE DESIGN: Architecture Design and Standards Recommendations, Raised Access Floor and Design Best Practices, connecting the infrastructure with copper and fiber. IT Hardware, Cooling System Options and Environmental Control, Electrical Power Systems, Room Layout, Fire Protection and Security Systems, Building Automation and Energy Management Systems, Commissioning and Handover.

UNIT III

STORAGE MANAGEMENT: Introduction to Storage Technology, Storage Systems Architecture, Physical and logical components of a connectivity environment, Major physical components of a disk drive and their functions, Concept of RAID and its components, Different RAID levels and their suitability for different application environments: RAID 0, RAID 1, RAID 3, RAID 4, RAID 5, RAID 0+1, RAID 1+0, RAID 6, Integrated and Modular storage systems, high-level architecture and working of an intelligent storage systems.

UNIT IV

NETWORKED STORAGE: Evolution of networked storage, Architecture, components, and topologies of FC-SAN, NAS, and IP-SAN, Benefits of the different networked storage options, Need for long-term archiving solutions and describe how CAS fulfill the need, Appropriateness of the different networked storage options for different application environments.

UNIT V

Managing Data Center: Reasons for planned/unplanned outages, Impact of downtime, Difference between business continuity (BC) and disaster recovery (DR), RTO and RPO, Identification of single points of failure in a storage infrastructure and solutions to mitigate these failures, Architecture of backup/recovery and the different backup/recovery topologies, replication technologies and their role in ensuring information availability and business continuity Remote replication technologies and their role in providing disaster recovery and business continuity capabilities, Key areas to monitor in a data center, Industry standards for data center monitoring and Management Key metrics to monitor storage infrastructure.

UNIT VI

Securing Storage and Storage Virtualization: Information Security, Critical security attributes for information systems, Storage security domains, Analyze the common threats in, each domain, Storage Virtualization: Forms, Configurations and Challenges, Types of Storage Virtualization: Block-level and File-Level.

Text Books

1. Mauricio Arregoces, ***"Data Center Fundamentals"***, Cisco Press, 1st edition, 2003.
2. Robert Spalding, ***"Storage Networks: The Complete Reference"***, Tata McGraw Hill, Osborne, 2003.
3. Marc Farley, ***"Building Storage Networks"***, Tata McGraw Hill, Osborne. 2001.
4. Meeta Gupta, ***"Storage Area Network Fundamentals"***, Pearson Education Limited, 2002

Reference Books:

1. G. Somasundaram, Alok Shrivastava, ***"Information Storage and Management"***, EMC Education Series, Wiley Publishing Inc., 2011.
2. Gustavo Santana, ***"Data Center Virtualization Fundamentals: Understanding Techniques and Designs for Highly Efficient Data Centers with Cisco Nexus, UCS, MDS, and Beyond"***, Cisco Press, 1st Edition, 2013

Course Title:	**Service Oriented Architecture**	**Semester VI**	
Course Code	**BTITSE605C**	**Course Type**	**Elective**
Pre-requisite	**Nil**	**L – T – P**	**3 – 0 – 0**
Stream	**Information Management & Quality Control**	**Credits**	**3**

Course Objectives:

1. To gain understanding of the basic principles of service orientation.
2. To learn service oriented analysis techniques.
4. To learn technology underlying the service design.
5. To learn advanced concepts such as service composition, orchestration and Choreography.
6. To know about various WS specification standards.

Course Outcomes:

After learning the course the students should be able:

1. Build applications based on XML.
2. Develop web services using technology elements.
3. Build SOA-based applications for intra-enterprise and inter-enterprise applications.

Course Content:

UNIT I

Introducing SOA: Fundamental SOA: Common Misperceptions about SOA, Common tangible benefits of SOA, Common pitfalls of adopting SOA, The Evolution of SOA:-from XML to Web services to SOA, The continuing evolution of SOA, The roots of SOA. Web Services and Primitive SOA: The Web services framework-Services, Service descriptions, messaging with SOAP.

UNIT II

Web Services and Contemporary SOA: Message exchange patterns- Service activity-coordination-Atomic transactions-Business activities-Orchestration-Choreography- Web Services and Contemporary SOA: Addressing- Reliable messaging-Correlation- Policies- Metadata exchange- Security- Notification and eventing.SOA and Service-Orientation: Principles of Service - Anatomy of a service-oriented architecture- Common principle of service orientation-Service Layers –Service orientation.

UNIT III

Building SOA: SOA Delivery Strategies- SOA delivery lifecycle phases. Service-Oriented Analysis: Introduction to service-oriented analysis-Benefits of a business-centric SOA- Deriving business services-Service-Oriented Analysis: Service modeling, Service modeling guidelines- Classifying service model logic- Contrasting service modeling approaches.

UNIT IV

Service-Oriented Design: Introduction to service-oriented design- WSDL-related XML Schema language basics- WSDL language basics- SOAP language basics- Service interface, design tools. SOA Composition Guidelines: Steps to composing SO Considerations for choosing service layers and SOA standards, positioning of cores and SOA extensions.

UNIT V

SOA Service Design: - Overview-Service design of business service, application service, task centric service and guidelines. SOA Business Process Design: WS-BPEL language basics-WS Coordination.

UNIT VI

SOA support in J2EE – Java API for XML-based web services (JAX-WS) - Java architecture for XML binding (JAXB) – Java API for XML Registries (JAXR) - Java API for XML based RPC (JAX-RPC)-Web Services Interoperability Technologies (WSIT)

Text Books

1. Thomas Erl, ***"Service-Oriented Architecture: Concepts, Technology, and Design"***, Pearson Education, 2006.
2. Frank. P. Coyle, ***"XML, Web Services And The Data Revolution"***, Pearson Education, 2002.
3. Sandeep Chatterjee, James Webber, ***"Developing Enterprise Web Services. An Architect's Guide"***, Pearson Education, 2005.
4. Eric Newcomer, Greg Lomow, ***"Understanding SOA with Web Services"***, Pearson Education, 2005.
5. Ron Schmelzer et al. ***"XML and Web Services"***, Pearson Education, 2002

Reference Books:

1. Dan woods and Thomas Mattern, ***"Enterprise SOA designing IT for Business Innovation"***, O'REILLY, 1st Edition, 2006.
2. James McGovern, Sameer Tyagi, Michael E. Stevens, Sunil Mathew, ***"Java Web. Services Architecture"***, Morgan Kaufmann Publishers, 2003.
3. Atul Kahate, ***"XML and Related technologies"***, Pearson Education, 2008.
4. Kennard Scibner and Mark C. Stiver, ***"Understanding SOAP"***, SAMS publishing.
5. B. V. Kumar, S. V. Subrahmanya, ***"Web Services: An Introduction"***, TMH India, 2nd Edition, 2012.

Course Title:	**Network Programming**	**Semester VI**	
Course Code	**BTITSE605D**	**Course Type**	**Elective**
Pre-requisite	**Internetworking Protocols, Operating Systems**	**L – T – P**	**3 – 0 – 0**
Stream	**Network**	**Credits**	**3**

Course Objectives:

1. To learn the basics of socket programming using TCP Sockets.
2. To learn about Socket Options.
3. To learn to develop Macros for including Objects In MIB Structure.
4. To understand SNMPv1, v2 and v3 protocols & practical issues.

Course Outcomes:

After learning the course the students should be able:

1. To analyze the requirements of a networked programming environment and identify the issues to be solved;
2. To create conceptual solutions to those issues and implement a programming solution;
3. To understand the key protocols that support the Internet;
4. To apply several common programming interfaces to network communication;
5. To understand the use of TCP/UDP Sockets
6. To apply advanced programming techniques such as Broadcasting, Multicasting.

Course Content:

UNIT I

Socket And Application Devlopment: Introduction to Socket Programming - System Calls - Address conversion functions - POSIX Signal Handling - Server with multiple clients - Boundary conditions - Server process Crashes, Server host Crashes, Server Crashes and reboots, Server Shutdown - I/O Multiplexing - I/O Models -TCP echo client/server with I/O Multiplexing

UNIT II

Socket Optian: Socket options - getsockopt and setsockopt functions - Generic socket options - IP socket options -ICMP socket options - TCP socket options - Multiplexing TCP and UDP sockets - SCTP Sockets -SCTP Client/server - Streaming Example - Domain name system - gethostbyname, gethostbyaddr, getservbyname and getservbyport functions - Protocol Independent functions in TCP Client/Server Scenario

UNIT III

Advanced Socket: IPv4 and IPv6 interoperability - Threaded servers - Thread creation and termination - TCP echo server using threads - Mutex - Condition variables - Raw sockets - Raw socket creation - Raw socket output - Raw socket input - ping program - traceroute program

UNIT IV

Simple Network Management: SNMP network management concepts - SNMPv1 - Management information - MIB Structure – Object syntax - Standard MIB’s - MIB-II Groups - SNMPv1 protocol and Practical issues.

UNIT V

SNMP V2, V3 and RMO: Introduction to SNMPv2 - SMI for SNMPV2 - Protocol - SNMPv3 - Architecture and applications -Security and access control model - Overview of RMON.

UNIT VI

Protocols, Sessions, State, and Implementing Custom Protocols State vs. Stateless, Methods for Maintaining State, What Is a Protocol? Designing a Custom Protocol, Our Chat Protocol, Protocol Registration

Elementary Name, Address Conversions and design decisions Domain Name System, gethostbyname Function, RES_USE_INET6 Resolver Option, gethostbyname2 Function and IPv6 Support, gethostbyaddr Function, uname Function, gethostname Function, getservbyname and getservbyport Functions

Text Books

1. W. Richard Stevens, ***"UNIX Network Programming Vol-I"***, Addison-Wesley Professional, 3rd Edition, 2003.
2. William Stallings, ***"SNMP, SNMPv2, SNMPv3 and RMON 1 and 2"***, Pearson Edition, 3rd Edition, 2009.

Reference Books:

1. D.E. Comer, ***"Internetworking with TCP/IP Vol- III: Client-Server Programming and Application BSD Sockets Version"***, Pearson Edition, 2nd Edition, 2003.

Course Title:	**Advanced Database Technology**	**Semester VI**	
Course Code	**BTITSE605E**	**Course Type**	**Elective**
Pre-requisite	**Database Management Systems**	**L – T – P**	**3 – 0 – 0**
Stream	**Data Science**	**Credits**	**3**

Course Objectives:

1. To learn the various types of databases and their advanced applications.
2. To understand how and where databases are used in industry.
3. To examine the requirements on special databases.
4. To learn complex queries and interface them with applications.

Course Outcomes:

After learning the course the students should be able:

1. To explain how databases are used in various fields of industry.
2. To apply query evaluation techniques and query optimization techniques.
3. To develop transaction processing systems with concurrency control.
4. To design and develop a database application system as part of a team.
5. To explore open issues in advanced databases.

Course Content:

UNIT I

PARALLEL AND DISTRIBUTED DATABASES: Database System Architectures: Centralized and Client-Server Architectures – Server System, Architectures – Parallel Systems- Distributed Systems – Parallel Databases: I/O Parallelism – Inter and Intra Query Parallelism – Inter and Intra operation Parallelism – Distributed Database Concepts - Distributed Data Storage – Distributed Transactions – Commit Protocols – Concurrency Control – Distributed Query Processing – Three Tier Client Server Architecture- Case Studies.

UNIT II

OBJECT AND OBJECT RELATIONAL DATABASES: Concepts for Object Databases: Object Identity – Object structure – Type Constructors – Encapsulation of Operations – Methods – Persistence – Type and Class Hierarchies – Inheritance – Complex Objects – Object Database Standards, Languages and Design: ODMG Model – ODL – OQL – Object Relational and Extended – Relational Systems: Object Relational features in SQL /Oracle – Case Studies.

UNIT III

XML DATABASES: XML Databases: XML Data Model – DTD - XML Schema - XML Querying – Web Databases – JDBC– Information Retrieval – Data Warehousing – Data Mining.

UNIT IV

MOBILE DATABASES: Mobile Databases: Location and Handoff Management - Effect of Mobility on Data Management - Location Dependent Data Distribution - Mobile Transaction Models - Concurrency Control - Transaction Commit Protocols- Mobile Database Recovery Schemes.

UNIT V

INTELLIGENT DATABASES: Active databases – Deductive Databases – Knowledge bases – Multimedia Databases-Multidimensional Data Structures – Image Databases – Text/Document Databases- Video Databases – Audio Databases – Multimedia Database Design.

UNIT VI

COMPLEX QUERIES AND REASONING: Logic of Query Languages – Relational Calculi – Recursive rules – Syntax and semantics of Datalog – Fix-point semantics – Implementation Rules and Recursion – Rule rewriting methods – Compilation and Optimization – Recursive Queries in SQL – Open issues.

Text Books

1. Carlo Zaniolo, Stefano Ceri, ***“Advanced Database Systems”***, Morgan Kauffmann Publishers.
2. Subramaniam, ***“Multimedia Databases”***, Morgan Kauffman Publishers, 2008.
3. Rajesh Narang, ***“Object Oriented Interfaces and Databases”***, Prentice-Hall of India, Pvt. Ltd., 2004.
4. Thomas Cannolly and Carolyn Begg, ***“Database Systems, A Practical Approach to Design, Implementation and Management”***, Pearson Education, 3rd Edition, 2007.
5. Jeffrey A. Hoffer, Mary B. Prescottand Fred R. McFadden, ***“Modern Database Management”***, Prentice Hall, 2007.

Reference Books:

1. Henry F Korth, Abraham Silberschatz and S. Sudharshan, ***“Database System Concepts”***, McGraw Hill, 6th Edition, 2011.
2. C. J. Date, A. Kannan and S. Swamynathan, ***“An Introduction to Database Systems”***, Pearson Education, 8th Edition,2006.
3. R. Elmasri, S. B. Navathe, ***“Fundamentals of Database Systems”***, Pearson Education/Addison Wesley, 5th Edition, 2007.
4. Ramakrishnan, Gehrke, ***“Database Management System”***, Tata McGraw Hill Publications, 4th Edition.
5. Ramez Elmasri, Sham Navathe, ***“Fundamentals of Database Systems”***, Addison-Wesley, 2000.

Course Title:	**Operating Systems Lab**	**Semester VI**	
Course Code	**BTITL607**	**Course Type**	**Mandatory**
Pre-requisite	**Nil**	**L – T – P**	**0 – 0 – 2**
Stream	**Core**	**Credits**	**1**

Lab Experiments Objective:

1. To learn shell programming and the use of filters in the UNIX environment.
2. To learn to programming in C using system calls.
3. To learn to use the file system related system calls.
4. To process creation and inter process communication.
5. To familiarize with implementation of CPU Scheduling Algorithms, page replacement algorithms and Deadlock avoidance.

Lab Experiments List:

1. Basics of UNIX commands.
2. Shell Programming.
3. Implement the following CPU scheduling algorithms:
   Round Robin
   SJF
   FCFS
   Priority
4. Implement all file allocation strategies:
   Sequential
   Indexed
   Linked
5. Implement Semaphores.
6. Implement all File Organization Techniques:
   Single level directory
   Two level
   Hierarchical
   DAG
7. Implement Bankers Algorithm for Dead Lock Avoidance.
8. Implement an Algorithm for Dead Lock Detection.
9. Implement e all page replacement algorithms:
   FIFO
   LRU
   LFU
10. Implement Shared memory and IPC.
11. Implement Paging Technique of memory management.
12. Implement Threading & Synchronization Applications.

Course Title:	**Object Oriented Software and Web Engineering Lab**	**Semester VI**	
Course Code	**BTITL608**	**Course Type**	**Mandatory**
Pre-requisite	**Programming in Java**	**L – T – P**	**0 – 0 – 2**
Stream	**Core**	**Credits**	**1**

Lab Experiments Objective:

1. To learn the concept of Object Oriented Software Development Process.
2. To get acquainted with UML Diagrams.
3. To understand Object Oriented Analysis Processes.

Lab Experiments List:

1. Program to implement classes and objects.
2. Program to implement constructors and destructors with array of objects.
3. Program to demonstrate function overloading.
4. Program to implement different types of inheritances like multiple, Multilevel and hybrid.
5. I/O Program to demonstrate the use of abstract classes.
6. Program to demonstrate I/O streams and functions.
7. Program to perform all possible type conversions.
8. Program to demonstrate exception handling technique.
9. Program to implement networking concepts.
10. Program to implement RMI concepts.
11. Program to implement AWT concepts.
12. Program to implement swing concepts.
13. Program to design and implement applet.
14. Program to design and implement JDBC.
15. Program to design an event handling event for simulating a simple calculator.

Course Title:	**Software Testing Lab**	**Semester VI**	
Course Code	**BTITSEL609A**	**Course Type**	**Elective**
Pre-requisite	**Nil**	**L – T – P**	**0 – 0 – 2**
Stream	**Software Application & Development**	**Credits**	**1**

Lab Experiments Objective:

1. To implement different testing techniques to practical teat and understand their merits and demerits.

Lab Experiments List:

1. Design, develop, code and run the program in any suitable language to solve the commission problem. Analyze it from the perspective of data flow testing, derive at least 10 different test cases, execute these test cases and discuss the test results.
2. Design, develop, code and run the program in any suitable language to solve the NextDate problem. Analyze it from the perspective of decision table-based testing, derive at least 10 different test cases, execute these test cases and discuss the test results.
3. Design, develop, code and run the program in any suitable object-oriented language to solve the calendar problem. Analyze it from the perspective of OO testing, derive test cases to test the method that increment the date and the method that increments the month., execute these test cases and discuss the test results.
4. Design, develop, code and run the program in any suitable object-oriented language to solve the currency converter problem. Analyze it from the perspective of use case-based system testing, derive appropriate system test cases, execute these test cases and discuss the test results.
5. Design, develop, code and run the program in any suitable language to implement an absolute letter grading procedure, making suitable assumptions. Determine the basis paths and using them derive different test cases, execute these test cases and discuss the test results.
6. Design, develop, code and run the program in any suitable language to implement the binary search algorithm. Determine the basis paths and using them derive different test cases, execute these test cases and discuss the test results.

Course Title:	**Data Storage Technologies & Networks Lab**	**Semester VI**	
Course Code	**BTITSEL609B**	**Course Type**	**Elective**
Pre-requisite	**Computer Networks, Operating Systems**	**L – T – P**	**0 – 0 – 2**
Stream	**Infrastructure & Security Management**	**Credits**	**1**

Lab Experiments Objective:

1. Understand the functionalities of storage network administration.
2. Set up a NAS server to support file level data access via the NSF and the CIFS protocols.
3. Set up a SAN server to support the iSCSI protocol for block level data access.
4. Demonstrate ability to design and build a small-scale data center and a small-scale cloud computing environment.
5. Be hand-on with data and network management software.

Lab Experiments List:

1. Install a hard disk on a Linux machine covering all the below activities:
a. Connecting the disk to an HBA (Host Bus Adapter) and BIOS setup for the disk;
b. Partitioning the disk;
c. Creating file systems within disk partitions;
d. Mounting the files systems;
e. Setting up automatic mounting;
f. Labeling disk partitions;
g. Setting up swapping on swap partitions.
2. Use “smartmontools” to monitor the disk performance monitoring and testing:
a. Use “smartctl” to enable S.M.A.R.T. support and offline data collection on the disk;
b. Check the overall health of the disk;
c. Run a self-test on the disk;
d. Set up “smartd” to do tests automatically.
3. Use “hdparm”, “iostat”, and “iometer” tools to measure the performance of different storage devices, such as SATA drive, SCSI drive, and USB drives.
a. Plot graphs to compare read/write and sequential/random access rates among different storage devices.
4. Use Navisphere Manager Simulator to perform management on SAN disk array systems:
a. Configure storage pools and LUNs (Logical Unit Number) for storage groups;
b. Configure snapshots and clones;
c. Create SANCopy full and incremental sessions;
d. Create MirrorView synchronous and asynchronous images;
e. Expand a LUN to create metaLUNs;
f. Migrate a LUN to another LUN.
5. Use Openfiler for network storage configuration management:
a. Configure the Openfiler to support locally attached USB drives;
b. Set up a NAS server to support NSF and CIFS protocols;
c. Set up a SAN server to support an iSCSI protocol.
6. Configure Openfiler as a NAS Server:
a. Configure access control rules and NFS/CIFS shares for the NAS server;
b. Configure the Linux client machine to access the NFS shares on the NAS server;

c. Configure a Windows VM on the Linux client machine to access the CIFS shares on the NAS server;

d. Use Openfiler to set up a SAN server, to supports iSCSI protocol for the block level data access;

e. Configure access control rules for the SAN server and configure iSCSI targets on the server.

7. Use VMware to create virtual disks, Virtual Machine File Systems and provisioning.

a. Use thin and thick provisioning concepts.

Course Title:	**Service Oriented Architecture Lab**	**Semester VI**	
Course Code	**BTITSEL609C**	**Course Type**	**Elective**
Pre-requisite	**Programming in Java**	**L – T – P**	**0 – 0 – 2**
Stream	**Information Management & Quality Control**	**Credits**	**1**

Lab Experiments Objective:

1. To learn to create web services and web service clients.
2. To learn SOAP, UDDI and WSDL platforms.

Lab Experiments List:

1. Write a simple web application program in Java to create web services incorporating:
   a. Development of web service.
   b. Testing the web service.
   c. Developing the client.
   d. Deploying the application.
2. Write a factorial application program in Java to create web services.
3. Implement a Calculator program and calculate Simple and Compound Interest using .Net.
4. Develop an invoice order processing system.
5. Invoke EJB components as Web Service.

Course Title:	**Network Programming Lab**	**Semester VI**	
Course Code	**BTITSEL609D**	**Course Type**	**Elective**
Pre-requisite	**Programming in Java/C**	**L – T – P**	**0 – 0 – 2**
Stream	**Network**	**Credits**	**1**

Lab Experiments Objective:

1. To develop TCP Socket Programming, UDP applications and to implement File Transfer Protocols.
2. To utilize RMI and Routing Algorithms.

Lab Experiments List:

1. Write a socket Program for Echo/Ping/Talk commands.
2. Create a socket (TCP) between two computers and enable file transfer between them.
3. Create a socket (UDP) between two computers and enable file transfer between them.
4. Write a program to implement Remote Command Execution. (Two M/Cs may be used)
5. Write a code simulating ARP /RARP protocols.
6. Create a socket for HTTP for web page upload and download.
7. Write a program for TCP module implementation.(TCP services)
8. Write a program for File Transfer in client-server architecture using following methods.
a. (a) RS232C (b) TCP/IP
9. Write a program to implement RMI (Remote Method Invocation)
10. Perform a case study about the different routing algorithms to select the network path with its optimum and economical during data transfer.
a. Shortest path routing
b. Flooding
c. Distance vector
11. Implement client in C and server in Java and initiate communication between them.
12. Using OPNET
a. Create a scenario with the following specifications.
i. No of subnets – 2
ii. No. of nodes – 40
iii. Traffic
1. FTP - 11 to 21
2. FTP - 30 to 40
3. UDP - 5 to 7
iv. Routing Protocol – AODV
v. 802.16, Show the throughput using different bandwidths i.e., 10 Mbps and 100 Mbps respectively.
b. Create a scenario as described below.
No of students – 2
SN -1 Nodes – 15
SN -2 Nodes - 10
Generate FTP Traffic & HTTP traffic between Nodes 1 to 11 (FTP)
14 to 7 (HTTP / Gen FTP)

- · Trace the packet within the Simulation time and display the Trace file.

Course Title:	**Advanced Database Technology Lab**	**Semester VI**	
Course Code	**BTITSEL609E**	**Course Type**	**Elective**
Pre-requisite	**SQL**	**L – T – P**	**0 – 0 – 2**
Stream	**Data Science**	**Credits**	**1**

Lab Experiments Objective:

1. To learn the various types of databases and their advanced applications.
2. To understand how and where databases are used in industry.
3. To examine the requirements on special databases.
4. To learn complex queries and interface them with applications.

Lab Experiments List:

1. A University wants to track persons associated with them. A person can be an Employee or Student. Employees are Faculty, Technicians and Project associates. Students are Full time students, Part time students and Teaching Assistants.

a. Design an Enhanced Entity Relationship (EER) Model for university database. Write OQL for the following

1. Insert details in each object.
2. Display the Employee details.
3. Display Student Details.
4. Modify person details.
5. Delete person details.

b. Extend the design by incorporating the following information.

Students are registering for courses which are handled by instructor researchers (graduate students). Faculties are advisors to graduate students. Instructor researchers' class is a category with super class of faculty and graduate students. Faculty is having sponsored research projects with a grant supporting instruction researchers. Grants are sanctioned by different agencies. Faculty belongs to different departments. Department is chaired by a faculty. Implement for the Insertion and Display of details in each class.

2. Consider the application for University Counseling for Engineering Colleges. The college, department and vacancy details are maintained in 3 sites. Students are allocated colleges in these 3 sites simultaneously. Implement this application using parallel database [State any assumptions you have made].
3. There are 5 processors working in a parallel environment and producing output. The output record contains college details and students mark information. Implement parallel join and parallel sort algorithms to get the marks from different colleges of the university and publish 10 ranks for each discipline.
4. Create triggers and assertions for Bank database handling deposits and loan and admission database handling seat allocation and vacancy position. Design the above relational database schema and implement the following triggers and assertions.

a. When a deposit is made by a customer, create a trigger for updating customers account and bank account

b. When a loan is issued to the customer, create a trigger for updating customer's loan account and bank account.

c. Create assertion for bank database so that the total loan amount does not exceed the total balance in the bank.

d. When an admission is made, create a trigger for updating the seat allocation details and vacancy position.

5. Construct a knowledge database for kinship domain (family relations) with facts. Extract the following relations using rules.

   Parent, Sibling, Brother, Sister, Child, Daughter, Son, Spouse, Wife, husband, Grandparent, Grandchild, Cousin, Aunt and Uncle.

6. Work with Weka tool classification and clustering algorithms using the given training data and test with the unknown sample. Also experiment with different scenarios and large data set

7. Design XML Schema for the given company database, Department (deptName, deptNo, deptManagerSSN, deptManagerStartDate, deptLocation), Employee (empName, empSSN, empSex, empSalary, empBirthDate, empDeptNo, empSupervisorSSN, empAddress, empWorksOn), Project (projName, projNo, projLocation, projDeptNo, projWorker)

a. Implement the following queries using XQuery and XPath

   i. Retrieve the department name, manager name, and manager salary for every department'

   ii. Retrieve the employee name, supervisor name and employee salary for each employee who works in the Research Department.

   iii. Retrieve the project name, controlling department name, number of employees and total hours worked per week on the project for each project.

   iv. Retrieve the project name, controlling department name, number of employees and total hours worked per week on the project for each project with more than one employee working on it.

b. Implement a storage structure for storing XML database and test with the above schema.

Teaching and Evaluation Scheme Final year B. Tech. (Information Technology)

Sr. No	Code	Course title	Weekly Teaching hours			Evaluation Scheme			Credit	Total Hours
			L	T	P	MSE	CA	ESE		
		Semester VII								
1	BTIT701	Cloud Computing and Storage Management	2	-	-	20	20	60	2	2
2	BTITDE702	Open / Departmental Elective - Group 3	3	-	-	20	20	60	3	3
3	BTIT DE703	Open / Departmental Elective - Group 4	3	-	-	20	20	60	3	3
4	BTIT SE704	Stream Elective - Group 3	3	-	-	20	20	60	3	3
5	BTITL705	Cloud Computing and Storage Management Lab	-	-	2		25	25	1	2
6	BTITDEL706	Open / Departmental Elective - Group 3 Lab	-	-	2	-	25	25	1	2
7	BTITSEL707	Stream Elective - Group 3 Lab	-	-	2	-	25	25	1	2
8	BTITP708	Project Phase I	-	-	8	-	50	50	4	8
9	BTIT709	Industrial Training Assessment	-	-	-	-	-	50	2	-
Summary of Semester Assessment Marks, Credit & Hours			**11**	**-**	**14**	**80**	**205**	**415**	**20**	**25**
		Semester VIII								
1	BTIT DE801	Open/Departmental Elective - Group 5	3	-	-	20	20	60	3	3
2	BTITSE802	Stream Elective - Group4	3	-	-	20	20	60	3	3
3	BTIT SE803	Stream Elective - Group 5	3	-	-	20	20	60	3	3
4	BTITSE804	Stream Elective - Group 6	3	-	-	20	20	60	3	3
5	BTITDEL805	Open/Departmental Elective - Group 5 Lab	-	-	2		25	25	1	2
7	BTITSEL806	Stream Elective - Group 4 Lab	-	-	2	-	25	25	1	2
8	BTITSEL807	Stream Elective - Group 6 Lab	-	-	2	-	25	25	1	2
9	BTITP808	Project Phase II	-	-	12		50	50	5	12
Summary of Semester Assessment Marks, Credit & Hours			**12**	**-**	**18**	**80**	**205**	**365**	**20**	**30**

List of Open/Departmental Electives – Group 3

Sr. No.	Course Code	Title of the Course	Prerequisite
1	BTITDE702A	Pattern Recognition	Nil
2	BTITDE702B	Soft Computing	Nil

List of Open/Departmental Electives – Group 4

Sr. No.	Course Code	Title of the Course	Prerequisite
1	BTITDE703A	Natural Language Processing	Nil
2	BTITDE703B	Artificial Intelligence	Nil

List of Stream Electives – Group 3

Sr. No.	Course Code	Title of the Course	Prerequisite
1	BTITSE704A	Real Time Systems	Operating Systems, Design and Analysis of Algorithms
2	BTITSE704B	Information Security	Internetworking Protocols
3	BTITSE704C	Management Information Systems	Decision Support Systems
4	BTITSE704D	Distributed Computing	Operating Systems
5	BTITSE704E	Data Warehousing and Data Mining	Database Management Systems

List of Open/Departmental Electives – Group 5

Sr. No.	Course Code	Title of the Course	Prerequisite
1	BTITDE801A	Internet of Things	Microprocessor & Microcontrollers
2	BTITDE801B	E-commerce Systems	Nil

List of Stream Electives – Group 4

Sr. No.	Course Code	Title of the Course	Prerequisite
1	BTITSE802A	Mobile Computing	Internetworking Protocols, Operating Systems
2	BTITSE802B	Cryptography	Computer Architecture and Organization
3	BTITSE802C	Information Retrieval	Design and Analysis of Algorithms
4	BTITSE802D	Network Security	Internetworking Protocols, Network Programming
5	BTITSE802E	Big Data Analytics	Database Management Systems

List of Stream Electives – Group 5

Sr. No.	Course Code	Title of the Course	Prerequisite
1	BTITSE803A	User Experience Design	Software Engineering
2	BTITSE803B	Infrastructure Auditing & Implementation	IT Service Management
3	BTITSE803C	Cyber Law and IPR	Nil
4	BTITSE803D	Optical Networks	Internetworking Protocols
5	BTITSE803E	Web & Text Mining	Data Mining

List of Stream Electives – Group 6

Sr. No.	Course Code	Title of the Course	Prerequisite
1	BTITSE804A	Multimedia Applications	Nil
2	BTITSE804B	Ethical Hacking	Operating Systems
3	BTITSE804C	CRM & SCM	Enterprise Resource Planning
4	BTITSE804D	Wireless Networking	Internetworking Protocols
5	BTITSE804E	Machine Learning	Engineering Mathematics

Course Title:	**Cloud Computing and Storage Management**	**Semester VII**	
Course Code	**BTIT701**	**Course Type**	**Compulsory**
Pre-requisite	**Nil**	**L – T – P**	**2 – 0 – 0**
Stream	**Core**	**Credits**	**2**

Course Objectives:

1. To learn the concept of cloud computing.
2. To understand the trade-off between deploying applications in the cloud over local infrastructure.
3. To identify different storage virtualization technologies and their benefits.
4. To understand and articulate business continuity solutions including backup and recovery technologies, local and remote replication solutions.

Course Outcomes:

After learning the course the student will be able:

1. To understand the key dimensions of the challenge of Cloud Computing.
2. To assess the economics, financial and technological implications for selecting cloud computing for organization.
3. To describe and apply storage technologies.
4. To identify leading storage technologies that provide cost-effective IT solutions for medium to large scale businesses and data centers.
5. To describe important storage technology features such as availability, replication, scalability and performance.

Course Content:

UNIT I

Introduction: Distributed Computing and Enabling Technologies, Cloud Fundamentals: Cloud Definition, Evolution, Architecture, Applications, Deployment models and service models.

UNIT II

Virtualization: Issues with virtualization, Virtualization technologies and architectures, Internals of virtual machine monitors/hypervisors, Virtualization of data centers and Issues with Multi-tenancy.

UNIT III

Implementation: Study of Cloud computing Systems like Amazon EC2 and S3, Google App Engine and Microsoft Azure, Build Private/Hybrid Cloud using open source tools, Deployment of Web Services from inside and outside a Cloud Architecture, MapReduce and its extensions to Cloud Computing, HDFS and GFS.

UNIT IV

Storage virtualization: Fixed Content and Archives, Types, Features, Benefits, CAS Architecture, Object storage and retrieval, Examples: Storage Virtualization-forms of virtualization, SNIA Taxonomy – Storage virtualization configurations, Challenges, Types of storage virtualization - Business

Continuity- Overview of emerging technologies such as Cloud storage, Virtual provisioning, Unified Storage, FCOE, FAST.

UNIT V

Business Continuity and Recovery: Information Availability, BC Terminology, Life cycle, Failure analysis: Backup and Recovery- Backup purpose, considerations, Backup Granularity, Recovery considerations- Backup methods, Process, backup and restore operations, Overview of emerging technologies: Duplication, Off site backup.

UNIT VI

Storage security and Management: Storage security framework, Securing the Storage infrastructure, Risk triad: Managing the storage infrastructure, Monitoring the storage infrastructure, identify key parameters and components to monitor in a storage infrastructure, List key management activities and examples, Define storage management standards and initiative-Industry trend.

Text Books:

1. Rajkumar Buyya, James Broberg, Andrzej Goscinski, ***"Cloud Computing Principles and Paradigms"***, Wiley Publishers, 2011.
2. Barrie Sosinsky, ***"Cloud Computing Bible"***, Wiley Publishers 2010.
3. Tim Mather, Subra Kumaraswamy, Shahed Latif, ***"Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance"***, O'Reilly 2010.
4. EMC Corporation, ***"Information Storage and Management"***, 1st Edition, Wiley India 2009..

Reference Books:

1. Rajkumar Buyya, Christian Vacchiola, S Thamarai Selvi, ***"Mastering Cloud Computing"***, McGraw Hill, 2013
2. Michael Miller, ***"Cloud Computing : Web-based Applications that change the way you work and collaborate online"***, Pearson Education, 2008
3. IBM, ***"Introduction to Storage Area Networks and System Networking"***, 5th Edition, November 2012.
4. Robert Spalding, ***"Storage Networks: The Complete Reference"***, Tata McGraw Hill, Osborne, 6th reprint 2003.
5. Marc Farley, ***"Building Storage Networks"***, Tata McGraw Hill, Osborne, 1st Edition, 2001.

Course Title:	**Pattern Recognition**	**Semester VII**	
Course Code	**BTITDE702A**	**Course Type**	**Elective**
Pre-requisite	**Nil**	**L – T – P**	**3 – 0 – 0**
Stream	**Departmental**	**Credits**	**3**

Course Objectives:

1. To study pattern recognition topics and be exposed to recent developments in pattern recognition research.
2. To provide in-depth design concepts and implementation techniques of pattern recognitions.

Course Outcomes:

1. Identify and explain detailed aspects of internal structures of pattern recognitions.
2. Compare and contrast design issues for statistical pattern recognition.
3. Develop implementation skills for building pattern recognition.

Course Content:

UNIT I

Introduction: Machine Perception, Definition of Pattern Recognition (PR), Pattern Recognition system: Sensing, Segmentation & grouping, Feature extraction, Classification and Post processing, Design cycle: Data collection, Feature choice, Model choice, Training, Evaluation and computational complexity. Learning and adaptation: Supervised learning, Unsupervised learning and Reinforcement learning. Examples of PR Applications, Pattern Recognition Extensions. Machine learning : Components of learning, Learning models, Geometric models, Probabilistic models, Logic models, Grouping and grading, Learning versus design, Theory of learning, Feasibility of learning, Error and noise, Training versus testing, Theory of generalization, Generalization bound, Approximation-generalization tradeoff, Bias and variance, Learning curve.

UNIT II

Statistical Pattern Recognition (StatPR): Introduction to StatPR, Baye's theorem, Multiple features, Conditionally independent features, Decision boundaries, Unequal costs of error, Estimation of error rates, Characteristic curves, Estimating the composition of populations, Introduction to supervised parametric approaches and unsupervised approaches. Cluster analysis: Clustering techniques, Cluster analysis, Cluster validity. Feature selection & extraction: Feature selection criteria, Feature set search algorithm, Feature selection.

UNIT III

Tree Classifiers: (a) Decision Trees: CART, C4.5, ID3, (b) Random Forests, Linear Discriminants, Discriminative Classifiers: the Decision Boundary, (a) Separability, (b) Perceptrons, (c) Support Vector Machines.

UNIT IV

Parametric Techniques: Generative methods grounded in Bayesian Decision Theory (a) Maximum Likelihood Estimation (b) Bayesian Parameter Estimation (c) Sufficient Statistics. Non-Parametric Techniques :(a) Kernel Density Estimators (b) Parzen Window (c) Nearest Neighbor Methods.

UNIT V

Syntactic (Structural) Pattern Recognition (Syntpr): Introduction to SyntPR, Syntactic PR: primitive selection & pattern grammars, Higher dimensional grammars, Syntactic recognition, Automata, Error – correcting parsing, Shape & texture analysis, Image database management. Structural analysis using constraint satisfaction and structural matching, The Formal Language-based approach to SyntPR, Learning/Training in the Language-based Approach (Grammatical Inference). Problem solving methods for PR: Problem solving models, Problem solving algorithms.

UNIT VI

Unsupervised Methods : Exploring the Data for Latent Structure :(a) Component Analysis and Dimension Reduction: i. The Curse of Dimensionality, ii. Principal Component Analysis, iii. Fisher Linear Discriminant, iv. Locally Linear Embedding, (b) Clustering: i. K-Means, ii. Expectation Maximization, iii. Mean Shift. Classifier Ensembles : (a) Bagging, (b) Boosting / AdaBoost, Algorithm Independent, Topics Theoretical Treatments in the Context of Learned Tools: (a) No Free Lunch Theorem, (b) Ugly Duckling Theorem, (c) Bias-Variance Dilemma, (d) Jacknife and Bootstrap Methods.

Text Books:

1. Duda, R.O., Hart, P.E., Stork, D.G. ***"Pattern Classification",*** Wiley, 2nd Edition, 2001.
2. Eart Gose, Richard Johnsonburg and Steve Joust, ***"Pattern Recognition and Image Analysis"***, Prentice-Hall of India-2003.

Reference Books:

1. Bishop, C. M. ***"Pattern Recognition and Machine Learning"*** Springer, 2nd Edition, 2007.
2. Marsland, S., ***"Machine Learning: An Algorithmic Perspective"***, CRC Press. 2009.
3. Theodoridis, S. and Koutroumbas, K., ***"Pattern Recognition"***, 4th Edition, Academic Press, 2008.
4. Russell, S. and Norvig, N., ***"Artificial Intelligence: A Modern Approach",*** Prentice Hall, Series in Artificial Intelligence, 2003.

Course Title:	**Soft Computing**	**Semester VII**	
Course Code	**BTITDE702B**	**Course Type**	**Elective**
Prerequisite	**Nil**	**L – T – P**	**3 – 0 – 0**
Stream	**Departmental**	**Credits**	**3**

Course Objectives:

1. To introduce a relatively new computing paradigm for creating intelligent machines useful for solving complex real world problems.
2. To gain insight into the tools that make up the soft computing technique: fuzzy logic, artificial neural networks and hybrid systems
3. To create awareness of the application areas of soft computing technique
4. To learn alternative solutions to the conventional problem solving techniques in image/signal processing, pattern recognition/classification, control system

Course Outcomes:

After learning the course the student will be able:

1. To use a new tool /tools to solve a wide variety of real world problems
2. To find an alternate solution, more adaptable, resilient and optimum
3. To apply knowledge of soft computing domain to real world problems

Course Content:

UNIT I

Artificial Neural Network: Biological neuron, Artificial neuron model, Concept of bias and threshold, McCulloch Pits Neuron Model, Implementation of logical AND, OR, XOR functions. Soft Topologies of neural networks, Learning paradigms: Supervised, Unsupervised, Reinforcement, Linear neuron model: Concept of error energy, Gradient descent algorithm and application of linear neuron for linear regression, Activation functions: Binary, Bipolar (linear, signup, log sigmoid, tan sigmoid) Learning mechanisms: Hebbian, Delta Rule of Perceptron and its limitations.

UNIT II

Artificial Neural Network: Multilayer perceptron (MLP) and back propagation algorithm, Application of MLP for classification and regression of self organizing Feature Maps, Clustering of Learning vector quantization. Radial Basis Function networks: Cover’s theorem,Mapping functions (Gaussian, Multi-quadrics, Inverse multiquadrics, Application of RBFN for classification and regression of Hopfield network, Associative memories.

UNIT III

Fuzzy Logic: Concept of Fuzzy number, Fuzzy set theory (continuous, discrete) of operations on fuzzy sets, Fuzzy membership functions (core, boundary, support), Primary and composite linguistic terms, Concept of fuzzy relation, Composition operation (T-norm, T-conorm) of Fuzzy if-then rules.

UNIT IV

Fuzzy Logic: Fuzzification, Membership value assignment techniques, De-fuzzification (Maxmembership principle, Centroid method, Weighted average method), Concept of fuzzy inference, Implication rules: Dienes-Rescher Implication, Mamdani Implication, Zadeh Implication, Fuzzy Inference systems: Mamdani fuzzy model, Sugeno fuzzy model, Tsukamoto fuzzy model, Implementation of a simple two-input single output FIS employing Mamdani model Computing.

UNIT V

Fuzzy Control Systems: Control system design, Control (Decision) Surface, Assumptions in a Fuzzy Control System Design, Fuzzy Logic Controllers, Comparison with traditional PID control, Advantages of FLC, Architecture of a FLC: Mamdani Type, Example Aircraft landing control problem.

UNIT VI

Adaptive Neuro-Fuzzy Inference Systems (ANFIS): ANFIS architecture, Hybrid Learning Algorithm, Advantages and Limitations of ANFIS Application of ANFIS/CANFIS for regression.

Text Books:

1. Laurene Fausett, ***"Fundamentals of Neural Networks: Architectures, Algorithms And Applications"***, Pearson Education, 2008.
2. Timothy Ross, "***Fuzzy Logic With Engineering Applications"***, 3rd Edition, John Wiley & Sons, 2010.
3. J.S. Jang, C.T. Sun, E. Mizutani, ***"Neuro- Fuzzy and Soft Computing"***, PHI Learning Private Limited.
4. S. N. Sivanandam, S. N. Deepa, ***"Principles of Soft Computing"***, John Wiley & Sons, 2007.

Reference Books:

1. John Hertz, Anders Krogh, Richard Palmer, ***"Introduction to the theory of neural computation"***, Addison –Wesley Publishing Company, 1991.
2. Simon Haykin, ***"Neural Networks A comprehensive foundation"***, Prentice Hall International Inc-1999.
3. José C. Principe Neil R. Euliano , W. Curt Lefebvre, ***"Neural and Adaptive Systems: Fundamentals through Simulations"***, John-Wiley & Sons, 2000.
4. Peter E. Hart, David G. Stork Richard O. Duda, ***"Pattern Classification"***, 2nd Edition, 2000.
5. Sergios Theodoridis , Konstantinos Koutroumbas, ***"Pattern Recognition"***, 4th Edition, Academic Press, 2008.
6. Hung T. Nguyen, Elbert A. Walker, ***"A First Course in Fuzzy Logic"***, 3rd Edition, Taylor & Francis Group, LLC, 2008.
7. S. N. Sivanandam , S. Sumathi, S. N. Deepa, ***"Introduction to Fuzzy Logic using MATLAB"***, Springer Verlag, 2007.

Course Title:	**Natural Language Processing**	**Semester VII**	
Course Code	**BTITDE703A**	**Course Type**	**Elective**
Pre-requisite	**Nil**	**L – T – P**	**3 – 0 – 0**
Stream	**Open/Departmental**	**Credits**	**3**

Course Objectives:

1. To learn the leading trends and systems in natural language processing.
2. To understand the concepts of morphology, syntax, semantics and pragmatics of the language.
3. To recognize the significance of pragmatics for natural language understanding.
4. To describe simple system based on logic and demonstrate the difference between the semantic presentation and interpretation of that presentation.
5. To describe application based on natural language processing and to show the points of syntactic, semantic and pragmatic processing.

Course Outcomes:

After learning the course the student will be able:

1. To understand the models, methods and algorithms of statistical Natural Language Processing.
2. To implement probabilistic models in code, estimate parameters for such models and run meaningful experiments to validate such models.
3. To apply core computer science concepts and algorithms, such as dynamic programming.
4. To understand linguistic phenomena and explore the linguistic features relevant to each NLP task.
5. To identify opportunities and conduct research in NLP.
6. To analyze experimental results and write reports.

Course Content:

UNIT I

Introduction to NLP: Definition, Issues and strategies, Application domain, Tools for NLP, Linguistic organization of NLP, NLP vs. PLP.

UNIT II

Word Classes: Review of Regular Expressions, CFG and different parsing techniques. Morphology: Inflectional, derivational, Parsing and parsing with FST, Combinational Rules.

UNIT III

Phonology: Speech sounds, Phonetic transcription,Phoneme and phonological rules, Optimality theory, Machine learning of phonological rules, Phonological aspects of prosody and speech synthesis. Pronunciation, Spelling and N-grams: Spelling errors, Detection and elimination using probabilistic models, Pronunciation variation (lexical, allophonic, dialect), Decision tree model, Counting words in Corpora, Simple N-grams, smoothing (Add One, Written-Bell, Good-Turing), N-grams for spelling and pronunciation.

UNIT IV

Syntax: POS Tagging: Tagsets, Concept of HMM tagger, Rule based and stochastic POST, Algorithm for HMM tagging, Transformation based tagging. Sentence level construction & unification: Noun phrase, Co-ordination, Sub-categorization, Concept of feature structure and unification.

UNIT V

Semantics: Representing Meaning: Unambiguous representation, Canonical form, Expressiveness, Meaning structure of language, Basics of FOPC. Semantic Analysis: Syntax driven, Attachment & integration, Robustness. Lexical Semantics: Lexemes (homonymy, polysemy, synonymy, hyponymy), WordNet, Internal structure of words, Metaphor and metonymy and their computational approaches. Word Sense Disambiguation: Selectional restriction based, Machine learning based and dictionary based approaches.

UNIT VI

Pragmatics: Discourse: Reference resolution and phenomena, Syntactic and semantic constraints on coreference, Pronoun resolution algorithm, Text coherence, Discourse structure. Dialogues: Turns and utterances, Grounding, Dialogue acts and structures. Natural Language Generation: Introduction to language generation, Architecture, Discourse planning (text schemata, rhetorical relations).

Text Books:

1. D. Jurafsky & J. H. Martin, ***"Speech and Language Processing – An introduction to Language processing, Computational Linguistics, and Speech Recognition"***, Pearson Education.
2. Allen, James, ***"Natural Language Understanding"***, 2nd Edition, Benjamin/Cummings, 1996.

Reference Books:

1. Bharathi, A., Vineet Chaitanya and Rajeev Sangal, ***"Natural Language Processing-A Pananian Perspective",*** Prentice Hall India, 1995.
2. Eugene Cherniak, ***"Statistical Language Learning"***, MIT Press, 1993.
3. Manning, Christopher and Heinrich Schütze, ***"Foundations of Statistical Natural Language Processing",*** MIT Press, 1999.

Course Title:	**Artificial Intelligence**	**Semester VII**	
Course Code	**BTITDE703B**	**Course Type**	**Elective**
Pre-requisite	**Nil**	**L – T – P**	**3 – 0 – 0**
Stream	**Departmental**	**Credits**	**3**

Course Objectives:

1. To acquaint the students with the theoretical and computational techniques in Artificial Intelligence.
2. To use various symbolic knowledge representation to specify domains and reasoning tasks of a situated software agent.
3. To use different logical systems for inference over formal domain representations and trace how a particular inference algorithm works on a given problem specification.
4. To understand the conceptual and computational trade-offs between the expressiveness of different formal representations.

Course Outcomes:

After learning the course the students should be able:

1. To find appropriate idealizations for converting real world problems into AI search problems formulated using the appropriate search algorithm.
2. To analyze, formalize and write algorithmic methods for search problem.
3. To explain important search concepts, the definitions of admissible and consistent heuristics and completeness and optimality.
4. To implement and execute by hand alpha-beta search.
5. To design good evaluation functions and strategies for game playing.
6. To carry out proofs in first order and propositional logic using techniques such as resolution, unification, backward and forward chaining.
7. To choose and implement learning algorithms such as decision trees, support vector machines, and boosting.

Course Content:

UNIT I

Introduction: Overview of Artificial intelligence- Problems of AI, AI techniques, Tic - Tac - Toe problem. Intelligent Agents: Agents & environment, Nature of environment, Structure of agents, Goal based agents, Utility based agents, Learning agents.

UNIT II

Problem Solving: Problems, Problem Space & search: Defining the problem as state space search, Production system, Problem characteristics and issues in the design of search programs. Search techniques: Solving problems by searching: problem solving agents, Searching for solutions; uniform search strategies: Breadth first search, Depth first search, Depth limited search, Bidirectional search, Comparing uniform search strategies.

UNIT III

Heuristic search strategies: Greedy best-first search, A* search, Memory bounded heuristic search: local search algorithms & optimization problems: Hill climbing search, Simulated annealing search, Local beam search, Genetic algorithms; Constraint satisfaction problems, Local search for constraint satisfaction problems. Adversarial search: Games, optimal decisions & strategies in games, The minimax search procedure, Alpha-beta pruning, Additional refinements, Iterative deepening.

UNIT IV

Knowledge & reasoning: Knowledge representation issues, Representation & mapping, Approaches to knowledge representation, Issues in knowledge representation. Using predicate logic: Representing simple fact in logic, Representing instant & ISA relationship, Computable functions & predicates, Resolution, Natural deduction. Representing knowledge using rules: Procedural verses declarative knowledge, Logic programming, Forward verses backward reasoning, Matching, Control knowledge.

UNIT V

Probabilistic reasoning: Representing knowledge in an uncertain domain, The semantics of Bayesian networks, Dempster-Shafer theory, Fuzzy sets & fuzzy logics, Planning: Overview, Components of a planning system, Goal stack planning, Hierarchical planning and other planning techniques.

UNIT VI

Natural Language processing: Introduction, Syntactic processing, Semantic analysis, Discourse & pragmatic processing. Learning: Forms of learning, Inductive learning, Learning decision trees, explanation based learning, Learning using relevance information, Neural net learning & genetic learning. Expert Systems: Representing and using domain knowledge, Expert system shells and knowledge acquisition.

Text Books:

1. Rich, E. and Knight K., ***"Artificial Intelligence"***, Tata McGraw- Hill.
2. Russell, S. and Norvig P., ***"Artificial Intelligence: A Modern Approach"***, Pearson Education.
3. Patterson, Dan W. , ***"Introduction to Artificial Intelligence & Expert Systems"***, PHI, 2005.

Reference Book:

1. Nilsson, N. J., Morgan Kaufmann, ***"Artificial Intelligence: A New Synthesis"***,Tata McGraw-Hill.

Course Title:	**Real Time Systems**	**Semester VII**	
Course Code	**BTITSE704A**	**Course Type**	**Elective**
Pre-requisite	**Operating Systems, Design and Analysis of Algorithms**	**L – T – P**	**3 – 0 – 0**
Stream	**Software Application and Development**	**Credits**	**3**

Course Objectives:

1. To introduce students to the fundamental problems, concepts and approaches in the design and analysis of real-time systems.
2. To study issues related to the design and analysis of systems with real-time constraints.
3. To learn real-time scheduling and schedulability analysis.
4. To understand formal specification and verification of timing constraints and properties.
5. To design methods for real-time systems.
6. To learn new techniques of state-of-the-art real-time systems research.

Course Outcomes:

After learning the course the student will be able:

1. To characterize real-time systems and describe their functions.
2. To analyze, design and implement a real-time system.
3. To apply formal methods to the analysis and design of real-time systems.
4. To apply formal methods for scheduling real-time systems.
5. To characterize and debug a real-time system.

Course Content:

UNIT I
Introduction: Hard vs. Soft real time systems, A reference model of real time system. Real-time scheduling: Clock driven approach, Weighted Round-robin approach, Priority driven approach, Dynamic vs. static system, Effective Release Times and Deadlines, EDF and LST algorithm, Optimality and Non-Optimality of the EDF and LST algorithms, Off line vs. online Scheduling.
UNIT II
Clock-Driven Scheduling: Static, Time-Driven scheduler, General structure of Cyclic Schedules, Cyclic Executives, Improving the Average Response Time of a-periodic Jobs, Scheduling Sporadic Jobs.
UNIT III
Priority Driven Scheduling of Periodic Tasks: Fixed priority vs. Dynamic priority algorithms, Maximum Schedulable Utilization, Optimality of the RM and DM algorithms, A Schedulability test for fixed-priority tasks with short response times, Sufficient Schedulability conditions for the RM and DM algorithms.

UNIT IV

Scheduling Aperiodic and Sporadic Jobs in Priority-Driven Systems: Assumptions and Approaches, Deferrable Servers, Sporadic Servers, Constant Utilization, Total Bandwidth and Weighted Fair-Queuing Servers.

UNIT V

Resources and Resource Access control: Resource contention, Resource access control, Nonpreemptive critical section, Basic Priority-Inheritance protocol, Basic Priority Ceiling Protocol, Stack based, Priority-ceiling protocol, preemption ceiling protocol.

UNIT VI

Multiprocessor scheduling, Resource Access Control, and Synchronization: Model of multiprocessor & distributed systems, task assignment, multiprocessor Priority-ceiling protocol, Elements of Scheduling Algorithms for End-to-End Periodic Tasks- IPS protocols, PM protocols, MPM protocol.

Text Books:

1. Jane W. S. Liu, ***"Real-Time System"***, Pearson Education.
2. C. M. Krishna and K. G. Shin, ***"Real-Time Systems"***, McGraw Hill.

Reference Books:

1. Laplante, ***"Real Time System Design and Analysis: An Engineer Handbook"***, PHI.
2. Dr. K. V. K. Prasad, ***"Embedded Real Time System Concept Design and Programming"***, Wiley India.

Course Title:	**Information Security**	**Semester VII**	
Course Code	**BTITSE704B**	**Course Type**	**Elective**
Pre-requisite	**Internetworking Protocols**	**L – T – P**	**3 – 0 – 0**
Stream	**Infrastructure and Security Management**	**Credits**	**3**

Course Objectives:

1. To understand information security's importance in the increasingly computer-driven world.
2. To master the key concepts of information security and its working.
3. To develop a security mindset.
4. To learn to critically analyze situations of computer and network security usage.
5. To identify the salient issues, viewpoints and trade-offs of information security.

Course Outcomes:

After learning the course the student will be able:

1. To explain the challenges and scope of information security.
2. To explain security concepts as confidentiality, integrity and availability.
3. To explain the importance of cryptographic algorithms used in information security .
4. To identify and explain symmetric algorithms for encryption-based security of information.
5. To describe the access control mechanism used for user authentication and authorization.
6. To describe Secure Sockets Layer (SSL), Internet Protocol (IP) communications by using Internet Protocol Security (IPSec).
7. To explain the use of security tools as firewalls and intrusion prevention systems.
8. To explain malicious software issues introduced by software-based viruses and worms.
9. To describe the process of risk assessment in the context of IT security management.

Course Content:

UNIT I

Introduction to Information Systems: Security concepts, Computer security concepts, Threats, Attacks and Assets, Security functional requirements, A security architecture for Open Systems, Computer security trends, Computer security strategy.

UNIT II

Cryptographic Tools: Confidentiality with Symmetric Encryption, Message Authentication and Hash Functions, Public-Key Encryption, Digital Signatures and Key Management, Practical Application: Encryption of Stored Data.

UNIT III

Models, Frameworks, Standards & Legal Framework: A structure and framework of compressive security policy, policy infrastructure, policy design life cycle and design processes, PDCA model, Security policy standards and practices - ISO 27001, SSE-CMM, IA-CMM, ITIL & BS 15000, BS7799, Understanding Laws for Information Security: Legislative Solutions, Contractual Solutions, Evidential Issues, International Activity, Indian IT Act, Laws of IPR, Indian Copyright Act.

UNIT IV

Controls: Access control principles, Subjects, Objects and access rights, Discretionary access control, Role-based access control, Case study.

UNIT V

Virus and Malware: Introduction & types of Malicious Software (Malware), Propagation–Infected Content–Viruses, Propagation–Vulnerability Exploit–Worms, Propagation–Social Engineering–SPAM E-mail, Trojans, Payload–System Corruption, Payload–Attack, Agent–Zombie, Bots, Payload–Information Theft–Keyloggers, Phishing, Spyware, Payload–Stealthing–Backdoors, Rootkits, Countermeasures.

UNIT VI

Security issues: Database security challenge in the modern world, Federated Databases, securing Mobile databases, Network Security, Trusted and untrusted networks, Network attacks, Network security dimensions, Network attack – the stages; using firewalls effectively; Privacy – Privacy invasion due to direct marketing, Outsourcing using data masking ; privacy issues in smart card applications, Ethical Hacking ;Role of Cryptography in information security, digital signatures.

Text Books:

1. Nina Gobole, ***"Information Systems Security: Security Management, Metrics, Frameworks And Best Practices"***, Wiley, 2008.
2. Mark Rhodes –Ousley, ***"Information Security: The Complete Reference"***, McGraw-Hill Education, 2nd Edition, 2013.
3. Dhiren R Patel, ***"Information Security Theory and Practices"***, PHI Learning, 2008.
4. Mark Stamp, ***"Information Security: Principles and Practice"***, 2nd Edition, , Wiley, 2011.

Reference Books:

1. Gary R. McGraw, ***"Software Security: Building Security In"*** Addison Wesley, 2006.
2. Ankit Fadia, ***"Network Security: A Hacker's Perspective"***, 2006.

Course Title:	**Management Information Systems**	**Semester VII**	
Course Code	**BTITSE704C**	**Course Type**	**Elective**
Pre-requisite	**Decision Support Systems**	**L – T – P**	**3 – 0 – 0**
Stream	**Information Management & Quality Control**	**Credits**	**3**

Course Objectives:

1. To create interest and awareness about the proliferation of the Information Systems in today's organizations.
2. To understand categories of MIS: Operations Support System, Management Support System and Office automation system, Functional management system.
3. To learn Information Systems for strategic management and strategic role of information systems.
4. To plan for information systems: Identification of Applications, Business Application Planning, Systems and Critical Success Factors, Method of Identifying Applications.
5. To understand System Development Process and Approaches, System Implementation, System maintenance, Introduction to MIS Risks, System Evaluation, IT Procurement Options. Change management in IT Projects.

Course Outcomes:

After learning the course the student will be able:

1. To understand the usage and constituents of MIS in organizations.
2. To understand the classifications, understanding and the different functionalities of these MIS.
3. To explain the functions and issues at each stage of system development.
4. To identify emerging trends in MIS technologies.
5. To identify and assess MIS in real-life organization.

Course Content:

UNIT I

Management & organizational support systems for digital firm: Definition of MIS; Systems Approach to MIS: Report writing s/w, MIS and Human factor considerations, concept of organizational information sub-system, MIS & problem solving.

UNIT II

Information systems & business strategy: Information Management, Who are the users? Manager & Systems, Evolution of Computer based information system (CBIS), Model of CBIS. Information services organization: Trend to End-User computing, Justifying the CBIS, Achieving the CBIS, Managing the CBIS, Benefits & Challenges of CBIS implementation. Strategic Information System, Business level and Firm level Strategy.

UNIT III

Information systems in the enterprise: Systems from Management and functional perspective and their relationship: Executive Information System, Decision support system sales and Marketing Information System, Manufacturing Information System, Human-Resource Information System. Finance and Account Information System.

UNIT IV

Information technology for competitive advantage: Firm in its environment, What are the information resources? Who manages the information resources? Strategic planning for information resources. End-User Computing as a strategic issue, Information resource management concept.

UNIT V

E-commerce and international information system: Introduction to E-Commerce, Business Intelligence. E-Commerce strategy, Electronic Data Interchange, E-commerce methodology, E-commerce technology, Business application of the Internet. Electronic Business success strategies.

UNIT VI

Managing International Information Systems: IIS architecture, Global business Drivers, Challenges, Strategy: divide, conquer and appease, Cooptation, Business organization, Problems in implementing global information systems, Computer crime, ethics and social issues.

Text Book:

1. Kelkar, S.A., ***"Management Information Systems"***, Prentice Hall of India, 2003.

Reference Books:

1. Mark G. Simkin, ***"Introduction to computer Information System for Business"***, 1996.
2. James A. Senn, ***"Analysis & Design of Information Systems"***, McGraw-Hill.

Course Title:	**Distributed Computing**	**Semester VII**	
Course Code	**BTITSE704D**	**Course Type**	**Elective**
Pre-requisite	**Operating Systems**	**L – T – P**	**3 – 0 – 0**
Stream	**Networking**	**Credits**	**3**

Course Objectives:

1. To understand the major tools and techniques that allow programmers to effectively program the parts of the code that require substantial communication and synchronization.
2. To study the core ideas behind modern coordination and communication paradigms and distributed data structures
3. To introduce a variety of methodologies and approaches for reasoning about concurrent and distributed programs.
4. To realize basic principles and best practice engineering techniques of concurrent and distributed computing.
5. To study the safety and progress properties of concurrent and distributed algorithms.
6. To understand the performance of current multi-core and future many-core systems.

Course Outcomes:

After learning the course the student will be able:

1. To identify the core concepts of distributed systems.
2. To learn orchestration of multiple machines to correctly solve problems in an efficient, reliable and scalable way.
3. To examine concepts of distributed systems in designing large systems.
4. To apply distributed computing concepts to develop sample systems.

Course Content:

UNIT I

Introduction: Historical background, Key characteristics, Design goals and challenges, Review of networking and internetworking, Internet protocols.

UNIT II

Processes and Inter process Communication: Processes and threads, Virtualization, Code migration, The API for the Internet protocols, External data representation, Client-server communication, Multicast communication, Message oriented communication, Network virtualization, Overlay networks, RPC and MPI.

UNIT III

Naming: Name services and Domain Name System, Directory services, Case study: X.500 directory service.

UNIT IV

Time, Global States and Synchronization: Physical and logical clocks, Global states, Mutual exclusion, Election algorithms, Consistency and Replication: Consistency models, Replica management, Consistency protocols, Case studies of highly available services: the gossip architecture and Coda.

UNIT V

Fault Tolerance and Security: Distributed Commit, Recovery, Security Issues, Cryptography. Distributed File Systems: File service architecture, Case study: Sun Network File System, The Andrew File System.

UNIT VI

Peer to peer Systems: Introduction, Napster, Peer-to-peer middleware, Routing overlays, Case studies: Pastry, Tapestry. Distributed Object Based Systems: Distributed objects, Java beans, CORBA.

Text Books:

1. Tanenbaum A.S, ***"Distributed Systems: Principles and Paradigms"***, 2nd Edition, Pearson Education, 2006.
2. Coulouris G., Dollimore J., Kindberg T. and Blair G., ***"Distributed Systems: Concepts and Design"***, 5th Edition, Addison Wesley, 2011.
3. Mahajan S., Shah S., ***"Distributed Computing"***, 1st Edition, Oxford University Press, 2010.

Reference Books:

1. Hwang K., Dongarra J., Geoffrey C. Fox, ***"Distributed and Cloud Computing: From Parallel Processing to the Internet of Things"***, Morgan Kaufmann, 2011.
2. Comer D.E. and Droms, R.E., ***"Computer Networks and Internets"***, 4th Edition, Prentice-Hall, 2004.

Course Title:	**Data Warehousing and Data Mining**	**Semester VII**	
Course Code	**BTITSE704E**	**Course Type**	**Elective**
Pre-requisite	**Database Management Systems**	**L – T – P**	**3 – 0 – 0**
Stream	**Data Science**	**Credits**	**3**

Course Objectives:

1. Introduce the concepts, techniques, design and applications of data warehousing and data mining.
2. Enable students to understand and implement classical algorithms in data mining and data warehousing.
3. Enable students to learn how to analyze the data, identify the problems and choose the relevant algorithms to apply.

Course Outcomes:

After learning the course the student will be able:

1. Understand the functionality of the various data mining and data warehousing components.
2. Appreciate the strengths and limitations of various data mining and data warehousing models.
3. Compare the various approaches to data warehousing and data mining implementations.
4. Describe and utilize a range of techniques for designing data warehousing and data mining systems for real-world applications.

Course Content:

UNIT I

Introduction to data warehousing, Evolution of decision support systems, Modeling a data warehouse, granularity in the data warehouse, Data warehouse life cycle, building a data warehouse, Data Warehousing Components, Data Warehousing Architecture.

UNIT II

On Line Analytical Processing, Categorization of OLAP Tools, Introduction to Data mining and knowledge discovery, Relation to Statistics, Databases, Data Mining Functionalities, Steps In Data Mining Process, Architecture of a Typical Data Mining Systems, Classification of Data Mining Systems.

UNIT III

Overview of Data Mining Techniques, Data Preprocessing, Data Cleaning, Data Integration, Data Transformation and Data Reduction, Data Generalization and Summarization Based Characterization, Mining Association Rules In Large Databases.

UNIT IV

Classification and Prediction, Issues Regarding Classification and Prediction, Classification By Decision Tree Induction, Bayesian Classification, Other Classification Methods.

UNIT V

Prediction, Clusters Analysis, Types of Data In Cluster Analysis, Categorization of Major Clustering Methods, Partitioning methods, Hierarchical Methods.

UNIT VI

Applications of Data Mining, Social Impacts of Data Mining, Case Studies, Mining WWW, Mining Text Database, Mining Spatial Databases.

Text Books:

1. Adriaans, ***" Data mining"***, Addison- Wesley, 1996.
2. Margaret Dunham, ***"Data Mining: Introductory and Advanced Topics"***, Published by Prentice Hall.
3. Weiss, Sholom M.,***"Predictive data mining : a practical guide",*** Kaufmann Publishers, 1998.

Reference Books:

1. Pang-Ning Tan, Michael Steinback, Vipin Kumar, ***"Introduction to Data Mining"***, Pearson Education, 2008.
2. M.Humphires, M.Hawkins, ***"Data Warehousing: Architecture and Implementation"***, Pearson Education, 2009.
3. Anahory, Murray, ***"Data Warehousing in the Real World"***, Pearson Education, 2008.
4. Kargupta, Joshi, etc., ***"Data Mining: Next Generation Challenges and Future Directions"***, Prentice Hall of India Pvt. Ltd, 2007.

Course Title:	**Cloud Computing and Storage Management Lab**	**Semester VII**	
Course Code	**BTITL705**	**Course Type**	**Compulsory**
Pre-requisite	**Internetworking Protocols**	**L – T – P**	**0 – 0 – 2**
Stream	**Core**	**Credit**	**1**

Lab Experiments Objectives:

Learner will be able to...

1. Appreciate cloud architecture.
2. Create and run virtual machines on open source OS.
3. Implement Infrastructure, storage as a Service.
4. Install and appreciate security features for cloud.

Lab Experiments List:

1. Study of Cloud Computing & Architecture.
2. Study and implementation of Infrastructure as a Service.
3. Implementation of Private cloud using Eucalyptus or Open stake.
   - Working with KVM to create VM.
   - Installation and configuration of Private cloud.
   - Bundling and uploading images on a cloud.
   - Creating web based UI to launch VM.
   - Working with Volumes – Attached to the VM.

Course Title:	**Pattern Recognition Lab**	**Semester VII**	
Course Code	**BTITDEL706A**	**Course Type**	**Elective**
Pre-requisite	**NIL**	**L – T – P**	**0 – 0 – 2**
Stream	**Departmental**	**Credit**	**1**

Lab Experiments Objectives:

1. To study pattern recognition topics and be exposed to recent developments in pattern recognitions research.
2. To provide in-depth design concepts and implementation techniques of pattern recognitions.

Lab Experiments List:

1. Feature Representation.
2. Mean and Covariance.
3. Linear Perceptron Learning.
4. Generation of Random Variables.
5. Bayesian Classification.
6. MLE: Learning the classifier from data.
7. Data Clustering: K-Means, MST-based.

Course Title:	**Soft Computing – Lab**	**Semester VII**	
Course Code	**BTITDEL706B**	**Course Type**	**Elective**
Pre-requisite	**Programming in Java/C/C++**	**L – T – P**	**0 – 0 – 2**
Stream	**Departmental**	**Credit**	**1**

Lab Experiments Objectives:

1. To utilize Soft computing algorithms to solve engineering problems.
2. To compare results and provide a analysis of algorithms efficiency.
3. To apply soft computing thought process for solving issues.

Lab Experiments List:

1. Implement simple logic network using MP neuron model.
2. Implement a simple linear regression with a single neuron model.
3. Implement and test MLP trained with back-propagation algorithm.
4. Implement and test RBF network.
5. Implement SOFM for character recognition.
6. Implement fuzzy membership functions (triangular, trapezoidal, gbell, PI, Gamma, Gaussian)
7. Implement defuzzyfication (Max-membership principle, Centroid method, Weighted average method).
8. Implement FIS with Mamdani Inferencing mechanism.
9. A small project: may include classification or regression problem, using any soft computing technique studied earlier.

Course Title:	**Real Time Systems Lab**	**Semester VII**	
Course Code	**BTITSEL707A**	**Course Type**	**Elective**
Pre-requisite	**Programming in Java/C/C++**	**L – T – P**	**0 – 0 – 2**
Stream	**Software Application and Development**	**Credit**	**1**

Lab Experiments Objectives:

1. To design and write programs to demonstrate various real time system concepts of scheduling processes.
2. To demonstrate how real time principles can be applied to business problems by simulating business processes.

Lab Experiments List:

1. Execute a program to demonstrate real time scheduling EDF vs. LST to show a comparative result.
2. Demonstrate clock driven scheduler system.
3. Develop a random generator to set priority and demonstrate a priority driven scheduler system.
4. Simulate a manufacturing process to demonstrate resource and resource control scheduling system in real time.
5. Simulate a logistics service provider scheduling of product delivery system using the principles of real-time system learned in the course.

Course Title:	**Information Security – Lab**	**Semester VII**	
Course Code	**BTITSEL707B**	**Course Type**	**Elective**
Pre-requisite	**Programming in Java/C/C++**	**L – T – P**	**0 – 0 – 2**
Stream	**Infrastructure and Security Management**	**Credit**	**1**

Lab Experiments Objectives:

1. To be familiar with the algorithms of data mining,
2. To be acquainted with the tools and techniques used for Knowledge Discovery in Databases.
3. To be exposed to web mining and text mining.

Lab Experiments List:

1. Implement the following SUBSTITUTION & TRANSPOSITION TECHNIQUES concepts:
   a. Caesar Cipher
   b. Playfair Cipher
   c. Hill Cipher
   d. Vigenere Cipher
   e. Rail fence – row & Column Transformation.
2. Implement the following algorithms
   a. DES
   b. RSA Algorithm
   c. Diffiee-Hellman
   d. MD5
   e. SHA-1
3. Implement the SIGNATURE SCHEME - Digital Signature Standard.
4. Demonstrate how to provide secure data storage, secure data transmission and for creating digital signatures (GnuPG).
5. Setup a honey pot and monitor the honeypot on network (KF Sensor).
6. Installation of rootkits and study about the variety of options.
7. Perform wireless audit on an access point or a router and decrypt WEP and WPA.(Net Stumbler).
8. Demonstrate intrusion detection system (ids) using any tool (snort or any other s/w).

Course Title:	**Management Information Systems - Lab**	**Semester VII**	
Course Code	**BTITSEL707C**	**Course Type**	**Elective**
Pre-requisite	**Programming in Java/Python**	**L – T – P**	**0 – 0 – 2**
Stream	**Information Management & Quality Control**	**Credit**	**1**

Lab Experiments Objectives:

1. To prepare organizational data for MIS reports and dashboards.
2. To learn what data should be used to prepare MIS reports.
3. To write programs to produce MIS reports.
4. To depict data in a MIS report to support decision making.

Lab Experiments List:

1. Prepare a MIS report for HR system to depict the various grades of employee in an organization by years of service.
2. Prepare a EIS report of Sales of an organization.
3. Prepare a graphical EIS dashboard of the Sales over a period of 1 year.
4. Prepare a manufacturing MIS report of all orders fulfilled, in progress and pending for management.
5. Prepare a monthly MIS profit and loss dashboard from financial data.
6. Prepare an EIS for reporting population demographic.

Course Title:	**Distributed Computing-Lab**	**Semester VII**	
Course Code	**BTITSEL707D**	**Course Type**	**Elective**
Pre-requisite	**Programming in Java/C/C++**	**L – T – P**	**0 – 0 – 2**
Stream	**Networking**	**Credit**	**1**

Lab Experiments Objective:

1. To implement distributed systems paradigms practically to understand impact on resources and processes.

Lab Experiments List:

1. Load Balancing Algorithm.
2. Scalability in Distributed Environment.
3. Client/server using RPC/RMI.
4. Inter-process communication.
5. Election Algorithm.
6. Distributed Deadlock.
7. Name Resolution protocol.
8. Clock Synchronization algorithms.
9. Mutual Exclusion Algorithm.
10. Group Communication.
11. CORBA architecture.
12. Parallel Algorithms.
13. Message Passing Interface.

Course Title:	**Data Warehousing and Data Mining-Lab**	**Semester VII**	
Course Code	**BTITSEL707E**	**Course Type**	**Elective**
Pre-requisite	**SQL**	**L – T – P**	**0 – 0 – 2**
Stream	**Data Science**	**Credit**	**1**

Lab Experiments Objectives:

1. To be familiar with the algorithms of data mining.
2. To be acquainted with the tools and techniques used for Knowledge Discovery in Databases.
3. To be exposed to web mining and text mining.

Lab Experiments List:

1. Creation of a Data Warehouse.
2. Apriori Algorithm.
3. FP-Growth Algorithm.
4. K-means clustering.
5. One Hierarchical clustering algorithm.
6. Bayesian Classification.
7. Decision Tree.
8. Support Vector Machines.
9. Applications of classification for web mining.
10. Case Study on Text Mining or any commercial application.

Course Title:	**Project Phase – I**	**Semester VII**	
Course Code	**BTITP708**	**Course Type**	**Compulsory**
Pre-requisite	**Nil**	**L – T – P**	**0–0 – 8**
Stream	**Core**	**Credits**	**4**

The project should enable the students to combine the theoretical and practical concepts studied in his/her academics. The project work should enable the students to exhibit their ability to work in a team, develop planning and execute skills and perform analyzing and trouble shooting of their respective problem chosen for the project. The students should be able to write technical report, understand the importance of teamwork and group task. The students will get knowledge about literature survey, problem definition, its solution, and method of calculation, trouble shooting, costing, application and scope for future development.

Project work

The project work is an implementation of learned technology. The knowledge gained by studying various subjects separately supposed to utilize as a single task. A group of 03/04 students will have to work on assigned work. The topic could be a product design, specific equipment, live industrial problem etc. The project work involves experimental/theoretical/computational work. It is expected to do necessary literature survey by referring current journals belonging to Information Technology reference books and internet. After finalization of project, requisites like equipments, data, tools etc. should be arranged.

Project Activity

The project groups should interact with guide, who in turn advises the group to carry various activities regarding project work on individual and group basis. The group should discuss the progress every week in the project hours and follow further advice of the guide to continue progress. Guide should closely monitor the work and help the students from time to time. The guide should also maintain a record of continuous assessment of project work progress on weekly basis.

Phase I

1. Submission of project/problem abstract containing problem in brief, requirements, broad area, applications, approximate expenditure if required etc.
2. Problem definition in detail.
3. Literature survey.
4. Requirement analysis.
5. System analysis (Draw DFD up to level 2, at least).
6. System design, Coding/Implementation (20 to 30%).

Course Title:	**Industrial Training Assessment**	**Semester VII**	
Course Code	**BTIT709**	**Course Type**	**Compulsory**
Pre-requisite	**Nil**	**L – T – P**	**0 – 0 – 0**
Stream	**Core**	**Credits**	**2**

The students receive theoretical knowledge of the basic engineering and applied engineering in first six semesters. They have to do in plant training of four weeks at least during vacation after sixth semester. The training enables the students to expose to industry during their training, provides orientation and improves their prospects for employment. The students should prefer industrial training in the domain of Information Technology.

Training report and Assessment

During the industrial training he/she will observe layout, working environment, various equipments, tools, instruments etc. under the supervision of supervisor and engineer of the company. Students are required to submit a printed report of industrial training in the seventh semester. The report should contain information about the major field of company, particularly about the section/department where he/she have undergone the training giving the details of equipments, product, tools their detailed specification, use etc. The training report and field work done by students will be assessed by internal examiner(s) and appropriate grade will be awarded.

Course Title:	**Internet of Things**	**Semester**	**VIII**
Course Code	**BTITDE801A**	**Course Type**	**Elective**
Pre-requisite	**Microprocessor & Micro-controllers**	**L – T – P**	**3 – 0 – 0**
Stream	**Departmental**	**Credits**	**3**

Course Objectives:

1. To understand the vision of IoT.
2. To understand IoT market perspective.
3. To study the data and knowledge management and use of devices in IoT technology.
4. To understand state of the art – IoT Architecture.
5. To study the real world IoT design constraints, industrial automation and commercial building automation in IoT.

Course Outcomes:

After learning the course the students should be able:

1. To interpret the vision of IoT from a global context.
2. To determine the market perspective of IoT.
3. To compare and contrast the use of devices, gateways and data management in IoT.
4. To implement state of the art architecture in IoT.
5. To illustrate the application of IoT in industrial automation and identify real world design constraints.

Course Content:

UNIT I

M2M to IoT-The Vision-Introduction, From M2M to IoT, M2M towards IoT-the global context, A use case example, Differing characteristics.

UNIT II

M2M to IoT: A Market Perspective– Introduction, Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies, M2M to IoT. An architectural overview: Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, Standards considerations.

UNIT III

M2M and IoT Technology Fundamentals - Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service (XaaS), M2M and IoT Analytics, Knowledge Management.

UNIT IV

IoT Architecture: State of the Art, Introduction, State of the art, Architecture Reference Model - Introduction, Reference model and architecture, IoT reference model.

UNIT V

IoT Reference Architecture: Introduction, Functional view, Information view, Deployment and operational View, Other relevant architectural views. Real-World Design Constraints - Introduction, Technical design constraints-hardware is popular again, Data representation and visualization, Interaction and remote control.

UNIT VI

Industrial Automation: Service-oriented architecture-based device integration, SOCRADES: realizing the enterprise integrated Web of Things, IMC-AESOP: from the Web of Things to the Cloud of Things, Commercial Building Automation: Introduction, Case study: phase one-commercial building automation today, Case study: phase two- commercial building automation in the future.

Text Book:

1. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle,***"From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence"***, Academic Press, 1st Edition, 2014.

Reference Books:

1. Vijay Madisetti, Arshdeep Bahga, ***"Internet of Things (A Hands-on-Approach)"***, VPT, 1st Edition, 2014.
2. Francis da Costa, ***"Rethinking the Internet of Things: A Scalable Approach to Connecting Everything"***, 1st Edition, Apress Publications, 2013.

Course Title:	**E-commerce Systems**	**Semester**	**VIII**
Course Code	**BTITDE801B**	**Course Type**	**Elective**
Pre-requisite	**Nil**	**L – T – P**	**3 – 0 – 0**
Stream	**Departmental**	**Credits**	**3**

Course Objectives:

1. To learn the importance of E-commerce and its impact on business.
2. To understand the various E-commerce business models and its uses.
3. To learn the various E-commerce technologies and IT requirements for a successful E-commerce business.
4. To discover factors required for good E-commerce systems.

Course Outcomes:

After learning the course the students should be able:

1. To explain E-commerce systems construct limitations and benefits.
2. To design E-commerce applications.
3. To discuss security and IT requirements to deploy E-commerce systems.
4. To explain the critical success factors of good E-commerce applications.

Course Content:

UNIT I

Introduction to E-commerce: Meaning, Nature and scope; channels of E-commerce, Business applications of E-commerce, Traditional commerce vs. E-commerce and Business model of E-commerce: B2B, B2C, C2C, B2G and other models of E-commerce.

UNIT II

Mobile commerce: Introduction to M-Commerce, History and key benefits & limitations, Critical success factors, Wireless Application Protocol (WAP), Mobile banking. Electronic payment system: Type of payment systems: E-cash and currency servers, E-cheques, Credit card, Smart card, Electronic purses and debit cards, Operational, Credit and legal risks of e-payments, Risk management options for e-payment system, Order fulfillment for E-commerce.

UNIT III

E-commerce strategy: Overview, Strategic methods for developing E- commerce.

UNIT IV

The Four C's of E-commerce: (Convergence, Collaborative Computing, Content Management & Call Center). Convergence: Technological Advances in Convergence: Types, Convergence and its implications, Convergence and Electronic Commerce, Collaborative Computing: Collaborative product development, contract as per CAD, Simultaneous Collaboration, Security. Content Management: Definition of content, Authoring Tools and Content Management, Content: partnership, repositories, convergence, providers, Web Traffic and Traffic Management; Content Marketing. Call Center: Definition, Need, Tasks Handled, Mode of Operation, Equipment, Strength & Weaknesses of Call Center, Customer Premises Equipment (CPE).

UNIT V

E-commerce Technologies: Relationship Between E-Commerce and Networking, Different Types of Networking for E-Commerce, Internet, Intranet and Extranet, EDI Systems.

UNIT VI

Security issues in e-commerce: Security risk of e-commerce, Type and sources of threats, Protecting the electronic commerce assets and intellectual property, Firewalls, Client server network security, Data and message security, Digital identification and electronic signature, Encryption approach to e-commerce security.

Text Books:

1. C.S.V. Murthy, ***"E-Commerce Concept-model-strategies"***, Himalaya Publication House.
2. Nidhi Dhawan, ***"E-Commerce Concepts and Applications"***, International book house Pvt. Ltd.
3. Kalkota and Whinston, ***"Frontiers of Electronic Commerce"***, Pearson publication.

Reference Books:

1. Elias M. Awad., ***"Electronic Commerce"***, PHI.
2. Joseph, ***"E-commerce"***, PHI, 2nd Edition.
3. Bhaskar Bharat, ***"Electronic Commerce - Technologies & Applications"***, TMH
4. Chris Bates, ***"Web Programming"***, Wiley publication, 3rd Edition, 2009.
5. B.V. Kumar, S.V. Subrahmanya, ***"Web Services: An Introduction"***, Tata McGraw Hill, 2008.

Course Title:	**Mobile Computing**	**Semester**	**VIII**
Course Code	**BTITSE802A**	**Course Type**	**Elective**
Pre-requisite	**Internetworking Protocols , Operating Systems**	**L – T – P**	**3 – 0 – 0**
Stream	**Software and Application Development**	**Credits**	**3**

Course Objectives:

1. To describe the basic concepts and principles in mobile computing.
2. To understand the concept of Wireless LANs, PAN, Mobile Networks, and Sensor Networks.
3. To explain the structure and components for Mobile IP and Mobility Management.
4. To understand positioning techniques and location-based services and applications.
5. To describe the important issues and concerns on security and privacy.
6. To design and implement mobile applications to realize location-aware computing.
7. To design algorithms for location estimations based on different positioning techniques and platforms.
8. To acquire the knowledge to administrate and to maintain a Wireless LAN.

Course Outcomes:

After learning the course the students should be able:

1. To describe wireless and mobile communications systems.
2. To choose an appropriate mobile system from a set of requirements.
3. To work around the weaknesses of mobile computing.
4. To interface a mobile computing system to hardware and networks.
5. To program applications on a mobile computing system and interact with servers and database systems.

Course Content:

UNIT I

Fundamental of Wireless and basics of wireless network: Digital communication, Wireless communication system and limitations, Wireless media, Frequency spectrum, Technologies in digital wireless communication, Wireless communication channel specification, Wireless network, Wireless switching technology, Wireless communication.

UNIT II

Mobile Communications and Computing: An Overview Mobile Communication, Mobile Computing, Mobile Computing Architecture, Mobile Devices, Mobile System Networks, Data Dissemination, Mobility Management, Security, Mobile Devices and Systems, Mobile Phones, Digital Music Players, Hand-held Pocket Computers, Hand-held Devices: Operating Systems, Smart Systems, Limitations of Mobile Devices, Automotive Systems.

UNIT III

GSM and other architectures: GSM-Services and System Architectures, Radio Interfaces, Protocols Localization, Calling, Handover, Security, New Data Services, modulation, Multiplexing, Controlling the medium access, Spread spectrum, Coding methods, CDMA, IMT 2000, WCDMA and CDMA 2000, 4G Networks.

UNIT IV

Mobile Network and Transport Layer: IP and Mobile IP Network Layers, Packet Delivery and Handover Management, Location Management, Registration, Tunneling and Encapsulation, Route optimization, Dynamic Host Configuration Protocol, Mobile Transport Layer, Conventional TCP/IP Transport Layer Protocol, Indirect TCP, Snooping TCP, Mobile TCP, Mobile Ad-hoc Networks (MANET), Routing and Routing Algorithms in MANET, Security in ad-hoc networks.

UNIT V

Data Dissemination and Data Synchronization in Mobile Computing: Communication Asymmetry, classification of data delivery mechanism, data dissemination broadcast models, selective tuning and indexing techniques, synchronization, synchronization software for mobile devices, synchronization protocols.

UNIT VI

Mobile Devices and Mobile Operating System: Mobile agent, Applications framework, Application server, Gateways, Service discovery, Device management, Mobile file system, Mobile Operating Systems, Characteristics, Basic functionality of Operating Systems: Window 8, iOS, Android OS.

Text Books:

1. Raj Kamal, “Mobile Computing”, Oxford University Press-New Delhi, 2nd Edition.
2. Dr. Sunil kumar S. Manavi, Mahabaleshwar S. Kakkasageri, ***“Wireless and Mobile Networks, Concepts and Protocols”***, Wiley, India.

Reference Books:

1. Mark Ciampa, ***“Guide to Designing and Implementing wireless LANs”***, Thomson learning, Vikas Publishing House, 2001.
2. Ray Rischpater, ***“Wireless Web Development”***, Springer Publishing,
3. Sandeep Singhal, ***“The Wireless Application Protocol”***, Pearson Publication.
4. P.Stavronlakis, ***“Third Generation Mobile Telecommunication Systems”***, Springer Publishers.

Course Title:	**Cryptography**	**Semester**	**VIII**
Course Code	**BTITSE802B**	**Course Type**	**Elective**
Pre-requisite	**Computer Architecture & Organization**	**L – T – P**	**3 – 0 – 0**
Stream	**Infrastructure & Security Management**	**Credits**	**3**

Course Objectives:

1. To learn cryptography in information security implementation.
2. To know the methods of conventional encryption.
3. To understand the concepts of public key encryption and number theory.
4. To understand authentication and Hash functions.
5. To know the network security tools and applications.
6. To understand the system level security used.

Course Outcomes:

After learning the course the students should be able:

1. To compare and contrast a range of different cryptosystems.
2. To list and elaborate the differences between secret key and public key cryptosystems.
3. To identify the different approaches to quantifying secrecy.
4. To recognize the different modes of operation for block ciphers and their applications.
5. To explain the role of hash functions in Information Security.
6. To discuss the place of ethics in the Information Security Area.

Course Content:

UNIT I

Introduction: What is cryptology: (cryptography + cryptanalysis), Overview of cryptology: How cryptography works, how to break a cryptographic system, Classical conventional encryption, Modern conventional encryption, Public key encryption, Hashing algorithm, OSI security architecture, Cryptanalysis of classical cryptosystems, Shannon's theory.

UNIT II

Symmetric Cipher: Classical Encryption Techniques, Symmetric Cipher Model, Block Cipher principles, DES, Triple DES, Cryptanalysis of symmetric key ciphers: Differential and Linear Cryptanalysis, Block cipher design principle, The Euclidean algorithm, Finite field of form GP(p), Advance Encryption Standard (AES), AES cipher, Multiple encryption and triple DES, Stream Cipher and RC4, Placement of encryption function, Traffic confidentiality, Key distribution, Random number generation. System security: Intrusion detection, Password management, Virus countermeasure, Denial of service attack, Firewall design principles, Trusted System.

UNIT III

Public Key Cryptography: Key Management - The Discrete Logarithm Problem (DLP) and the Diffie Hellman Key Exchange algorithm, Cryptanalysis of DLP, Elliptic Curve Architecture and Cryptography : Confidentiality using Symmetric Encryption, Public Key Cryptography, RSA, Primality Testing, Factoring algorithms, Other attacks on RSA and semantic security of RSA ElGamal cryptosystems.

UNIT IV

Authentication and Hash Function: Authentication requirements, Authentication functions, Message Authentication codes, Hash functions, Security of hash functions, Hash functions: The Merkle Damgard Construction and MACs, MD5 message Digest algorithm - Secure Hash Algorithm, RIPEMD, HMAC, CMAC, Whirlpool and Comparative analysis. Digital Signatures, Authentication Protocols, Digital Signature Standard.

UNIT V

Network Security: Authentication Applications: Kerberos - X.509 Authentication Service, Electronic Mail Security - PGP - S/MIME - IP Security - Web security.

UNIT VI

System Level Security: Intrusion detection, Password management, Viruses and related Threats, Virus Counter measures, Firewall Design Principles, Trusted Systems. Cryptanalysis: Differential Cryptanalysis, Linear Cryptanalysis, Truncated differential cryptanalysis, etc. Assignments (not limited to this): including Cryptographic standards, application of cryptosystems, network security (IPSEC, VPN, Web Security), privilege management infrastructure (PMI) and Access Control, e-Commerce and Smart IC cards).

Text Book:

1. William Stallings, ***"Cryptography and Network Security - Principles and Practices"***, Prentice Hall of India, 3rd Edition, 2003.

Reference Books:

1. Atul Kahate, ***"Cryptography and Network Security"***, Tata McGraw-Hill, 2003.
2. Bruce Schneier, ***"Applied Cryptography"***, John Wiley & Sons Inc, 2001.
3. Charles B. Pfleeger, Shari Lawrence Pfleeger, ***"Security in Computing"***, Pearson Education, 3rd Edition, 2003.

Course Title:	**Information Retrieval**	**Semester**	**VIII**
Course Code	**BTITSE802C**	**Course Type**	**Elective**
Pre-requisite	**Design and Analysis of Algorithms**	**L – T – P**	**3 – 0 – 0**
Stream	**Information Management & Quality Control**	**Credits**	**3**

Course Objectives:

1. To learn the techniques used to retrieve useful information from repositories such as the Web.
2. To understand the concepts in information retrieval such as documents, queries, collections and relevance.
3. To learn approaches for efficient indexing for quick identification of candidate answer documents
4. To learn modern techniques for crawling data from the web.

Course Outcomes:

After learning the course the students should be able:

1. To apply information retrieval principles to locate relevant information in large collections of data.
2. To understand and deploy efficient techniques for the indexing of document objects that are to be retrieved.
3. To implement features of retrieval systems for web-based and other search tasks.
4. To analyze the performance of retrieval systems using test collections.
5. To make practical recommendations about deploying information retrieval systems in different search domains, including considerations for document management and querying.

Course Content

UNIT I

Introduction to the Course: Information retrieval problem, First take at building an inverted index, Processing of Boolean queries, Extended Boolean model vs. ranked retrieval. Term vocabulary and postings lists: document delineation and character sequence decoding, Determining vocabulary of terms, Faster postings list intersection via skip pointers, Positional postings and phrase queries.

UNIT II

Dictionaries, Tolerant Retrieval and Indexing: Search structures for dictionaries, Wildcard queries, Spelling correction, Phonetic correction; Index construction, Blocked sort-based indexing, Single-pass in-memory indexing, Distributed indexing, Dynamic indexing and other types; Index compression: Heaps' and Zipf's law, Dictionary compression and postings file compression.

UNIT III

Scoring and IR System Evaluation: Parametric and zone indexes, Term frequency and weighing, Vector space model for scoring, Variant tf-idf functions, Efficient scoring and ranking, Components of an IR system, Vector space scoring and query operator interaction, IR system evaluation, Standard test collections, Evaluation of unranked and ranked retrieval results, Assessing relevance, System quality and user utility; Relevance feedback and pseudo relevance feedback, Global methods for query reformulation.

UNIT IV

XML and Probabilistic Information Retrieval: Basic concepts of XML retrieval and challenges, vector space model for XML retrieval, Text-centric vs. data centric XML retrieval, Probability ranking principal, Binary independence model, Appraisal and some extensions, Language models for information retrieval, Query likelihood model, Language modeling vs. other approaches in IR.

UNIT V

Document Classification: Text classification problem, Naïve Bayes text classification, Bernoulli model, Feature selection, Evaluation of text classification; Vector space classification: Document representations and measure of relatedness in vector spaces, Rocchio classification, k nearest neighbor, Linear vs. Non-linear classifiers, Bias-variance tradeoff; Support vector machines, Extensions to SVM models, Issues in the classification of text documents, Machine learning methods in ad hoc information retrieval.

UNIT VI

Document Clustering and Matrix Decomposition: Flat clustering, Cardinality, Evaluation of clustering, K-means, Model based clustering, Hierarchical Agglomerative clustering, Singlelink and complete-link clustering, Group-average agglomerative clustering, Centroid clustering, Optimality of HAC, Divisive clustering, Cluster labeling; Matrix decompositions, Term document matrices and singular value decomposition, Low-rank approximations, Latent semantic indexing.

Web Search: Basics concepts, Web graph, Spam, Search user experience, Index size and estimation, Near-duplicates and shingling, Web crawling and indexes: Overview, Crawler architecture, DNS resolution, URL frontier, Distributing indexes and connectivity servers; Link analysis: Anchor text and web graph, Page Rank, Hubs and Authorities.

Text Books:

1. Manning, C. D., Raghavan, P., Schütze, H. ***"Introduction to Information Retrieval",*** Cambridge University Press, 2008.
2. Witten, I. H., Moffat, A., Bell, T. C. ***"Managing Gigabytes: Compressing and Indexing Documents and Images.",*** Morgan Kaufmann, 1999.
3. Grossman, D. A., ***"Information Retrieval: Algorithms and Heuristics"***, Springer, 2004.

Reference Books:

1. Baeza-Yates, R., Ribeiro-Neto, B. ***"Modern information Retrieval"***, ACM press, 1999
2. Belew, R. K. ***"Finding Out About: A Cognitive Perspective on Search Engine Technology and the WWW"***, Cambridge University Press, 2000.
3. Chakrabarti S. ***"Mining the Web: Discovering Knowledge from Hypertext Data"***, Morgan Kaufmann, 2003.
4. Manning, C. D. ***"Foundations of Statistical Natural Language Processing"***, H. Schütze (Ed.). MIT press, 1999.

Course Title:	**Network Security**	**Semester VIII**	
Course Code	**BTITSE802D**	**Course Type**	**Elective**
Pre-requisite	**Internetworking Protocols, Network Programming**	**L – T – P**	**3 – 0 – 0**
Stream	**Networks**	**Credits**	**3**

Course Objectives:

1. To understand the number theory used for network security.
2. To understand the design concept of cryptography and authentication.
3. To understand the design concepts of internet security.
4. To develop experiments on algorithm used for security.

Course Outcomes:

After learning the course the students should be able:

1. To describe network security awareness and a clear understanding of its importance.
2. To explain how threats to an organization are discovered, analyzed and dealt with.
3. To explain protocols for security services.
4. To describe network security threats and countermeasures
5. To explain network security designs using available secure solutions (such as PGP, SSL, IPSec, etc).
6. To demonstrate advanced security issues and technologies (such as DoS attack detection and containment, and anonymous communications).

Course Content

UNIT I

Model of network security, Security attacks, services and attacks, OSI security architecture, Classical encryption techniques, SDES, Block cipher Principles, DES, Strength of DES, Block cipher design principles, Block cipher mode of operation, Evaluation criteria for AES, RC4 - Differential and linear cryptanalysis, Placement of encryption function, traffic confidentiality.

UNIT II

Number Theory, Prime number, Modular arithmetic, Euclid's algorithm, Fermat's and Euler's theorem, Primality, Chinese remainder theorem, Discrete logarithm, Public key cryptography and RSA Key distribution, Key management, Diffie Hellman key exchange, Elliptic curve cryptography.

UNIT III

Authentication requirement, Authentication function, MAC, Hash function, Security of hash function and MAC – SHA - HMAC – CMAC - Digital signature and authentication protocols – DSS.

UNIT IV

Security Services for E-mail-establishing keys-privacy-authentication of the source-Message Integrity-Non-repudiation-Pretty Good Privacy-S/MIME.

UNIT V

SSL/TLS Basic Protocol-computing the keys- client authentication-PKI as deployed by SSL-Attacks fixed in v3- Exportability-Encoding-Secure Electronic Transaction (SET).

UNIT VI

Firewall Design Principles- Packet Filters- Application level Gateways-Tunnels-DoS attacks-Intrusion Detection-Password Management-Malicious Software.

Text Book:

1. William Stallings, ***"Cryptography & Network Security"***, Pearson Education, 4th Edition, 2010.

Reference Books:

1. Charlie Kaufman, Radia Perlman, Mike Speciner, ***"Network Security, Private Communication in Public World"***, PHI, 2nd Edition, 2002.
2. Bruce Schneier, Neils Ferguson, ***"Practical Cryptography"***, Wiley Dreamtech India Pvt. Ltd, 1st Edition, 2003.
3. Douglas R Simson ***"Cryptography – Theory and Practice"***, CRC Press, 1st Edition, 1995.

Course Title:	**Big Data Analytics**	**Semester**	**VIII**
Course Code	**BTITSE802E**	**Course Type**	**Elective**
Pre-requisite	**Database Management Systems**	**L – T – P**	**3 – 0 – 0**
Stream	**Data Science**	**Credits**	**3**

Course Objectives:

1. To understand the concept of Big Data.
2. To learn Big Data file systems and their storage methods.
3. To learn to process Big Data information for analytics.
4. To discuss and understand Big Data implementations within large corporations like Google and Facebook.

Course Outcomes:

After learning the course the students should be able:

1. To model and implement efficient big data solutions for various application areas using appropriately selected algorithms and data structures.
2. 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.
3. To explain trade-offs in big data processing techniques.
4. To explain the Big Data Fundamentals including the evolution of Big Data, the characteristics of Big Data and the challenges introduced.
5. To apply non-relational databases techniques for storing and processing large volumes of structured and unstructured data, as well as streaming data.
6. To apply the novel architectures and platforms introduced for Big data in particular Hadoop and MapReduce.

Course Content

UNIT I

Introduction to Big Data: Introduction to Big Data, The four dimensions of Big Data: Volume, Velocity, Variety, Veracity, Drivers for Big Data, Introducing the Storage, Query Stack, Revisit useful technologies and concepts, Real-time Big Data Analytics.

UNIT II

Distributed File Systems: Hadoop Distributed File System, Google File System, Data Consistency.

UNIT III

Big Data Storage Models: Distributed Hash-table, Key-Value Storage Model (Amazon's Dynamo), Document Storage Model (Facebook's Cassandra), Graph storage models.

UNIT IV

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 NoSQL, Algorithms for detecting similar items, Recommendation systems, Data stream analysis algorithms, Clustering algorithms, Detecting frequent items.

UNIT V

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 Netfix Prize, Link Analysis with case studies of the PageRank algorithm and the Spam farm analysis, Crowd Sourcing.

UNIT VI

Big Data Issues: Privacy, Visualization, Compliance and Security, Structured vs. Unstructured Data.

Text Book:

1. Anand Rajaraman and Jeffrey Ullman, ***"Mining of Massive Datasets"***, Cambridge University Press, 2012.

Reference Books:

1. Christopher D. Manning, Prabhakar Raghavan, Hinrich Schütze, ***"An Introduction to Information Retrieval"***, Cambridge University Press, 2008.
2. Jimmy Lin and Chris Dyer, ***"Data-Intensive Text Processing with MapReduce"***, Morgan and ClayPool Publishers, 2010.

Course Title:	**User Experience Design**	**Semester**	**VIII**
Course Code	**BTITSE803A**	**Course Type**	**Elective**
Pre-requisite	**Software Engineering**	**L – T – P**	**3 – 0 – 0**
Stream	**Software and Application Development**	**Credits**	**3**

Course Objectives:

1. To understand user experience design principles
2. To understand the various elements and how the elements of user experience work together.
3. To understand strategy, structure, skeleton and scope as an element of user experience.
4. To identify business goals, user needs, content requirements.
5. To create a functional specification and an effective information design.
6. To learn to prioritize specs and requirements.
7. To architect information effectively and navigation.
8. To learn resources available to assist with User Experience Design Process.

Course Outcomes:

After learning the course the students should be able:

1. To design applications and web pages with effective and easy to use user experience.
2. To utilize tools and techniques for research and build user screens based on best practices.
3. To collect and document business, user and information specification.
4. To implement user screens and package information with ease of navigations.

Course Content:

UNIT I

UX Introduction: User Interaction with the products, Applications and services, Cognitive Model/Mental Model; Necessity of User Experience Design; Definition of User Experience (UX) Design.

UNIT II

Elements of UX Design: Core elements of User Experience, Working of elements, UX Design Process: Defining the UX Design Process and Methodology.

UNIT III

UX Design Process: Research and define: importance of research, Research methods and tools, Understanding the User needs and goals, Understanding the business goals, Deliverables of the research and define phase-Insight on User goals and business goals, Hands-on assignments and Quiz.

UNIT IV

UX Design Process: IDEATE/DESIGN - Visual design principles, Information design and data, Visualization: Interaction design, Information architecture, Wire-framing and story-boarding, UI elements and widgets, Screen design and layouts, Hands-on assignments and quiz.

UNIT V

UX Design Process: PROTOTYPE and TEST: Necessity of testing your design, Usability testing, Types of usability testing, Usability testing process, Plan for the usability tests, Prototype your design to test, Introduction of prototyping tools, Conduction and preparation of usability test results.

UNIT VI

UX Design Process: iterate/improve: Understanding the Usability test findings, Applying the Usability test feedback in improving the design. UX Design Process: Communication with implementation team UX Deliverables to be given to implementation team.

Text Books:

1. Jesse James Garrett, ***"The Elements of User Experience: User-Centered Design for the Web and Beyond"***, New Riders Publishing, 2nd Edition, 2002.
2. Steve Krug, ***"Don't Make Me Think, Revisited: A Common Sense Approach to Web Usability"***, 3rd Edition, 2014.
3. Thomas Tullis, Willaim Albert, ***"Measuring the User Experience: Collecting, Analyzing, and Presenting Usability Metrics"***, Morgan Kaufman, 1st Edition, 2008.

Reference Books:

1. Jeff Gothelf, Josh Seiden, ***"Lean UX: Applying Lean Principles to Improve User Experience"***, O'Reilly, 1st Edition, 2013.
2. Kevin Mullet, Darrell Sano, ***"Designing Visual Interfaces: Communication Oriented Techniques"***, Soft Press, 1995.
3. Wilbert O. Galitz, ***"The Essential Guide to User Interface Design: An Introduction to GUI Design Principles and Techniques"***, Wiley, 2002.

Course Title:	**Infrastructure Auditing & Implementation**	**Semester**	**VIII**
Course Code	**BTITSE803B**	**Course Type**	**Elective**
Pre-requisite	**IT Service Management**	**L – T – P**	**3 – 0 – 0**
Stream	**Infrastructure & Security Management**	**Credits**	**3**

Course Objectives:

1. To know the goals and objectives of IT audit and its role in internal control system.
2. To learn the techniques of audit planning and audit performance, gathering of audit related information and audit evidence.
3. To understand how to audit and evaluate effectiveness of the IT internal controls system.
4. To learn the fundamentals of information risk management and audit of information security.

Course Outcomes:

After learning the course the students should be able:

1. To describe the need for information security audit.
2. To define the requirements of IT risks, security and policies required for organizations.
3. To explain the mandatory items that need to be checked.

UNIT I

Fundamentals of infrastructure audit: meaning and definition, Overview, Choice of correct methods, Need, Scope and objectives.

UNIT II

Introduction to risk assessment: Entity area, strategies and policies in operation, support, External Drivers, User Interaction, Consequences-Importance of demonstrating control over network and security staffs, Risk of operator access controls over device and server settings.

UNIT III

Checklist for IT audit: Alignment with business strategy, Long term IT strategy, Short range IT plans, Information system security policy, Implementation of security policy, Information system audit guidelines, Acquisition and implementation of packaged software.

UNIT IV

Requirement identification and analysis Configuration audits: Need for an audit trail, A real-time live-network change review, Automatically verify compliance with both external best practices and internal standards.

UNIT V

Vendor selection criteria and process: Tracking the vendor selection criteria, Contracting- The issues of site licenses, Usage of open sources software, Annual maintenance contracts.

UNIT VI

Implementation: Importance of regulations and standards such as Sarbanes-Oxley, ISO 17799 and Visa's Cardholder Information Security Program (CISP), On-demand historical reports, Governance and

Cobit as a model for IT compliance. Benefits of infrastructure audit, Strong change management process.

Text Books:

1. Richard E. Cascarino, ***"Auditor's Guide to Information Systems Auditing"***, Wiley, 2007.
2. Chris Jackson, ***"Network Security Auditing"***, Cisco Press, 2010.

References:

1. www.netwrix.com
2. www.rbi.org

Course Title:	**Cyber Law and IPR**	**Semester**	**VIII**
Course Code	**BTITSE803C**	**Course Type**	**Elective**
Pre-requisite	**Nil**	**L – T – P**	**3 – 0 – 0**
Stream	**Information Management & Quality Control**	**Credits**	**3**

Course Objectives:

1. To understand cyber laws and its applicability in India.
2. To learn the basic concepts of technology and law, digital contracts, rights of netizens and E-governance. To study cyber space and the cyber laws and regulating them through relevant Acts.
3. To learn the comparative study of national and international laws keeping in view international scenario in a no-barrier world.
4. To be aware about IPR in scientific and technical community for protecting their inventions.
5. To understand IPR from a non-lawyers perspective like senior managers, administrators etc.
6. To experience practices and procedures in various government offices administering IPR Laws.

Course Outcomes:

After learning the course the students should be able:

1. To describe the cyber world and cyber law in general.
2. To explain about the various facets of cyber crimes.
3. To explain the problems arising out of online transactions and provoke them to find solutions.
4. To clarify the Intellectual Property issues in the cyber space and the growth and development of the law in this regard.
5. To educate about the regulation of cyber space at national and international level.

Course Content

UNIT I

Introduction to Cyber crimes: Definition, Cybercrime and information security, Classes of cybercrime and categories, Cyber offences, Cybercrimes with mobile and wireless devices.

UNIT II

Jurisdiction in the cyber world across the world: Cybercrime law in Asia, Cybercrime and federal laws, Legal principles on jurisdiction and jurisdictional disputes w.r.t. the internet in United States of America, Cybercrime legislation in African region, Foreign judgments in India.

UNIT III

Indian IT act: Information Technology Act, 2000(Complete including digital signature, certifying authorities and E-governance), Positive aspects, Weak areas, Amendments to the Information Technology Act, 2008. Challenges to Indian law and cyber crime scenario in India. Protection of cyber consumers in India.

UNIT IV

Emerging Electronic System: E – commerce; E – governance; Concept of Electronic Signature; Credit Cards; Secure Electronic Transactions.

UNIT V

Intellectual property Rights: Intellectual Property law basics, Types of Intellectual Property, Agencies responsible for Intellectual Property registration. International organizations, Agencies and Treaties. Increasing importance of Intellectual Property Law.

UNIT VI

Copyright issues in Cyberspace: Relevant provisions under Copyright Act, 1957, regulating copyright issues in Cyberspace; Online Software Piracy – legal issues involved; Analysis of sufficiency of provisions of Copyright Act to deals with Online Software.

Piracy: Trademark issues in Cyberspace – Domain Name; Cyber squatting as a form of Domain Name dispute; Case law.

Case studies: Highlight the cybercrimes, cyber laws and Intellectual property Rights with the help of minimum 5 cases with reference to Indian IT act for better understanding.

Text Books:

1. Herman T. Tavani, ***"Ethics & Technology, Ethical Issues in an Age of Information and Communication Technology"***, John Wiley & Sons, 3rd Edition, 2011.
2. Syed Shakil Ahmed, Reheja Rajiv, ***"A Guide to Information Technology (Cyber Laws & E-commerce)"***, Capital Law House, 2001.
3. Kamath Nandan, ***"Law Relating to Computers Internet & E-commerce (A guide to Cyber Laws & the Information Technology Act, 2000 with Rules & Notification)"***, Universal Book Traders, 2nd Edition, Reprint: 2002.

Reference Books:

1. Ahmad Tabrez, "***Cyber law , E-commerce & M-Commerce"***, A. P. H. Publishing Corporation, 2003.
2. Bakshi P.M and Suri R.K, ***"Cyber and E-commerce Laws"***, Bharat Publishing House, 1st Edition, 2002.
3. Vishwanathan Suresh T, ***"The Indian Cyber Law"***, Bharat Law House, 2nd Edition, 2001.
4. Prasad T.V.R. Satya, ***"Law Relating to Information Technology (Cyber Laws)"***, Asia Law House , 1st Edition, 2001.
5. Reed Chris, ***"Computer Law"***, 3rd Edition, Universal Law Publishing Co. Pvt. Ltd., 1996 (First Indian Reprint 2000).
6. P. Narayanan, ***"Intellectual Property (Trade Marks & the Emerging concepts of Cyber property rights (HB)"***, 3rd Edition. (HB), 2002.

Course Title:	**Optical Networks**	**Semester**	**VIII**
Course Code	**BTITSE803D**	**Course Type**	**Elective**
Pre-requisite	**Internetworking Protocols**	**L – T – P**	**3 – 0 – 0**
Stream	**Networking**	**Credits**	**3**

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 to acquire knowledge about fault and congestion management.

Course Outcomes:

The student will be able to:

1. Design a system, component or process as per needs and specification.
2. Gain knowledge on optical network architectures ranging from optical access networks to backbone optical transport networks.
3. Gain the knowledge on methodologies of optical network design optimization.
4. Explore techniques of optical network survivability.
5. Solve the Problems in the discipline of optical networks.

Course Content

UNIT I

Optical Layer: SONET/SDH: Multiplexing, CAT and LCAS, Sonnet/SDH Layers, SONET Frame Structure, SONET/SDH physical layer, Elements of a SONET/SDH infrastructure, Optical Transport Network: Hierarchy, Frame Structure, Multiplexing, Generic framing procedure Ethernet: Frame structure, Switches, Ethernet Physical layer, Carrier transport IP: Routing and forwarding, Quality of service. Multiprotocol label switching: Labels and forwarding, Quality of service, Signaling and routing, Carrier transport, Resilient packet ring: Quality of service, Node structure, Fairness storage area networks: Fiber channel.

UNIT II

WDM Network Elements: Optical line terminals, Optical line amplifiers, Optical Add/Drop Multiplexers: OADM Architectures, Reconfigurable OADMs, Optical cross connects: All-Optical OXC configurations.

UNIT III

Control and Management: Network management functions: Management framework, Information model, Management protocols. Optical layer services and interfacing, Layers within the Optical layer, Multi vendor Interoperability.

UNIT IV

Performance and Fault Management: The Impact of transparency, BER measurement, Optical trace, Alarm management, Data Communication Network (DCN) and Signaling, Policing, Optical layer overhead, Client layers. Configuration management: Equipment management, Connection management, Adaptation management. Optical Safety: Open Fiber Control protocol.

UNIT V

Protection in SONET/SDH: Point-to-Point links, Self-healing rings, Unidirectional line-switched rings, Bidirectional line-switched rings, Ring Interconnection and dual homing. Protection in the client layer: Protection in Resilient Packet Rings, Protection in Ethernet, Protection in IP, Protection in MPLS, Why Optical Layer protection: Service classes based on protection. Optical Layer protection schemes: 1+1 OMS Protection, 1:1 OMS Protection, OMS-DPRing, OMS-SPRing, 1:N Transponder Protection, 1+1 OCh Dedicated Protection, OCh-SPRing, OCH-Mesh Protection, GMPLS Protection, Interworking between layers.

UNIT VI

WDM Network Design: Cost Trade-OFFS: A detailed ring network example LTD and RWA problems, Light path topology design, Routing and wavelength assignment, Wavelength conversion. Dimensioning, Wavelength- routing networks, Statistical dimensioning models: First-passage model, Blocking model, Maximum load dimensioning models: Offline light path requests, Online RWA in rings.

Text Book:

1. Rajeev Ramaswamy, Kumar N Sivarajan, "***Optical Networks***" , Elsevier Publication, 3rd Edition, 2009.

Reference Book:

1. Uyless Black," ***Optical Networks-Third generation transport system***" Pearson Publication, 2013.

Course Title:	**Web & Text Mining**	**Semester**	**VIII**
Course Code	**BTITSE803E**	**Course Type**	**Elective**
Pre-requisite	**Data Warehouse and Data Mining**	**L – T – P**	**3 – 0 – 0**
Stream	**Data Science**	**Credits**	**3**

Course Objectives:

1. To learn the concepts of database technology evolutionary path which has led to the need for data mining and its applications.
2. To learn the essential techniques of data and text mining.
3. To understand data mining standard predictive methods to unstructured text.
4. To discuss the standard techniques of preparation and handling methods to transform that can be mined.

Course Outcomes:

After learning the course the students should be able:

1. To examine the types of the data to be mined and present a general classification of tasks and primitives to integrate a data mining system.
2. To explore DWH and OLAP and devise efficient and cost effective methods for maintaining DWHs.
3. To discover interesting patterns from large amounts of data to analyze and extract patterns to solve problems, make predictions of outcomes.
4. To comprehend the roles that data mining plays in various fields and manipulate different data mining techniques.
5. To evaluate systematically supervised and unsupervised models and algorithms w.r.t. their accuracy.

Course Content

UNIT I

Introduction to Information Retrieval: Inverted indices and Boolean queries, Query optimization, The nature of unstructured and semi-structured text.

UNIT II

Text encoding: Tokenization, Stemming, Lmmatization, Stop words, Phrases, Further optimizing indices for query processing, Proximity and phrase queries, Positional indices.

UNIT III

Index compression: Lexicon compression and postings lists compression, Gap encoding, Amma codes, Zipf's Law. Blocking. Extreme compression, Query expansion: spelling correction and synonyms. Wild-card queries, Permuterm indices, N-gram indices. Edit distance, Soundex, Language detection. Index construction. Postings size estimation, Merge sort, Dynamic indexing, Positional indexes, N-gram indexes, Real-world issues.

UNIT IV

Parametric or fielded search: Document zones, The vector space retrieval model, Scoring documents, Vector space scoring, The cosine measure, Efficiency considerations, Nearest neighbor techniques, Reduced dimensionality approximations, Random projection. Results summaries: Static and dynamic, Evaluating search engines.

User happiness, Precision, Recall, F-measure, Creating test collections: kappa measure, interjudge agreement. Relevance, approximate vector retrieval.

UNIT V

Feedback: Relevance feedback, Pseudo relevance feedback, Query expansion, Automatic thesaurus generation, Sense-based retrieval, Experimental results of performance effectiveness.

Probabilistic models for text problems, Classical probabilistic IR, Language models, Introduction to text classification, Naive Bayes models, Spam filtering, Probabilistic language models for IR, Bayesian nets for IR.

UNIT VI

Introduction to the problem: Partitioning methods, K-means clustering, Mixture of Gaussians model, Clustering versus classification, Hierarchical agglomerative clustering, Clustering terms using documents, Labelling clusters, Evaluating clustering, Text-specific issues, Reduced dimensionality/spectral methods, Latent semantic indexing (LSI), Applications to clustering and to information retrieval.

Vector space classification using hyperplanes, centroids, k Nearest Neighbors, Support Vector machine classifiers, Kernel functions, Text classification, Exploiting text-specific features, Feature selection, Evaluation of classification, Micro- and macro averaging, Comparative results.

Text Books:

1. Michael Geatz and Richard Roiger, ***"Data Mining: A Tutorial Based Primer"***, Pearson Education.
2. Thomas W. Miller, ***"Data and Text Mining: A Business Applications Approach"***, Pearson Education.
3. Pang-Ning Tan, Michael Steinbach, Vipin Kumar, ***"Introduction to Data Mining"***, Pearson Education.

Reference Books:

1. R. Baeza-Yates and B. Ribeiro-Neto, ***"Modern Information Retrieval"***, Pearson Education, 1999.
2. D.A. Grossman, O. Frieder, ***"Information Retrieval: Algorithms and Heuristics"***, Springer, 2004.
3. W. Frakes and R. Baeza-Yates, ***"Information Retrieval: Data Structures and Algorithms"***, 1st Edition, Pearson Education.

Course Title:	**Multimedia Applications**	**Semester**	**VIII**
Course Code	**BTITSE804A**	**Course Type**	**Elective**
Pre-requisite	**Nil**	**L – T – P**	**3 – 0 – 0**
Stream	**Software and Application Development**	**Credits**	**3**

Course Objectives:

1. To understand the overview of basic topics in multimedia.
2. To learn the software technologies of non-traditional interfaces.
3. To learn the development of interactive multimedia applications.

Course Outcomes:

After learning the course the students should be able:

1. To understand basic concepts related to MM including data standards, algorithms and softwares.
2. To experience development of multimedia software by utilizing existing libraries and descriptions of algorithms.
3. To demonstrate cutting-edge multimedia topics through independent study and presentations in class.

Course Content:

UNIT I

Introduction: Components of Multimedia, Multimedia and Hypermedia multimedia building blocks, Communication and information transfer model, Multimedia information systems, Application purposes of multimedia, Electronics performance support systems. Interaction Technologies and devices: Human Computer Interface, Input/output technologies, Combined I/O device, Storage technologies, Processing technologies.

UNIT II

Multimedia Authoring and data representation: Multimedia Authoring: Production, Presentation and auto authoring, Image data types, Image representation, Image acquisition, Picture display, Working with image.

UNIT III

Compression Technologies for multimedia: Need for data compression, Compression basics, Llossless and lossy compression, Image compression standards, Video compression standards, Basic audio compression standards.

UNIT IV

Text, Hypertext and Hypermedia, and Digital audio: Visual representation of text, Digital representation of characters, Formatting aspect text, Hypertext and hypermedia, Producing digital audio, Psychoacoustics, Processing sound, Representation of audio files, Digitization of sound, MIDI, Quantization and transmission of audio.

UNIT V

Designing multimedia: Development phases and teams, Analysis phase, Design phase, Development phase, Implementation phase, Evaluation and testing.

UNIT VI

Multimedia networks and communication: Multimedia in the Internet, Streaming stored audio/video, Streaming live audio/video, real-time interactive audio/video, Real-time interactive protocols: RTP, RTCP, Session Initialization protocol (SIP), H.323, SCTP. QoS: Data flow, Flow classes, Flow control, Integrated services, Differentiated services. Multimedia content management systems, Multimedia indexing, Multimedia retrieval.

Text Books:

1. Li. Z., Drew M., ***"Fundamentals of Multimedia"***, Pearson Education publishers, 2004.
2. Chow V. W. S., ***"Multimedia Technology and Applications"***, Springer.

Reference Books:

1. Banerji A., and Ghosh A.M., ***"Multimedia Technologies"***, McGraw Hill International, 2009.
2. Stamou G., and Kollias S., ***"Multimedia Contents and the Semantic Web"***, John Wiley & Sons., 2005.

Course Title:	**Ethical Hacking**	**Semester**	**VIII**
Course Code	**BTITSE804B**	**Course Type**	**Elective**
Pre-requisite	**Operating Systems**	**L – T – P**	**3 – 0 – 0**
Stream	**Infrastructure & Security Management**	**Credits**	**3**

Course Objectives:

1. To understand how intruders escalate privileges.
2. To understand Intrusion Detection, Policy Creation, Social Engineering, Buffer Overflows and different types of attacks and their protection mechanisms.
3. To learn about ethical laws and tests.

Course Outcomes:

After successful completion of the course, the student will be able:

1. To understand the core concepts related to malware, hardware and software vulnerabilities and their causes.
2. To understand ethics behind hacking and vulnerability disclosure.
3. To appreciate the Cyber Laws and impact of hacking.
4. To exploit the vulnerabilities related to computer system and networks using state of the art tools and technologies.

Course Content:

UNIT I

Types of data stolen from the organizations, Elements of Information Security, Authenticity and non-repudiation, Security challenges, Effects of hacking, Types of hacker, Ethical hacker.

UNIT II

Hacktivism - role of security and penetration tester, Penetration testing methodology, Networking and computer attacks – Malicious software (Malware), Protection against malware, Intruder attacks on networks and computers, Addressing physical security, Key loggers and Back doors.

UNIT III

Web tools for foot printing, Conducting competitive intelligence, Google hacking, Scanning, Enumeration, Trojans and backdoors, Virus and worms, Proxy and packet filtering, Denial of service, Sniffer, Social Engineering: Shoulder surfing, Dumpster Diving, Piggybacking.

UNIT IV

Physical Security: Attacks and protection, Steganography: Methods, Attacks and measures, Cryptography : Methods and types of attacks, Wireless hacking, Windows hacking, Linux hacking.

UNIT V

Routers, Firewall and Honeypots, IDS and IPS, Web filtering, Vulnerability, Penetration testing, Session hijacking, Web server, SQL Injection, Cross site scripting, Exploit writing, Buffer overflow, Reverse engineering, Email hacking, Incident handling and response, Bluetooth hacking, Mobiles phone hacking.

UNIT VI

An introduction to the particular legal, Professional and ethical issues likely to face the domain of ethical hacking, Ethical responsibilities, Professional integrity and making appropriate use of the tools and techniques associated with ethical hacking, Social Engineering, Host Reconnaissance, Session Hijacking, Hacking - Web Server, Database, Password Cracking, Network and Wireless, Trojan, Backdoor, UNIX, LINUX, Microsoft, NOVEL Server, Buffer Overflow, Denial of Service Attack, Methodical Penetration Testing.

Text Books:

1. Michael T. Simpson, Kent Backman, James E., ***"Corley, Hands-On Ethical Hacking and Network Defense"***, CENGAGE Learning, 2^{nd} Edition, 2010.
2. Patrick Engebretson, ***"The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy"***, Syngress Basics Series – Elsevier, August 4, 2011.

Reference Books:

1. Steven DeFino, Barry Kaufman, Nick Valenteen, ***"Official Certified Ethical Hacker Review Guide"***, CENGAGE Learning, 2009-11-01.
2. Whitaker, Newman, ***"Penetration Testing and Network Defense"***, Cisco Press, Indianapolis, IN, 2006.

Course Title:	**CRM & SCM**	**Semester**	**VIII**
Course Code	**BTITSE804C**	**Course Type**	**Elective**
Pre-requisite	**Enterprise Resource Planning**	**L – T – P**	**3 – 0 – 0**
Stream	**Information Management and Quality Control**	**Credits**	**3**

Course Objectives:

1. To make students understand the how IT is an enabler for SCM and CRM.
2. To understand supply chain strategy framework and supply chain strategies.
3. To comprehend the functionalities of CRM in service sector.

Course Outcomes:

After learning the course the students should be able:

1. To understand the concept of logistics and supply chain management.
2. To appreciate the importance of logistics function in overall success of any business/industrial sector.
3. To understand the interrelationship between logistics and supply chain management.
4. To understand the importance and dynamics of supply chain management in any business/industrial sector.
5. To know the world class best practices being carried out in supply chain management.
6. To understand the procurement and outsourcing strategies.
7. To understand the impact of customer relationship management in effective supply chain management.
8. To know how to measure the performance of supply chain operations.

Course Content:

UNIT I

Introduction to CRM: What is CRM? Why we need CRM? Definition of CRM, Architecture of CRM, Technology considerations of CRM, Technology components of CRM, Customer life cycle, Customer lifetime value computation, Implications of globalization on customer relationship management.

UNIT II

Introduction to e-CRM: Definition of e-CRM, Its need, Features, Framework of e-CRM, Six e's of e-CRM, CRM Vs e-CRM, Architecture of e-CRM, Implementing a technology based CRM solution.

UNIT III

Introduction to Supply Chain: What is SCM?, Why SCM? Generic types of supply chain, Major drivers of Supply chain, Supply Chain strategies, Value in Supply Chain- quality, Delivery, Flexibility, Core competencies in Supply Chain.

UNIT IV

Source management in Supply Chain: Insourcing, outsourcing, Partner selection, Sourcing strategies, Procurement strategies, Managing Inventory in Supply chain, Definition of inventories, Selective inventory control, Vendor managed inventory systems, Inventory performance measures- financial, operational & inventory turnover ratio (ITR), Transportation decisions in a Supply Chain – Transportation Strategy, Transportation selection, Mode of transportation, Transportation management system (TMS).

UNIT V

e- SCM: Information technology in Supply Chain: Typical IT solutions- EDI, Intranet, Extranet, Data Warehousing, E- commerce, E-procurement, Bar coding technology, GPS, RFID.

UNIT VI

Information Systems in Supply Chain Case Study – A live case of use of IT, Case Studies for SCM & CRM, For SCM: Mumbai Tiffinwala, For CRM: Sales Force.

Text Books:

1. Bowersox, Closs & Cooper , ***"Supply Chain & Logistic Management"***, Tata McGraw Hill 2nd Edition.
2. Paul Greenberg, ***"CRM at the speed of light"***, YMH 2nd Edition.

Reference Book:

1. Kristin Anderson and Carol Kerr, ***"Customer Relationship Management"***, Tata McGraw Hill.

Course Title:	**Wireless Networking**	**Semester**	**VIII**
Course Code	**BTITSE804D**	**Course Type**	**Elective**
Pre-requisite	**Internetworking Protocols**	**L – T – P**	**3 – 0 – 0**
Stream	**Networking**	**Credits**	**3**

Course Objectives:

1. To study the evolving wireless technologies and standards.
2. To understand the architectures of various access technologies such as 3G, 4G, WiFi etc.
3. To understand various protocols and services provided by next generation netwoks.

Course Outcomes:

After learning the course the students should be able:

1. To keep himself updated on latest wireless technologies and trends in the communication field.
2. To understand the transmission of voice and data through various networks..

Course Content:

UNIT I

Introduction, Technology and service trends of emerging Wireless technologies, The amazing growth of Mobile Communications, A little history, Mobile Communications fundamentals, Mobile data, WiFi, Bluetooth, Cable systems, Wireless migration options, Harmonization process.

UNIT II

WiFi (802.11), 802.11 Standards, WiFi protocols, Frequency allocation, Modulation and coding schemes, Network architecture, Typical WiFi configurations, Security, 802.11 Services, Hot spots, Virtual Private Networks (VPNs), Mobile VPN, VPN types, WiFi Integration with 3G/4G, Benefits of convergence of WiFi and Wireless Mobile.

UNIT III

Introduction, Universal mobile telecommunications service (UMTS), UMTS services, The UMTS air interface, Overview of the 3GPP release 1999 Network Architecture, Overview of the 3GPP Release 4 Network Architecture, Overview of the 3GPP Release 5, All-IP Network Architecture, Overview CDMA2000, TD-CDMA, TD-SCDMA, Commonality among WCDMA, CDMA2000, TD-CDMA, and TD-SCDMA.

UNIT IV

LTE Ecosystem, Standards, Radio spectrum, LTE architecture, User Equipment (UE), Enhanced Node B (eNodeB), Core network (EPC), Radio channel components, TD-LTE, Multiple Input Multiple Output, LTE scheduler, Carrier aggregation, Cell search, Cell reselection, Attach and default bearer activation, Handover (X2, S1, Inter-MME), Self-Organizing Networks (SONs), Relay cells, Heterogeneous Network (HetNET), Remote radio heads (RRH), VoLTE, LTE advanced.

UNIT V

Introduction, Standards, Generic WiMAX Architecture, Core network, Radio network, WiMAX Spectrum, Modulation, Channel structure, Mixed mode, Interference Mitigation techniques, Frequency planning, Features and applications, Security, QoS, Profiles, Origination, Handover, Femto and SON.

UNIT VI

Why VoIP?, The Basics of IP transport, VoIP challenges, H.323, The Session Initiation Protocol (SIP), Distributed architecture and media gateway control, VoIP and SS7, VoIP Quality of Service.

Text Books:

1. Clint Smith, P.E., Daniel Collins, ***"Wireless Networks: Design and Integration for LTE, EVDO, HSPA, and WiMAX"***, McGraw Hill 3rd Edition,
2. Eldad Perahia, Robert Stacey, ***"Next Generation Wireless LANs"***, Cambridge University Press, 2nd Edition.

Reference Books:

1. Yi-Bang Lin, Imrich Chlamtac, ***"Wireless and Mobile Network Architecture"***, Wiley India Edition.
2. Dipankar Ray chaudhary, Maria Gerla, ***"Emerging Wireless Technologies and the Future Mobile Internet"***, Cambridge University Press.

Course Title:	**Machine Learning**	**Semester VIII**	
Course Code	**BTITSE804E**	**Course Type**	**Elective**
Pre-requisite	**Engineering Mathematics III**	**L – T – P**	**3 – 0 – 0**
Stream	**Data Science**	**Credits**	**3**

Course Objectives:

1. To understand the basic concepts and methods of machine learning.
2. To make use of some elementary machine learning techniques in the design of computer systems.
3. To develop a broad perspective about the applicability of ML algorithms in different fields.
4. To understand the major machine learning algorithms, the problem settings and assumptions that underlies them.
5. To possess insights, concerning the relative strengths and weaknesses of various common machine learning methods.

Course Outcomes:

After learning the course the student will be able:

1. To demonstrate knowledge of the machine learning literature.
2. To describe how and why machine learning methods work.
3. To demonstrate results of parameter selection.
4. To explain relative strengths and weaknesses of different machine learning methods.
5. To select and apply appropriate machine learning methods to a selected problem.
6. To implement machine learning algorithms on real datasets.
7. To suggest ways to improve results.

Course Content:

UNIT-I

Introduction: Well-posed learning problems, Designing a Learning System, Perspectives and Issues in Machine learning, Concept Learning and General-to-specific Ordering: A concept learning task, Concept learning as Search, Finding a maximally specific hypothesis, Version Spaces and Candidate elimination algorithm, Inductive Bias.

UNIT-II

Decision Tree Learning: Decision tree learning algorithm, Hypothesis space search in decision tree Evaluating Hypothesis: Estimating Hypothesis accuracy, Basics of sampling theory, Deriving confidence intervals, Hypothesis testing, comparing learning algorithms.

UNIT-III

Bayesian Learning: Bayes theorem and concept learning, Maximum likelihood and least square error hypotheses, Minimum description length principle, Bayes optimal classifier, Gibbs algorithm, Naive Bayes classifier, Computational Learning Theory: Probably learning an approximately correct hypothesis, PAC learnability, The VC dimension, the mistake bound model for learning.

UNIT-IV

Linear Models for Regression: Linear basis function models, The Bias-Variance decomposition, Bayesian Linear Regression, Bayesian Model comparison

Kernel Methods: Constructing kernels, Radial basis function networks, Gaussian Processes

UNIT-V

Approximate Inferencing: Variational inference, Variational mixture of Gaussians, Variational linear regression, Variational logistic regression, Hidden Markov Models: Learning algorithms for HMM, the Viterbi algorithm, Linear Dynamical Systems.

UNIT-VI

Reinforcement Learning: The learning task, Q learning, Non-deterministic rewards and action, Temporal difference learning, Generalizing from examples.

Text Books:

1. Mitchell, Tom. M., *"Machine Learning"*, McGraw-Hill Education, 1st Edition, May 2013.
2. Segaran, Toby. ***"Programming Collective Intelligence- Building Smart Web 2.0 Applications"***, O'Reilly Media, August 2007.

Reference Books:

1. Miroslav, Kubat. ***"An Introduction to Machine Learning"***, Springer Publishing.
2. Bishop, C. M., ***"Pattern Recognition and Machine Learning"***, Springer Publishing.
3. Conway, Drew and White, John Myles, ***"Machine Learning for Hackers"***, O'Reilly Media, February 2012.

Course Title:	**Internet of Things Lab**	**Semester VIII**	
Course Code	**BTITDEL805A**	**Course Type**	**Elective**
Pre-requisite	**Microprocessors and Microcontrollers Lab**	**L – T – P**	**0 – 0 – 2**
Stream	**Departmental**	**Credit**	**1**

Lab Experiments Objective:

1. To implement M2M programs using ARM/Raspberry Pi boards.
2. To interface real-world devices with Internet and display data and information collected.

Lab Experiments List:

1. Write program for creating different LED patterns and use ARM/Raspberry Pi boards, on-board LEDs for checking output.
2. Write program for interfacing LEDs and push to on switch with ARM/Raspberry Pi board at different GPIO pins.
3. Write program for interfacing 16x2 LCD with ARM/Raspberry Pi board at different GPIO pins.
4. Write program to read the onboard temperature and display on cloud.

Course Title:	**E-commerce Systems Lab**	**Semester VIII**	
Course Code	**BTITDEL805B**	**Course Type**	**Elective**
Pre-requisite	**Programming in Web Technologies**	**L – T – P**	**0 – 0 – 2**
Stream	**Departmental**	**Credit**	**1**

Lab Experiments Objective:

1. To design an E-commerce website.
2. To develop the various modules for a B2C E-commerce business.
3. To program and implement various web pages and workflows to deploy a B2C ecommerce business.
4. To develop the various web forms and page panels for an ecommerce.

List of Lab Experiments:

1. Students can choose any online retail business on the B2C model of e-commerce business.
2. Creating the Website Layout for E-Commerce.
3. Inserting & Displaying the Products & Categories.
4. Creating the Shopping Cart.
5. Creating the User Registration & Login Systems.
6. Creating the Checkout System.
7. Creating the Payment Integration System.
8. Creating the Admin Panel for E-commerce.
9. Uploading the E-Commerce to Online Server.

Course Title:	**Mobile Computing - Lab**	**Semester VIII**	
Course Code	**BTITSEL806A**	**Course Type**	**Elective**
Pre-requisite	**Programming in Java**	**L – T – P**	**0 – 0 – 2**
Stream	**Software and Application Development**	**Credit**	**1**

Lab Experiments Objectives:

1. Know the components and structure of mobile application development frameworks for Android and windows OS based mobiles.
2. Understand how to work with various mobile application development frameworks.
3. Learn the basic and important design concepts and issues of development of mobile applications.
4. Understand the capabilities and limitations of mobile devices.

List of Lab Experiments:

1. Develop an application that uses GUI components, Font and Colours.
2. Develop an application that uses Layout Managers and event listeners.
3. Develop a native calculator application.
4. Write an application that draws basic graphical primitives on the screen.
5. Develop an application that makes use of database.
6. Develop an application that makes use of RSS Feed.
7. Implement an application that implements Multi threading.
8. Develop a native application that uses GPS location information.
9. Implement an application that writes data to the SD card.
10. Implement an application that creates an alert upon receiving a message.
11. Write a mobile application that creates alarm clock.

Course Title:	**Cryptography Lab**	**Semester VIII**	
Course Code	**BTITSEL806B**	**Course Type**	**Elective**
Pre-requisite	**Programming in Java/C/C++**	**L – T – P**	**0 – 0 – 2**
Stream	**Infrastructure & Security Management**	**Credit**	**1**

Lab Experiments Objectives:

1. Know the components and structure of mobile application development frameworks for Android and windows OS based mobiles.
2. Understand how to work with various mobile application development frameworks.
3. Learn the basic and important design concepts and issues of development of mobile applications.
4. Understand the capabilities and limitations of mobile devices.

List of Lab Experiments:

1. Encryption using binary/byte addition.
2. Encryption using binary Exclusive-OR (XOR).
3. Triple DES with CBC mode and Weak DES keys.
4. RSA Encryption and Factorization Attacks.
5. Attack on RSA encryption with short RSA modulus
6. Hash generation and sensitivity of hash functions to plaintext modifications.
7. Digital Signature Visualization.
8. RSA Signature.
9. Study of Attack on Digital Signature/Hash Collision.

Course Title:	**Information Retrieval- Lab**	**Semester VIII**	
Course Code	**BTITSEL806C**	**Course Type**	**Elective**
Pre-requisite	**Design and Analysis of Algorithms lab**	**L – T – P**	**0 – 0 – 2**
Stream	**Information Management & Quality Control**	**Credit**	**1**

Lab Experiments Objectives:

1. To implement various information retrieval (IR) algorithms across data and web successfully.
2. To compare results and discuss the merits and demerits of various algorithms.

Lab Experiments List:

1. Representation of a Text Document in Vector Space Model and Computing Similarity between two documents.
2. Pre-processing of a Text Document: stop word removal and stemming.
3. Construction of an Inverted Index for a given document collection comprising of at least 50 documents with a total vocabulary size of at least 1000 words.
4. Classification of a set of Text Documents into known classes (You may use any of the Classification algorithms like Naive Bayes, Max Entropy, Rochio's, Support Vector Machine). Standard Datasets will have to be used to show the results.
5. Text Document Clustering using K-means. Demonstrate with a standard dataset and compute performance measures- Purity, Precision, Recall and F-measure.
6. Crawling/ Searching the Web to collect news stories on a specific topic (based on user input). The program should have an option to limit the crawling to certain selected websites only.
7. To parse XML text, generate Web graph and compute topic specific page rank.
8. Matrix Decomposition and LSI for a standard dataset.
9. Mining Twitter to identify tweets for a specific period (and/or from a geographical location) and identify trends and named entities.
10. Implementation of PageRank on Scholarly Citation Network.

Course Title:	**Network Security - Lab**	**Semester VIII**	
Course Code	**BTITSEL806D**	**Course Type**	**Elective**
Pre-requisite	**Programming in Java / C / C++**	**L – T – P**	**0 – 0 – 2**
Stream	**Networks**	**Credit**	**1**

Lab Experiments Objectives:

1. To highlight the issues with computer and network security by giving the hands on knowledge of various things like monitoring and analyzing network traffic.
2. To install and configure different tools like Wireshark, SNORT, NMAP and Port Scanners etc.

Lab Experiments List:

1. Perform An Experiment To Grab A Banner With Telnet And Perform The Task Using Netcat Utility.
2. Perform An Experiment For Port Scanning With Nmap, Superscan Or Any Other Software.
3. Using Nmap.
4. Find Open Ports On A System.
5. Find The Machines Which Are Active.
6. Find The Version Of Remote Os On Other Systems.
7. Find The Version Of S/W Installed On Other System.
8. Perform An Experiment On Active And Passive Finger
9. Printing Using Xprobe2 and Nmap.
10. Perform an experiment to demonstrate how to sniff for Router Traffic by Using the Tool Wireshark.
11. Perform an experiment How To Use Dumpsec.
12. Perform a Wireless Audit Of An Access Point / Router And Decrypt WEP And WPA.
13. Perform an Experiment To Sniff Traffic Using Arp Poisoning.
14. Install Jcrypt Tool (Or Any Other Equivalent) And Demonstrate Asymmetric, Symmetric Cryptography Algorithm, Hash And Digital/PKI Signatures.
15. Demonstrate Intrusion Detection System (Ids) Using Any Tool e.g. Snort Or Any Other S/W.
16. Install Rootkits And Study Variety Of Options.
17. Generating Password Hashes With Openssl.
18. Setup A Honey Pot And Monitor The Honeypot On Network.

Course Title:	**Big Data Analytics - Lab**	**Semester VIII**	
Course Code	**BTITSEL806E**	**Course Type**	**Elective**
Pre-requisite	**Programming in Java / C / C++ / Python**	**L – T – P**	**0 – 0 – 2**
Stream	**Data Science**	**Credit**	**1**

Lab Experiments Objective:

1. To learn the concepts of Big data processing techniques by writing programs in Hadoop and MapReduce algorithms.

Lab Experiments List:

1. Study of Hadoop ecosystem.
2. Two programming exercises on Hadoop.
3. Two programming exercises in No SQL.
4. Implementing simple algorithms in MapReduce: Matrix multiplication, Aggregates, joins, sorting, searching.
5. Implementing any one frequent item set algorithm using MapReduce.
6. Implementing any one clustering algorithm using MapReduce.
7. Implementing any one data streaming algorithm using MapReduce.
8. Mini Project: one real life large data application to be implemented (use standard datasets available on the web).

Course Title:	**Multimedia Applications-Lab**	**Semester VIII**	
Course Code	**BTITSEL807A**	**Course Type**	**Elective**
Pre-requisite	**Programming in Java / C / Python**	**L – T – P**	**0 – 0 – 2**
Stream	**Software and Application Development**	**Credit**	**1**

Lab Experiments Objectives:

1. To write programs to edit and modify multimedia files into different formats.
2. To write programs to service multimedia information on demand through streaming.
3. To transfer multimedia data from one system to other.

Lab Experiments List:

1. Assignment on: Image editing using Photoshop (or other image editing software).
2. Audio editing using Sound Forge or Audacity (or other sound editing software).
3. Animation using Flash Video editing using Premier or Adobe.
4. Write a program to convert audio files from one format to other.
5. Write a program to convert video files from one format to other.
6. Write a program to embed multimedia files on a webpage and stream them.
7. Write programs to transfer multimedia files from one device to another.

Course Title:	**Ethical Hacking- Lab**	**Semester VIII**	
Course Code	**BTITSEL807B**	**Course Type**	**Elective**
Pre-requisite	**Operating Systems lab**	**L – T – P**	**0 – 0 – 2**
Stream	**Infrastructure & Security Management**	**Credit**	**1**

Lab Experiments Objectives:

1. To understand the different kinds of hacker attacks to information and computer systems.
2. To simulate hacker attacks.
3. To change system parameters to prevent hacker attacks.
4. To write programs to prevent attacks and make system more resilient.

Lab Experiments List:

1. Use any 2 of the following hacking tools to expose system vulnerability (Nmap, Nessus, John the Ripper, Cain & Abel, Netstumbler, SQLMap).
2. Conduct and experiment to crack a password of an Application using the Cain & Abel tool.
3. Simulate a Denial of Service attack.
4. Execute a network sniffing exercise using Wireshark.
5. Discover vulnerabilities in a web server.
6. Create a simple website and write programs protect it from hacks such as (SQL injection, DoS, Cross Site Scripting XSS, Cookie/Session Poisoning, Form Tampering, Code injection and Defacement).

Course Title:	**CRM & SCM – Lab**	**Semester VIII**	
Course Code	**BTITSEL807C**	**Course Type**	**Elective**
Pre-requisite	**Enterprise Resource Planning**	**L – T – P**	**0 – 0 – 2**
Stream	**Information Management & Quality Control**	**Credit**	**1**

Lab Experiments Objectives:

1. To understand CRM and SCM as candidates to understand ERP applications deployed in organization.
2. To demonstrate the workings of various sub functions of CRM and SCM as learned in theory.

Lab Experiments List:

Students can download any open source CRM and SCM systems available to conduct the lab assignments

1. Set up an organizations customers, sales, product/services, departments and markets in the CRM/SCM system
2. Enter data for orders, customers, products, orders, quotes, invoices, payments in the CRM/SCM
3. Generate various CRM reports and alert with all the data entered

Course Title:	**Wireless Networking – Lab**	**Semester VIII**	
Course Code	**BTITSEL807D**	**Course Type**	**Elective**
Pre-requisite	**Internetworking Protocols**	**L – T – P**	**0 – 0 – 2**
Stream	**Networking**	**Credit**	**1**

Lab Experiments Objectives:

1. To give the practical exposure on wireless networks.
2. To configure and understand real issues in maintaining wireless networks.
3. To understand administrator functions.

Lab Experiments List:

1. Wireless Component and Media Identification.
2. Install a WLAN Adapter Card.
3. Wireless Mathematics.
4. Topology Design with Cisco Network Designer (CND).
5. Configuring Basic AP Settings.
6. Resetting the Bridge.
7. Antenna Setup.
8. Wireless Attacks and Countermeasures.
9. WLAN Design.
10. Site Survey Active Mode.

Course Title:	**Machine Learning – Lab**	**Semester VIII**	
Course Code	**BTITSEL807E**	**Course Type**	**Elective**
Pre-requisite	**Engineering Mathematics**	**L – T – P**	**0 – 0 – 2**
Stream	**Data Science**	**Credit**	**1**

Lab Experiments Objective:

1. To implement various machine learning techniques to solve problems.

Lab Experiments List:

1. Learn the data preprocessing steps to start a machine learning method for a practical.
2. Solve a stated problem using the simple linear regression method.
3. Use the multiple linear regression method for a stated issue.
4. Implement a polynomial regression solution.
5. Use the support vector regression to implement a ML solution.
6. Solve a stated problem using the decision tree regression method.
7. Implement a random forest regression solution.
8. Implement a reinforcement learning program to demonstrate ML concepts.

Course Title:	**Project Phase - II**	**Semester VIII**	
Course Code	**BTITP808**	**Course Type**	**Mandatory**
Pre-requisite	**Nil**	**L – T – P**	**0 – 0 – 12**
Stream	**Core**	**Credits**	**5**

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.

SYLLABUS OF INFORMATION TECHNOLOGY

RTM NAGPUR UNIVERSITY, NAGPUR

ACADEMIC SESSION: 2015-2016

SEVENTH AND EIGHTH SEMESTERS

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur

Absorption Scheme for New course(C.B.S.) to Old course of Seventh Semester

B. E. (Information Technology)

As per Old course scheme of RTM, Nagpur University					As per New course(C.B.S.) scheme of RTM, Nagpur University		
Sr. No	Sub Code	Subjects	Th/ Pr		Subject Code	Subjects	Th/ Pr
1	8IT47	Distributed Databases and Object Oriented Databases	Th		BEIT701T	Data Warehousing and Mining	Th
2	8IT47	Distributed Databases and Object Oriented Databases	Pr		BEIT701P	Data Warehousing and Mining	Pr
3	7IT43	Computer System Security	Th		BEIT702T	Computer System Security	Th
4	7IT41	Computer Network and Internet	Pr		BEIT702P	Computer System Security	Pr
5	7IT44	Elective-I Artificial Intelligence	Th		BEIT703T	Artificial Intelligence	Th
6	8IT51	Elective-II Mobile Communication	Th		BEIT704T1	Elective-I Mobile Computing	Th
7	7IT45	Elective-II Multimedia Systems	Th		BEIT704T2	Elective-I Multimedia Systems	Th
8	-----	------	-----		BEIT704T3	Elective-I Bio-informatics	Th
9	-----	------	-----		BEIT704T4	Elective-I Compiler Design	Th
10	-----	------	-----		BEIT705T1	Elective-II Software Testing and Quality Assurance	Th
11	8IT51	Elective-II Parallel Processing	Th		BEIT705T2	Elective-II Cluster and Grid Computing	Th
12	7IT42	Digital Signal Processing	Th		BEIT705T3	Elective-II Digital Signal Processing	Th
13	-----	------	-----		BEIT705T4	Elective-II Digital Forensic for Information Technology	Th
14	7IT46	Mini Project	Pr		BEIT706P	Seminar on Project	Pr
15	7IT42	Digital Signal Processing	Pr		-----	------	-----
16	7IT44	Elective-I Operation Research	Th		-----	------	-----
17	7IT44	Elective-I VLSI Design	Th		-----	------	-----
18	7IT45	Elective-II Fuzzy System and Neural Networks	Th		-----	------	-----
19	7IT45	Elective-II Digital Image Processing	Th		-----	------	-----
20	7IT45	Elective-II CAD/CAM	Th		-----	------	-----
21	7IT45	Elective-II Management Information Systems	Th		-----	------	-----
22	7IT41	Computer Network and Internet	Th		-----	------	-----

Members,
BOS (CE/IT)

Chairman,
BOS (CE/IT)

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur

Absorbtion Scheme for New course(C. B. S.) to Old course of Eighth Semester

B. E. (Information Technology)

Sr. No	Sub Code	Subjects (As per Old course scheme of RTM, Nagpur University)	Th/ Pr		Subject Code	Subjects (As per New course (C. B. S.)scheme of RTM, Nagpur University)	Th/ Pr
1	-----	------	-----		BEIT801T	Distributed Systems	Th
2	-----	------	-----		BEIT801P	Distributed Systems	Pr
3	-----	------	-----		BEIT802T	Gaming Architecture and Programming	Th
4	-----	------	-----		BEIT802P	Gaming Architecture and Programming	Pr
5	8IT50	Elective-I Real Time Systems	Th		BEIT803T1	Elective-III Embedded Systems	Th
6	7IT45	Elective-II Digital Image Processing	Th		BEIT803T2	Elective-III Digital Image Processing	Th
7	8IT51	Elective-II Pattern Recognition	Th		BEIT803T3	Elective-III Pattern Recognition	Th
8	7IT45	Elective-II Fuzzy System and Neural Networks	Th		BEIT803T4	Elective-III Machine Learning	Th
9	-----	------	-----		BEIT804T1	Elective-IV Cyber Security	Th
10	-----	------	-----		BEIT804T2	Elective-IV Cloud Computing	Th
11	8IT49	E-Commerce	Th		BEIT804T3	Elective-IV E-Commerce and Enterprise Resource Planning	Th
12	8IT50	Elective-I Enterprise Resource Planning	Th				
13	8II50	Elective-I Fibre Optical Communication	Th		BEIT804T4	Elective-IV Wireless Sensor Networks	Th
14	8IT52	Project	Pr		BEIT805P	Project	Pr
15	8IT50	Elective-I Modelling and Simulation	Th		-----	------	-----
16	8IT51	Elective-II Advanced Microprocessor	Th		-----	------	-----
17	8IT51	Elective-II Parallel Processing	Th		-----	------	-----
18	8IT47	Distributed Databases and Object Oriented Databases	Th		-----	------	-----
19	8IT47	Distributed Databases and Object Oriented Databases	Pr		-----	------	-----
20	8IT48	Web Technologies	Th		-----	------	-----
21	8IT48	Web Technologies	Pr		-----	------	-----
22	8IT51	Elective-II Mobile Communication	Th		-----	------	-----

Members,
BOS (CE/IT)

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BOS (CE/IT)

FOUR YEAR BACHELOR OF ENGINEERING (B. E.) DEGREE COURSE
SEMESTER: SEVENTH
BRANCH: INFORMATION TECHNOLOGY

Sr. No.	Subject Code	Subjects	Workload				Credit				Marks				
			L	P	T	Total Hrs/ Week	L	P	T	Total	Theory		Practical		Total Marks
											Sess.	Univ.	Sess.	Univ.	
1	BEIT701T	Data Warehousing and Mining	4	-	1	5	4	-	1	5	20	80	-	-	100
2	BEIT701P	Data Warehousing and Mining	-	2	-	2	-	1	-	1	-	-	25	25	50
3	BEIT702T	Computer System Security	4	-	1	5	4	-	1	5	20	80	-	-	100
4	BEIT702P	Computer System Security	-	2	-	2	-	1	-	1	-	-	25	25	50
5	BEIT703T	Artificial Intelligence	4	-	1	5	4	-	1	5	20	80	-	-	100
6	BEIT704T	Elective -I	4	-	1	5	4	-	1	5	20	80	-	-	100
7	BEIT705T	Elective -II	4	-	1	5	4	-	1	5	20	80	-	-	100
8	BEIT706P	Seminar on Project	-	2	-	2	-	2	-	2	-	-	50	-	50
		Total	**20**	**6**	**5**	**31**	**20**	**4**	**5**	**29**	**100**	**400**	**100**	**50**	**650**

Elective I:

BEIT704T1: Mobile Computing
BEIT704T2: Multimedia Systems
BEIT704T3: Bio-informatics
BEIT704T4: Compiler Design

Elective II:

BEIT705T1: Software Testing and Quality Assurance
BEIT705T2: Cluster and Grid Computing
BEIT705T3: Digital Signal Processing
BEIT705T4: Digital Forensic for Info. Tech.

FOUR YEAR BACHELOR OF ENGINEERING (B. E.) DEGREE COURSE
SEMESTER: EIGHTH
BRANCH: INFORMATION TECHNOLOGY

Sr. No.	Subject Code	Subjects	Workload				Credit				Marks				
			L	P	T	Total Hrs/ Week	L	P	T	Total	Theory		Practical		Total Marks
											Sess.	Univ.	Sess.	Univ.	
1	BEIT801T	Distributed Systems	4	-	1	5	4	-	1	5	20	80	-	-	100
2	BEIT801P	Distributed Systems	-	2	-	2	-	1	-	1	-	-	25	25	50
3	BEIT802T	Gaming Architecture and Programming	4	-	1	5	4	-	1	5	20	80	-	-	100
4	BEIT802P	Gaming Architecture and Programming	-	2	-	2	-	1	-	1	-	-	25	25	50
5	BEIT803T	Elective-III	4	-	1	5	4	-	1	5	20	80	-	-	100
6	BEIT804T	Elective-IV	4	-	1	5	4	-	1	5	20	80	-	-	100
7	BEIT805P	Project	-	4	-	4	-	4	-	4	-	-	75	75	150
		Total	**16**	**8**	**4**	**28**	**16**	**6**	**4**	**26**	**80**	**320**	**125**	**125**	**650**

Elective III:

BEIT803T1: Embedded Systems
BEIT803T2: Digital Image Processing
BEIT803T3: Pattern Recognition
BEIT803T4: Machine Learning

Elective IV:

BEIT804T1: Cyber Security
BEIT804T2: Cloud Computing
BEIT804T3: E-Commerce and Enterprise Resource Planning
BEIT804T4: Wireless Sensor Networks

BEIT701T DATA WAREHOUSING AND MINING
(Theory Credit: 05)

Teaching Scheme:	**Examination Scheme:**
Lecture: 4 Hours/week	**Theory: T (U): 80 Marks T (I): 20 Marks**
Tutorial: 1 Hour/week	**Duration of University Exam. : 03 Hours**

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UNIT I:
Introduction to Data Warehousing:
Evolution of decision support systems, Failure of past decision support system, Operational v/s decision support systems, Data warehousing lifecycle, Architecture, Building blocks, Components of DW, Data Marts and Metadata

UNIT II:
Data Preprocessing:
Why preprocess the data?, Descriptive data summarization, Data cleaning, Data integration and transformation, Data reduction, Data Discretization and Concept Hierarchy Generation.

UNIT III:
OLAP Analytical Processing:
OLAP in Data warehouse, Demand for online analytical processing, need for multidimensional analysis, limitations of other analysis methods, OLAP definitions and rules, OLAP characteristics, major features and functions. OLAP models- ROLAP, MOLAP, HOLAP, Differentiation, Data cubes and operations on cubes

UNIT IV:
Introduction of Data Mining:
Motivation, Importance, Data Mining functionalities, KDD and Data Mining, Data Mining v/s Query tools, Interesting patterns, Architecture, Classification of Data Mining systems, Major issues from Data warehousing and Data Mining, Applications of Data Mining.

UNIT V:
Mining Frequent Patterns and Association:
Basic Concepts: Market Basket analysis, motivating example, Frequent Item sets, Closed Item sets and Association rules, Frequent Pattern Mining Efficient and Scalable Frequent Item set. Mining Methods: Apriori Algorithm, Generating Association rules from Frequent Item sets, mining various kinds of association rules.

UNIT VI:
Business Intelligence and Big Data:
BI-Defining Business Intelligence, Important factors in BI, BI Architecture, BI framework, Development of BI system, BI applications in Marketing, Logistics and Production, Retail Industry. Big Data: - Understanding the challenges of Big data, Big data meets hadoop. Hadoop: Meeting Big data challenges, Hadoop Ecosystem, Core components, developing applications with Hadoop.

Text Books:

1. Data Mining (Concepts and Techniques) - Han and Kamber
2. Data Mining and Business Intelligence - Shinde and Chandrashekhar, Dreamtech Press
3. Professional Hadoop Solutions - Lublinsky, Smith, Yakubovich, Wiley

Reference Books:

1. Introduction to Data Mining – Tan, Steinbach, Vipin Kumar, Pearson Education.
2. Fundamentals of Data Warehouses, Jarke, Vassiliou, 2nd Edition, Springer.
3. Data Warehousing in Real World - Anahory, Murray, Pearson Education
4. Data Warehousing - Paulraj Ponniah

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BEIT701P DATA WAREHOUSING AND MINING

(Practical Credit: 01)

Teaching Scheme:	**Examination Scheme:**
Practical: 2 Hours/week	**Practical: P (U): 25 Marks P (I): 25 Marks**
	Duration of University Exam. : 02 Hours

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Note:

1. Practicals are based on DATA WAREHOUSING AND MINING syllabus (subject code: BEIT701T)
2. Practicals have to be performed on any open source tool.
3. There should be at the most two practicals per unit

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BEIT702T COMPUTER SYSTEM SECURITY

(Theory Credit: 05)

Teaching Scheme:	**Examination Scheme:**
Lecture: 4 Hours/week	**Theory: T (U): 80 Marks T (I): 20 Marks**
Tutorial: 1 Hour/week	**Duration of University Exam. : 03 Hours**

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UNIT I:
Introduction:
Need of information security, OSI security Architecture, Attacks, services, mechanism, Model of network security, Classical Encryption Techniques: Symmetric, Asymmetric, cipher model; substitution – Ceasor cipher, monoalphabetic, play fair; Transposition-Railfence, columnar; Steganography, S-DES, DES, TDES, AES; Block cipher principle, Mode, strength of DES.

UNIT II:
Differential and linear Cryptanalysis, Blowfish, RC2, RC5, IDEA, CAST-128, Characteristic of advance symmetric block cipher, Euler function, Chinese remainder theorem, Discrete logarithm, confidentiality using conventional encryption, placement of encryption function traffic, confidentiality, key distribution, random number generator.

UNIT III:
Public key cryptography- principles, RSA algorithm, key management, Diffie-Hellman key exchange, elliptic curve cryptography, Message Authentication, hash function Authentication requirements, functions, codes, hash functions, Security of hash function and MACs, Hash and MAC algorithm, MD5, Message Digest algorithm.

UNIT IV:
Secure hash algorithm (SHA-1), RIPEMD-160, HMAC, digital signatures and Authentication protocol-digital signature, authentication protocol, digital signature standard. Network Security practices, authentication applications-Kerberos, x.509 directory authentication service, Kerberos encryption technique

UNIT V:
E-mail security-Pretty Good Privacy, S/MIME, data compression using ZIP, radix-64 conversion, PGP random number generation, IP Security-Overview, Architecture, authentication header, Encapsulating security payload, combining security association, key management.

UNIT VI:
Web Security requirements, secure socket layer and transport layer security, secure electronic transaction, network management security-basic concepts of SNMP, SNMP V1, community facility, SNMP V3; System security-intruders, viruses and worms and related threads firewall-design principles, trusted system, DOS.

Text Books:

1. Forouzan, ''Cryptography and Network Security", Tata-McGraw hill.
2. William Stallings, "Cryptography and Network Security: Principle and Practice", Fifth Edition, Pearson.
3. Atul Kahate, "Cryptography and Network Security", Tata-McGraw hill.

Reference Books:

1. Josef Pieprzyk, Thomas Hardjono, Jennifer Seberry, "Fundamentals of computer Security", Springer.

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BEIT702P COMPUTER SYSTEM SECURITY

(Practical Credit: 01)

Teaching Scheme:
Practical: 2 Hours/week

Examination Scheme:
Practical: P (U): 25 Marks P (I): 25 Marks
Duration of University Exam. : 02 Hours

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Note:

1. Practicals are based on COMPUTER SYSTEM SECURITY syllabus (subject code: BEIT702T)
2. There should be at the most two practicals per unit

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BEIT703T ARTIFICIAL INTELLIGENCE

(Theory Credit: 05)

Teaching Scheme:	**Examination Scheme:**
Lecture: 4 Hours/week	**Theory: T (U): 80 Marks T (I): 20 Marks**
Tutorial: 1 Hour/week	**Duration of University Exam. : 03 Hours**

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UNIT I:

History and Application of AI, the Turing Test approach, AI Problems and AI Techniques, Defining problem as state space representation, Production system, Problem characteristics, monotonic and non-monotonic production systems, Solving problems by searching-Toy problems, Real-World problems.

UNIT II:

Uniformed Search Strategies:

Breadth-first search, Depth-first search, Comparing uniformed search techniques.

Informed search strategies:

Generate-and-test, Hill climbing, best-first search, problem reduction, constraint satisfaction, Mean-ends analysis

UNIT III:

Knowledge Representation:

Issues in knowledge representation, Approaches to knowledge representation, introduction to ontology

Logic and Inferences:

Formal logic, history of logic and knowledge, propositional logic, resolution method in propositional logic

UNIT IV:

Structural Knowledge Representation:

Frames, scripts, predicate logic, semantic network, example of knowledge representation schemes, Truth maintenance system. Transition networks: RTN, ATN. Basic techniques of NLP, application of NLP

UNIT V:

Expert system:

Knowledge acquisition methods, knowledge engineering process, goals in knowledge system development, basic architecture of expert system, problem domain versus knowledge domain, Development of ES and life cycle of ES. Advantages of expert system, structure of Rule based expert system, characteristics of conventional system and expert system.

UNIT VI:

Statistical Reasoning:

Probability and Bayes theorem, Certainty factor, Dempster-Shafer theory, Fuzzy logic: crisp sets, application of fuzzy logic.

Text Books:

1. Artificial Intelligence (Third Edition) McGraw-Hill Elaine Rich, Kevin Knight.
2. A First course in Artificial Intelligence (McGraw-Hill) Deepak Khemani.
3. Artificial Intelligence A modern approach (Second Edition) Pearson, Stuart Russell, and Peter Norvig.

Reference Books:

1. Fuzzy Logic with Engineering application (Third edition) Timothy J.Rose

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ELECTIVE: I

BEIT704T1 MOBILE COMPUTING

(Theory Credit: 05)

Teaching Scheme:
Lecture: 4 Hours/week
Tutorial: 1 Hour/week

Examination Scheme:
Theory: T (U): 80 Marks T (I): 20 Marks
Duration of University Exam. : 03 Hours

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UNIT I:

Introduction to Mobile Computing:

Wireless Communication and examples, Applications cellular communication (1G to 4G Networks), GSM (Mobile services, system architecture protocol, Localization and Calling, Handover, Security)

UNIT II:

Mobile Computing Architecture:

Internet the ubiquitous network, Architecture for Mobile Computing three tier architecture, Design consideration for Mobile Computing, Mobile Computing, Mobile Computing through Internet.

UNIT III:

Wireless LAN:

Wireless LAN advantages, Applications, IEEE 802.11 standards, System Architecture, Protocol Architecture, Physical layer, Medium access control layer, MAC management roaming.

UNIT IV:

Mobility Management and Control:

Mobile agents, characteristics, requirement for Mobile Agent system, Platform (Aglet object Model, Agent Tcl architecture)

UNIT V:

Wireless Application Protocol:

WAP model, architecture, wireless datagram protocol, wireless transaction protocol, wireless session protocols.

UNIT VI:

Introduction to Android:

Layer android components, Mapping applications to process, Android development basics, Hardware tools, Android SDK features.

Text Books:

1. Mobile Communications: 2nd Edition, Jochen Schiller, Pearson Education.
2. Wireless Communication-Principles and Practice-2nd Edition, Theodore S. Rappaport, PHI Publications

Reference Books:

1. Mobile Computing- Technology, Applications and services creation-Ashok K. Talukder, Roopa R. Yavagal, TMH.
2. Mobile Computing-Theory and Practice-Kumkum Garg-Pearson Publications

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ELECTIVE: I

BEIT704T2 **MULTIMEDIA SYSTEMS**

(Theory Credit: 05)

Teaching Scheme:	**Examination Scheme:**
Lecture: 4 Hours/week	**Theory: T (U): 80 Marks T (I): 20 Marks**
Tutorial: 1 Hour/week	**Duration of University Exam. : 03 Hours**

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UNIT I:

Introduction : Definition of multimedia, Multimedia Basics, Where to use Multimedia, Multimedia Elements, Multimedia Applications

Multimedia Systems Architecture: Multimedia Workstation Architecture, High resolution Graphic displays, Multimedia Architecture Based on interface bus, Network architecture for Multimedia systems.

Evolving Technologies For Multimedia Systems: Hyper Speech, HDTV and UDTV, 3D Technologies and Holography, Virtual Reality, Video conferencing.

UNIT II:

Hardware: Macintosh Versus Windows Platform, Connections, Memory and Storage Devices, Input Devices, Output Hardware, Communication Devices

Basic Software Tools : Text Editing, Word Processing, OCR Software, Painting and Drawing Tools, 3D Modeling and Animation Tools, Image Editing, Sound Editing, Animation, Video, Digital Movie tools, Movie Editors, Compressing Movie Files

Making instant Multimedia : Linking Multimedia Object, office suites, word processors , spread sheets, databases, presentation tools, power point

Multimedia authoring tools: Types of authoring tools, card and page based authoring tools, Icon based authoring tools, and Time based authoring tools.

UNIT III:

Text: About Fonts and Faces, Using Text in Multimedia, Designing with Text, Hypermedia and Hypertext, The Power of Hypertext, Using Hypertext, Hypermedia Structures, Hypertext tools.

Images: Making Still Images, Bitmaps, 1 bit images, 8-bit gray level images, 8-bit color images, Dithering, 24 bit color images, Vector Drawing, Vector-Drawn Objects vs. Bitmaps, 3-D Drawing and Rendering, Color, Understanding Natural Light and Color, Computerized Color, Color Palettes, Color Look-up table.

Sound : The Power of Sound, Digital Audio, Making Digital Audio Files, MIDI Audio, MIDI vs. Digital Audio, Multimedia System Sounds, Adding Sound to Your Multimedia Project, Audio Recording, Keeping Track of Your Sounds, Audio CDs, Sound for Your Mobile, Sound for the Internet.

Animation: the Power of Motion, Principles of Animation, Animation by Computer, Animation Techniques.

Video: Using Video, How Video Works and Is Displayed, Analog Video, Digital Video, Displays, Digital Video Containers, Codec, Video Format Converters, Obtaining Video Clips, Shooting and Editing Video.

UNIT IV:

Data Compression: Need for Data compression, General Data compression Scheme, Compression standards, Non-lossy compression for images, Lossy compression for Photographs and video, Hardware Vs Software Compression.

Compression Schemes and standards:(Only Concepts of) Binary image compression, Color, Gray Scale image compression, JPEG, video image compression, Multimedia Standards for Video, Requirements for Full-motion Video Compression, MPEG, Audio compression, Fractal compression, advantages / disadvantages.

UNIT V:

Data and File Format Standards: Popular File Formats: RTF, RIFF, GIF, PNG, TIFF, MIDI, JPEG, JFIF, AVI, WAV, BMP, WMF, MIX, MPEG standards - TWAIN. **Multimedia Databases**, Storage and Retrieval, Database Management systems, Database Organization and Transaction management for multimedia systems.

Multimedia Skills: The Team, Project Manager, Multimedia Designer, Interface Designer, Writer, Video Specialist, Audio Specialist, Multimedia Programmer, Producer of Multimedia for the Web.

UNIT VI:

Designing and Producing: Designing, Designing the Structure, and Designing the User Interface, Producing, Tracking, Copyrights, Virtual reality designing and modeling (VRML).

The Internet and Multimedia: The Bandwidth Bottleneck, Internet Services, MIME Types, Multimedia on the Web, Web Page Makers and Site Builders, Plug-ins and Delivery Vehicles.

Designing for the World Wide Web: Developing for the Web, The Desktop Workspace and the Small, Device Workspace, Text for the Web, Images for the Web, GIF and PNG Images, JPEG Images, Clickable Buttons, Client-Side Image Maps, Sound for the Web, Animation for the Web, GIF89a - Video for the Web.

Delivering: Testing-Preparing for Delivery, File Archives, Delivering on CD-ROM, Delivering on DVD.

Text Books:

1. Multimedia: Making It Work By Tay Vaughan Eighth Edition, TMH
2. Fundamental of Multimedia - Ze-Nian Li & M. S. Drew ,PHI
3. Multimedia Systems Design - Prabhat k. Andleigh, Kiran Thakra
4. Multimedia Systems - John F. Koegel Buford

Reference Books:

1. Computer Graphics Multimedia and Animation - Malay K. Pakhira PHI, New Delhi - Second edition.
2. Principles of Multimedia by Ranjan Parekh - 2nd Edition TMH.
3. Computer Graphics and Multimedia - Anirban Mukhapathyay, Aruop Chattopadhyay - Vikas Publishing Ltd - Second Edition
4. Multimedia Technology and Applications- David Hillman Galgotia Publications Pvt Ltd.- Second Edition

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ELECTIVE: I

BEIT704T3 BIO-INFORMATICS

(Theory Credit: 05)

Teaching Scheme:	**Examination Scheme:**
Lecture: 4 Hours/week	**Theory: T (U): 80 Marks T (I): 20 Marks**
Tutorial: 1 Hour/week	**Duration of University Exam. : 03 Hours**

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UNIT I:

Introduction:

Bioinformatics objectives and overviews, Interdisciplinary nature of Bioinformatics, Data integration, Data analysis, Major Bioinformatics databases and tools. Metadata: Summary and reference systems, finding new type of data online.

UNIT II:

Molecular Biology and Bioinformatics:

Systems approach in biology, Central dogma of molecular biology, problems in molecular approach and the bioinformatics approach, Overview of the bioinformatics applications.

UNIT III:

The Information Molecules and Information Flow:

Basic chemistry of nucleic acids, Structure of DNA, Structure of RNA, DNA Replication, -Transcription, -Translation, Genes- the functional elements in DNA, Analyzing DNA,DNA sequencing. Proteins: Amino acids, Protein structure, Secondary, Tertiary and Quaternary structure, Protein folding and function, Nucleic acid-Protein interaction.

UNIT IV:

Perl:

Perl Basics, Perl applications for bioinformatics- Bioperl, Linux Operating System, Understanding and Using Biological Databases, Java clients, CORBA, Introduction to biostatics.

UNIT V:

Nucleotide sequence data:

Genome, Genomic sequencing, expressed sequence tags, gene expression, transcription factor binding sites and single nucleotide polymorphism. Computational representations of molecular biological data storage techniques: databases (flat, relational and object oriented), and controlled vocabularies, general data retrieval techniques: indices, Boolean search, fuzzy search and neighboring, application to biological data warehouses.

UNIT VI:

Biological data types and their special requirements:

Sequences, macromolecular structures, chemical compounds, generic variability and its connection to clinical data. Representation of patterns and relationships: alignments, regular expressions, hierarchies and graphical models.

Text Books:

1. O'Reilly, "Developing Bio informatics computer skills", Indian Edition's publication.
2. Rastogi, Mendiratta, Rastogi, "Bioinformatics concepts, skills & Applications", CBS Publishers.
3. Rashidi, Hooman and Lukas K. Buehler, "Bioinformatics Basic Applications" CRC Press.
4. "Bioinformatics" , Addison Wesley, Stephen Misner & Stephen Krawetz, "Bioinformatics- Methods & Protocols"

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ELECTIVE: I

BEIT704T4 COMPILER DESIGN

(Theory Credit: 05)

Teaching Scheme:
Lecture: 4 Hours/week
Tutorial: 1 Hour/week

Examination Scheme:
Theory: T (U): 80 Marks T (I): 20 Marks
Duration of University Exam. : 03 Hours

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UNIT I:

Introduction To Compilers:

Compilers and translators, structure of realistic compiler, types of compilers, cross compiler, Bootstrapping, Compiler writing tools, Design of Lexical Analyzer, FLEX tool, Parser generator tool: YACC

UNIT II:

Syntax Analysis:

Specification of syntax of programming languages using CFG, Top-Down parser -predictive parser, recursive descent parser, design of LL(1) parser, Bottom-up parsing techniques, LR parsing algorithm, Design of SLR, LARL, CLR parsers, Examples on LL and LR parsers

UNIT III:

Syntax Directed Translation:

Study of syntax directed definition and syntax directed translation schemes, evaluation orders of SDD's , implementation of SDTS, intermediate: postfix syntax tree, TAC, Translation of expression ,Control structures, declaration procedure calls and array reference

UNIT IV:

Storage Allocation And Error Handling:

Runtime Memory Management – Storage Organization, Storage allocation strategies, symbol table management and organization.

Error Detection And Recovery:

Lexical, syntactic, semantic errors, error recovery for LL and LR parsers

UNIT V:

Code Optimization: Principle sources of optimization, importance code optimization techniques, loop optimization, control flow analysis, data flow analysis, loop invariant compilation, induction variable removal, elimination of common Subexpression.

UNIT VI:

Code Generation: Problem in code generation, simple code generator, code generation algorithm, register allocation and assignment, code generation from DAG, heuristic ordering of DAGs, Labeling algorithm, peephole optimization

Text Books:

1. Principle of compiler Design: Alfred V. Aho and Jeffery D. Ullman, Narosa Pub.
2. Compilers Principles, Techniques, and Tools: Alfred Aho, Ravi Sethi, J. D. Ullman, 2nd Edition, Pearson
3. Principles and Practice of Compiler Writing: Aho, Sethi and Ullman, Addiison Wesley.
4. Compiler Construction: K. V. N. Sunitha, Pearson Education
5. Compiler Design: O.G. Kakde, 4th Edition, University Science Press.

Reference Books:

1. Principles of Compiler Design: V. Raghavan, TMH.
2. Fundamentals of Compiler Design: A. K. Pandey, S. K. Kataria and Sons, N. Delhi

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ELECTIVE: II

BEIT705T1 SOFTWARE TESTING AND QUALITY ASSURANCE

(Theory Credit: 05)

Teaching Scheme:	**Examination Scheme:**
Lecture: 4 Hours/week	**Theory: T (U): 80 Marks T (I): 20 Marks**
Tutorial: 1 Hour/week	**Duration of University Exam. : 03 Hours**

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UNIT I:

Basic concepts of Testing: Need of Testing, Basic concepts- errors, faults, defects, failures, objective of testing, central issue in testing, Testing activities, V-Model, Sources of information for test cases, Monitoring and Measuring Test Execution, Test tools and Automation, Limitation of Testing.

UNIT II:

Unit Testing: Concepts of Unit Testing, Static Unit Testing, Defect Prevention, Dynamic Unit Testing, Mutation Testing, Debugging, Unit Testing in Extreme Programming, Tools for Unit Testing.

UNIT III:

Control Flow Testing: Outline of Control Flow Testing, Control Flow Graphs, Path in Control Flow Graph, Path selection criteria, All path coverage criteria, Statement coverage, Path coverage, Predicate coverage criteria, Generating Test input, Examples of Data selection.

UNIT IV:

Data Flow and System Integration Testing: Introduction Data flow testing, Data flow graph, Data flow testing criteria, Comparison of Data flow test selection criteria. Fundamentals of System Integration: Types of interfaces and interface errors, System integration testing, Software and Hardware integration, Test plan, Off-the shelf component integration and testing.

UNIT V:

System Test Categories and Test Design: Taxonomy of system test, Basic Test, Functionality test, Robustness test, Performance test, Scalability test, Stress test, Load and Stability test, Reliability test, Regression test, Documentation Test. Test Design: Test cases, Necessity of test case documentation, Test case design methods, Functional specification based test case design, Use case bases, Application based test case design, Level of test execution.

UNIT VI:

Acceptance Testing and Software Quality: Types of acceptance testing, Acceptance criteria, Acceptance test plan and execution, Special Tests: Client server testing, Web application testing and Mobile application testing, fire view of software quality, ISO-9126 quality characteristics, ISO-9000:2000 software quality standard, ISO - 9000:2000 fundamentals.

Text Books:

1. Software Testing and Quality Assurance by Kshirsager Naik and Priyadarshini Tripathi (Wiley)
2. Software Testing Concepts and Tools by Nageswara Rao Pusuluri (Dream Tech Press)
3. Software Testing Principles, Techniques and tools, 1st Edition, by M. G. Limaye McGraw Hills

Reference Books:

1. "Foundations of Software Testing" 2E by Aditya P. Mathur , Pearson Education
2. Effective Methods for Software Testing- William E Perry, (Wiley). 2. Software Testing Tools by Dr. K. V. K. K. Prasad (Dream Tech)

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ELECTIVE: II

BEIT705T2 CLUSTER AND GRID COMPUTING

(Theory Credit: 05)

Teaching Scheme:
Lecture: 4 Hours/week
Tutorial: 1 Hour/week

Examination Scheme:
Theory: T (U): 80 Marks T (I): 20 Marks
Duration of University Exam. : 03 Hours

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UNIT I:
Introduction to Cluster Computing, Cluster Middleware: An Introduction, Early Cluster Architecture and High Throughput Computing Clusters, Networking, Protocols and I/O for Clusters, Setting Up and Administering a Cluster

UNIT II:
Cluster Technology for High Availability, Performance Models and Simulation, Process Scheduling, Load Sharing and Load Balancing, Distributed Shared Memory, Case Studies of Cluster Systems: Beowulf, COMPaS, NanOS and PARAM

UNIT III:
Introduction to Grid Architecture, Characterization of Grid, and Grid related standard bodies, Grid types, Topologies, Components and Layers, Comparison with other approaches.

UNIT IV:
System Infrastructure, Traditional paradigms for distributed computing, Web Services, Grid standards: OGSA and WSRF, Introduction to Globus Toolkit 3 and GT 4

UNIT V:
Semantic Grid and Autonomic Computing , Metadata and Ontology in semantic Web , Semantic Web Services, Layered Structure of Semantic Grid , Semantic Grid Activities , Autonomic Computing

UNIT VI:
Basic Services: Grid Security, Grid Monitoring, GMA, Review criteria overview of Grid Monitoring system – Autopilot. Grid Scheduling and Resource Management: Scheduling Paradigms, working of Scheduling

Text Books:

1. Grid and Cluster Computing, Prabhu C.S.R, PHI Learning Private Limited
2. The Grid (Chapter 1,2,3,4,5) Core Technologies by Maozhen Li, Mark Baker (John Wiley and Sons)
3. Cloud Computing for Dummies (Chapter 6,7) by Judith Hurwitz, R.Bloor, M. Kanfman, F. Halper (Wiley India Edition)
4. Cloud Security and Privacy (Chapter 8) by Tim Malhar, S.Kumaraswammy, S.Latif (SPD,O'REILLY)

Reference Books:

1. A networking Approach To Grid Computing by Daniel Minoli (Chapter 1) (John Wiley and Sons, INC Publication)
2. Cloud Computing: A Practical Approach by J. Vette, Toby J. Vette, Robert Elsenpeter (Tata McGraw Hill)
3. Distributed and Cloud Computing, First Edition, Geoffrey C. Fox,Kai Hwang,Jack J. Dongarra, Elsevier India Pvt. Ltd.-New Delhi
4. Distributed Systems: Principles and Paradigms, Second Edition, Andrew S. Tanenbaum, Maarten Van Steen, Person Eduction
5. High Performance Cluster Computing: Architectures and Systems, Vol. 1, Prentice Hall
6. In search of clusters (2nd ed.), Gregory F. Pfister, IBM, Austin, TX, Prentice-Hall

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ELECTIVE: II

BEIT705T3 DIGITAL SIGNAL PROCESSING

(Theory Credit: 05)

Teaching Scheme:
Lecture: 4 Hours/week
Tutorial: 1 Hour/week

Examination Scheme:
Theory: T (U): 80 Marks T (I): 20 Marks
Duration of University Exam. : 03 Hours

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UNIT I:

Basic elements of DSP and its requirement, advantage of digital over analog signal processing, Discrete time Signals and Systems, Classification of discrete time Systems, Response of LTI System to various inputs, Sampling Theorem, sampling process and reconstruction , Linear Convolution, Correlation(Auto and Cross).

UNIT II:

Z-Transform: Definition, Properties of Z-Transform, ROC's of Finite length and Infinite length Signals, Theorem of Z-Transform (Initial value and Final value Theorem), system function of LTI system, Relation of Z-Transform with Laplace and Fourier Transform.

Inverse Z-Transform: Power Series expansion, Partial fraction Expansion method causality and stability.

UNIT III:

Frequency Domain description of signal and system, Definition of Fourier transform and properties of Fourier transform, inverse Fourier transform, Definition of discrete Fourier transform and properties of DFT, inverse IDFT, DFT's of typical time signals, Circular Convolution using DFT and IDFT.

UNIT IV:

Design of IIR filter from Analog filter using approximation of derivative, Impulse Invariance, Bilinear Transformation, IIR filter structure: Direct-I, Direct-II, parallel and cascade form

UNIT V:

Design of FIR Filter based on Windows: Rectangular, Hamming, Hanning, Bartlett and blackman Window. FIR filter structure: Direct and cascade form

UNIT VI:

Introduction to FFT algorithm: Decimation in Time-FFT algorithm, Decimation in Frequency-FFT algorithm, Inverse FFT algorithm, Discrete Cosine Transform.

Text Books:

1. J. G. Proakis, Manolakis " Digital Signal Processing : Principle, Algorithms and applications, Pearson Education
2. A. V. Oppenheim, R. W. Schafer, "Discrete Time Signal Processing ", Pearson Education

Reference Books:

1. S. Salivahanana, A Vallaraj, C, Ganapriya" Digital Signal Processing", McGraw Hill

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ELECTIVE: II

BEIT705T4 DIGITAL FORENSIC FOR INFORMATION TECHNOLOGY

(Theory Credit: 05)

Teaching Scheme: **Examination Scheme:**

Lecture: 4 Hours/week **Theory: T (U): 80 Marks T (I): 20 Marks**

Tutorial: 1 Hour/week **Duration of University Exam. : 03 Hours**

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UNIT I:

Digital Forensics Fundamentals: What is Digital forensics?, Use of Digital forensics in law enforcement, computer forensics assistance, to human resources/employment proceedings, benefits of professional forensics methodology, steps taken by Digital forensics specialists Cyber Crimes: Definition, motives, and classification of cyber crimes. Modus operandi of cyber crime, types of cyber crimes,

UNIT II:

Computer Forensics Evidence Capture: Data recovery defined, data backup and recovery, the role of backup in data recovery, the data recovery solution Evidence Collection and Data Seizure: evidence, collection options, obstacles, types of evidence, the rules of evidence, volatile evidence, general procedure, collection and archiving, methods of collection, artifacts, collection steps controlling contamination: the chain of custody, Network Forensics: Network forensics overview, performing live acquisitions, developing standard procedures for network forensics, using network tools

UNIT III:

Duplication and Preservation of Digital Evidence: Preserving the digital crime scene computer evidence processing steps, legal aspects of collecting and preserving computer forensic evidence, Computer Forensics Analysis and Validation: Determining what data to collect and analyze, validating forensic data, addressing data, hiding techniques, and performing remote acquisitions

UNIT IV:

Processing Crime and Incident Scenes: Identifying digital evidence, collecting evidence in private sector incident scenes, processing law enforcement crime scenes, preparing for a search securing a computer incident or crime scene, seizing digital evidence at the scene, storing digital evidence, obtaining a digital hash, reviewing a case

UNIT V:

E-mail Investigations: Exploring the role of e-mail in investigations, exploring the roles of the client and server in e-mail, investigating e-mail crimes and violations, understanding e-mail servers, using specialized e-mail forensic tools,

Cell phone and mobile device forensics: Understanding mobile device forensics, understanding Acquisition procedures for cell phones and mobile devices, files present in SIM card, device data, external memory dump, evidences in memory card, operators systems,

Android forensics: Procedures for handling an android device, imaging android USB mass storage devices, logical and physical techniques

UNIT VI:

Working with Windows and DOS Systems: Understanding file systems, exploring Microsoft file structures, examining NTFS disks, understanding whole disc encryption, windows registry, Microsoft startup tasks, MSDOS startup tasks, virtual machines, Current Forensic Tools: Evaluating computer forensic tool needs, computer forensic software Tools, computer forensic hardware tools, validating and testing forensic software

Text Books:

1. The Basics of Digital Forensics: The Primer for Getting Started in Digital Forensics by John Sammons, Edition 1, Published by Elsevier February 24, 2012, ISBN: 978-1-59749-661-2

Reference Books:

1. Warren G. Kruse II and Jay G. Heiser, "Computer Forensics: Incident Response Essentials", Addison Wesley, 2002.
2. Nelson B, Phillips A, Enfinger F, Stuart C., "Guide to Computer Forensics and Investigations, 2^{nd} ed., Thomson Course Technology, 2006, ISBN: 0-619-21706-5.

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BEIT706P SEMINAR ON PROJECT

(Practical Credit: 02)

Teaching Scheme:
Practical: 2 Hours/week

Examination Scheme:
Practical: P (U): 00 Marks P (I): 50 Marks

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Note:

1. The topic of Seminar on project should be assigned to the students in the group of maximum five students based on recent trends in Information Technology and allied branches.

2. Senior faculty members should work as guide.

3. The research paper publication / presentation in reputed national and international journals / conferences should be given some weightage while evaluation.

4. Seminar reports should be written using technical research writing tools (e.g. Latex) and submitted to the department for internal evaluation.

5. The project should be carried out upto design phase during this semester.

6. The same project has to be considered and extended for eighth semester project head (BEIT805P).

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BEIT801T **DISTRIBUTED SYSTEMS**

(Theory Credit: 05)

Teaching Scheme:	**Examination Scheme:**
Lecture: 4 Hours/week	**Theory: T (U): 80 Marks T (I): 20 Marks**
Tutorial: 1 Hour/week	**Duration of University Exam. : 03 Hours**

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UNIT I:
Introduction: Distributed Computing Models, Software Concepts, Hardware Concepts, The Client-Server model, Issues in design of a distributed operating system.

UNIT II:
COMMUNICATION: Introduction to Message Passing, Advantages and features of message passing, Message format, Message Buffering, Remote Procedure Call, Extended RPC Models, Remote Object Invocation, Message Oriented Communication.

UNIT III:
Processes And Synchronization: Threads, code migration, clock synchronization, logical clocks, global state, Election algorithms, mutual exclusion, Distributed transaction.

UNIT IV:
Distributed Deadlock Detection: System model, Resources vs. communication deadlocks, deadlock prevention, avoidance, detection and resolution, Centralized deadlock detection, distributed deadlock detection, path pushing and edge chasing algorithm

UNIT V:
Distributed Shared Memory: Introduction, General architecture of distributed shared memory, Design and implementation, Issues of DSM, Granularity, structure of shared memory space, consistency models, thrashing, advantages of DSM

UNIT VI:
Distributed File System: Introduction, Desirable features of good distributed file system, file models, file accessing, sharing, caching methods, file replication, fault tolerance, Case Study: CORBA(CORBA RMI and Services)

Text Books:

1. Andrew Tanenbaum, Maarten Van Steen, "Distributed System- Principals Paradigm", PHI Publication.
2. Singhal and Shivratri, "Advanced Concept in Operating Systems", McGraw Hill.

BEIT801P DISTRIBUTED SYSTEMS

(Practical Credit: 01)

Teaching Scheme:
Practical: 2 Hours/week

Examination Scheme:
Practical: P (U): 25 Marks P (I): 25 Marks
Duration of University Exam. : 02 Hours

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Note:

1. Practicals are based on DISTRIBUTED SYSTEMS syllabus (subject code: BEIT801T)
2. There should be at the most two practicals per unit

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BEIT802T GAMING ARCHITECTURE AND PROGRAMMING

(Theory Credit: 05)

Teaching Scheme:	**Examination Scheme:**
Lecture: 4 Hours/week	**Theory: T (U): 80 Marks T (I): 20 Marks**
Tutorial: 1 Hour/week	**Duration of University Exam. : 03 Hours**

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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.

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.

UNIT III:

Development: The Development Process. Code Quality. Coding Priorities. Debugging and Module Completion. The Seven Golden Gambits. The Three Lead Balloons. GAME PROGRAMMING: Technologies: Display, Mixing 2D and 3D, DirectX, User Interface code, Resource caching, the main loop.

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, More Control Properties.

UNIT V:

2D Drawing and DirectX:

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.

UNIT VI:

Loading and Caching Game Resources:

Art and Sound Formats, Resource Files, Data Compression, IPac: A Resource File Builder, the Resource Cache, World Design and Cache Prediction, 3D Graphics and 3D Engines: 3D Graphics Pipeline, Setting Up a Project, Using a Scene Graph, 3D Middleware Review, Rolling Your Own 3D Engine.

Text Books:

1. Game Architecture and Programming, Shankarmani, Jain, Sinha, Wiley Publication, India
2. Fundamentals of Game Design, 3rd Edition, Ernest Adams, Pearson Publication

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
4. "Professional Game Programming" Mike McShaffry, Dreamtech Press.

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BEIT802P GAMING ARCHITECTURE AND PROGRAMMING

(Practical Credit: 01)

Teaching Scheme:
Practical: 2 Hours/week

Examination Scheme:
Practical: P (U): 25 Marks P (I): 25 Marks
Duration of University Exam. : 02 Hours

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Note:

1. Practicals are based on GAMING ARCHITECTURE AND PROGRAMMING syllabus (subject code: BEIT802T)
2. Students are suggested to choose at least One game idea, possibly:
    1. Single player (Puzzle, Educational, Strategy etc.)
    2. Multiplayer (Adventure, fighting, sports etc.)

    Then work on both the ideas covering following aspects:

    1. Feasibility and Design
    2. Planning for each stage with objective to achieve.
    3. Technical Architecture
    4. Component building
    5. Integration and testing
    6. Complexity level
    7. Review (This can taken from other students of same class or junior class).
3. Following are the Open Source Game Engine Tools recommended for implementation.
    1. GDevelop
    2. PlayConvas
    3. Unity
    4. Aleph One
    5. Adventure Game Studio
    6. Crystal Space
    7. Delta 3D
    8. Game Play 3D and many more

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ELECTIVE: III

BEIT803T1 EMBEDDED SYSYTEMS

(Theory Credit: 05)

Teaching Scheme:
Lecture: 4 Hours/week
Tutorial: 1 Hour/week

Examination Scheme:
Theory: T (U): 80 Marks T (I): 20 Marks
Duration of University Exam. : 03 Hours

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UNIT I:

Introduction to Embedded System:

Introduction, Embedded system vs General computing system, History of embedded system, Processor embedded into a system, Embedded hardware units and devices in a system, Embedded software in a system, examples in a embedded system, Embedded SoC, Complex system design and processors, Design process in ES, Formalization of system design, Classification of Es, Skills required in Embedded system design, Characteristics and quality attributes of Embedded system.

UNIT II:

Embedded System Design:

Hardware and Software design, Co-design, Embedded Software development Tools: In Circuit Emulators, Cross compilers, cross assemblers and tool chain, linker locator, Address resolution, PROM programmer, Rom Emulator. Memories: EPROM, PROM, Flash.

UNIT III:

RTOS for Embedded System:

Architecture of the kernel, Tasks and Task Scheduler, Threads , ISR, Multiprocessing and Multitasking, Semaphore and Shared Data, Mutex, Mailboxes, Message Queue, Events, Pipes, Timers, Signals, Memory Management, RTOS Task Scheduling Models, Interrupt Latency, Response of the task, OS Security issues, Introduction to Android.

UNIT IV:

Devices and Communication:

Serial Communication devices, Parallel device port, Buses: I^2C, UART, USART, CAN Bus, Devices: Wireless Devices, Timer and Counting Devices, Watch Dog Timer, Real Time Clock, Network Embedded System.

UNIT V:

Programming for Embedded System:

Software programming in assembly language (ALP) and High Level language 'C', C program element: Header and Source Files, Preprocessor Directives, Macros and Functions, Data Types, Data Structures, Modifiers, Statements, Loops and Pointers, Object Oriented Programming, Embedded Programming in C++, Embedded Programming in Java.

UNIT VI:

Microcontroller 8051:

Introduction, Architecture, Memory Management, Addressing Modes and Instruction Sets, I/O Ports, Timers/Counters, Routing Interface with OS, Wireless Communication Protocol, Routing Methodologies

Text Books:

1. Embedded System Architecture, Programming and Design by Raj Kamal, 3rd Edition TMH.
2. Introduction to Embedded System by Shibu K. V. 3rd Edition TMH.
3. The 8051 Microcontroller Based Embedded System By Manish K. Patel TMH.
4. An Embedded Software Primer by David E. Simon (Pearson Edu. Asia).
5. 8051 Microcontroller and Embedded System by Muhammad Ali Mazidi, Janice Mazidi, Janice Gillispie Mazidi, Pearson Edition.
6. Embedded / Real Time Systems: Concepts, Design and Programming (Black Book) By Dr. K. V. K. K. Prasad Dreamtech Press.
7. Embedded Systems Engineering, C. R. Sarma, University Press.

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ELECTIVE: III

BEIT803T2 DIGITAL IMAGE PROCESSING

(Theory Credit: 05)

Teaching Scheme:	**Examination Scheme:**
Lecture: 4 Hours/week	**Theory: T (U): 80 Marks T (I): 20 Marks**
Tutorial: 1 Hour/week	**Duration of University Exam. : 03 Hours**

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UNIT I:

DIGITAL IMAGE FUNDAMENTALS

Elements of digital image processing systems, Vidicon and Digital Camera working principles, Elements of visual perception, brightness, contrast, hue, saturation, mach band effect, Image sampling, Quantization, dither, Two-dimensional mathematical preliminaries, 2D transforms - DFT, DCT, KLT, SVD.

UNIT II:

IMAGE ENHANCEMENT

Histogram equalization and specification techniques, Noise distributions, Spatial averaging, Directional Smoothing, Median, Geometric mean, Harmonic mean, Contra harmonic mean filters, Homomorphic filtering, Color image fundamentals - RGB, HSI models, Color image enhancement.

UNIT III:

IMAGE RESTORATION

Image Restoration - degradation model, unconstrained restoration - Lagrange multiplier and constrained restoration, Inverse filtering-removal of blur caused by uniform linear motion, Wiener filtering, Geometric transformations-spatial transformations.

UNIT IV:

IMAGE SEGMENTATION

Edge detection, Edge linking via Hough transform, Thresholding, Region based segmentation, Region growing, Region splitting and merging, Segmentation by morphological watersheds, basic concepts, Dam construction, and Watershed segmentation algorithm.

UNIT V:

IMAGE COMPRESSION

Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, Vector Quantization, Transform coding, JPEG standard, MPEG

UNIT VI:

FEATURE EXTRACTION

Representation, Topological Attributes, Geometric Attributes Description, Boundary-based Description, Region-based Description, Relationship, Object Recognition, Deterministic Methods, Clustering, Statistical Classification, Syntactic Recognition, Tree Search, Graph Matching.

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.

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,

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ELECTIVE: III

BEIT803T3 PATTERN RECOGNITION

(Theory Credit: 05)

Teaching Scheme:
Lecture: 4 Hours/week
Tutorial: 1 Hour/week

Examination Scheme:
Theory: T (U): 80 Marks T (I): 20 Marks
Duration of University Exam. : 03 Hours

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UNIT I:

Pattern Classifier: Overview of Pattern recognition, Discriminant functions, supervised learning, parametric estimation, Maximum Likelihood Estimation,

UNIT II:

Bayes Classifier: Bayesian parameter Estimation, Problems with Bayes approach, Pattern classification by distance functions, Minimum distance pattern classifier.

UNIT III:

Clustering: Clustering for unsupervised learning and classification Clustering concept, C Means algorithm, Hierarchical clustering, Graph theoretic approach to pattern Clustering, Validity of Clusters.

UNIT IV:

Feature Extraction and Structural Pattern Recognition: KL Transforms, Feature selection through functional approximation, Binary selection, Elements of formal grammars, Syntactic description, stochastic grammars, Structural representation.

UNIT V:

Hidden Markov model and Support Vector Machine: State machine, Hidden Markov model, Training, Classification, Support vector machine, Feature Selection.

UNIT VI:

Recent Advances:

Fuzzy logic, Fuzzy Pattern Classifier, Pattern classification using genetic algorithms, Case study using Fuzzy pattern classifier and perception

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.

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ELECTIVE: III

BEIT803T4 MACHINE LEARNING

(Theory Credit: 05)

Teaching Scheme:	**Examination Scheme:**
Lecture: 4 Hours/week	**Theory: T (U): 80 Marks T (I): 20 Marks**
Tutorial: 1 Hour/week	**Duration of University Exam. : 03 Hours**

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UNIT I:

Introduction:

Machine Learning, Machine Learning Foundations, Overview, applications, Types of machine learning, basic concepts in machine learning, Examples of Machine Learning , Applications, Linear Models for Regression, Linear Basis Function Models, The Bias, Variance Decomposition, Bayesian Linear Regression, Bayesian Model Comparison

UNIT II:

Supervised Learning:

Linear Models for Classification, Discriminate Functions, Single layer neural network, linear reparability, general gradient descent, perception learning algorithm, multi-Layer perception: two-layers universal approximations, back propagation learning, important parameters, Margin of a classifier, dual perception algorithm, learning non-linear hypotheses with perception.

UNIT III:

Unsupervised Learning: Clustering, K-means, EM, Mixtures of Gaussians, The EM Algorithm in General, Model selection for latent variable models, high-dimensional spaces, The Curse of Dimensionality, Dimensionality Reduction, Factor analysis, Principal Component Analysis, Probabilistic PCA, Independent components analysis. Neural Networks, Feed-forward Network Functions, Error Back, propagation, Regularization , Mixture Density and Bayesian Neural Networks, Kernel Methods, Dual Representations , Radial Basis Function Networks. Ensemble methods, Bagging, Boosting

UNIT IV:

Instance-Based Learning:

Nearest neighbor classification, k-nearest neighbor, nearest neighbor error probability Machine, Machine learning concepts and limitations: Learning theory, formal model of the learnable, sample complexity, learning in zero-bayes and realizable case, VC-dimension, fundamental algorithm independent concepts, hypothesis class, target class, inductive bias, Occam’s razor, empirical risk, limitations of inference machines, approximation and estimation errors, Tradeoff.

UNIT V:

Support Vector Machine (SVM): Kernel functions, implicit non-linear feature space, theory, zero-Bayes, realizable infinite hypothesis class, finite covering, margin-based bounds on risk, maximal margin classifier. Machine learning assessment and Improvement: Statistical model selection, structural risk minimization, bootstrapping, bagging, boosting.

UNIT VI:

Advanced Learning:

Sampling, Basic sampling methods, Monte Carlo, Reinforcement Learning, K-Armed Bandit-Elements, Model-Based Learning, Value Iteration, Policy Iteration. Temporal Difference Learning, Exploration Strategies, Deterministic and Non-deterministic Rewards and Actions, Eligibility Traces, Generalization, Partially Observable States, the Setting-Example, Semi - Supervised Learning. Computational Learning Theory: Mistake bound analysis, sample complexity analysis, VC dimension. Occam learning, accuracy and confidence boosting

Text Books:

1. Machine Learning – Tom M. Mitchell, - MGH
2. Ethem Alpaydin, "Introduction to Machine Learning", Prentice Hall of India, 2005

Reference Books:

1. Christopher Bishop, "Pattern Recognition and Machine Learning" Springer, 2006
2. Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012
3. Stephen Marsland, "Machine Learning –An Algorithmic Perspective", CRC Press, 2009

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ELECTIVE: IV

BEIT804T1 CYBER SECURITY

(Theory Credit: 05)

Teaching Scheme:
Lecture: 4 Hours/week
Tutorial: 1 Hour/week

Examination Scheme:
Theory: T (U): 80 Marks T (I): 20 Marks
Duration of University Exam. : 03 Hours

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UNIT I:

Introduction: Cyber Crime; definitions, An origin of the Word, cyber crime - and information security, who are criminals? classification of cyber crimes; email spoofing, spamming, cyber defamation, internet time theft, salami attack or salami technique, data diddling, forgery, web jacking, news group spam or crimes emanating from usenet NewsGroup, Industrial spying or Industrial Espionage, hacking, online fraud, Pronography offenses, software piracy, Computer Sabotage, email bombing, mail bombs, usenet NewsGroup as a source of cyber crimes, computer network intrusion, password sniffing, credit crad fraud, identity theft.

UNIT II:

Introduction, categories of cyber crime, how criminals plan the attack: Reconnaissance, passive and active attacks, scamming/scrutinizing gathered information, attack (Gaining and maintaining the system access, Social engineering, classification of social engineering, cyber stalking, types of stalkers, cases reported on cyber stalking, how stalking works? Real life incidents of cyber stalking, cyber cafe and cyber crimes, fuel for cyber crimes, Botnet, attack vector, cloud computing: why cloud computing? types of services, cyber crime and cloud computing.

UNIT III:

Cyber crime: Mobile and wireless devices: Introduction proliferation of mobile and wireless devices trained in mobility, credit card fraud in mobile and wireless computing era - types and technique of credit card fraud, security challenges posed by mobile devices, registry selling for mobile devices, authentication service security - cryptographic security for mobile devices, LDAP security for handheld mobile computing devices, RAS security for mobile devices, Media player control security, networking API security for mobile computing applications, attacks on mobile phone - mobile phone theft, mobile viruses, mishing, vishing, hacking Bluetooth mobile devices, security implications for organizations, managing diversity and proliferation of hand-held devices, unconventional or stealth storage devices threats through cost and stolen devices. Protecting data on lost devices educating the laptop user, organizational measures of handling mobiles, device related security issues, organizational security policies and measures in mobile computing era.

UNIT IV:

Tools and methods used in Cyber crime: Introduction proxy servers and ananymizers phishing, password cracking - online attacks, offline attacks, strong, weak and rand password, random password, key loggers and spywares: s/w key loggers hardware key loggers, anti loggers, spywares, virus and worms, types of virus, Trojan horse and backdoors: backdoors, protection from Trojan horse, steganography, DoS and DDos attacks, SQL injection buffer overflow, attacks on wireless networks.

UNIT V:

Phishing and Identity theft: Introduction, phishing - methods of phishing, phishing techniques, spear phishing, types of phishing scams, phishing toolkit and spy phishing, phishing counter measures, Identity theft (ID theft) - Personally Identifiable Information (PII), types of identity theft, techniques of ID theft, Identity theft: counter measures, how to efface your Identity.

UNIT VI:

Cybercrime AND Cyber-security: The legal perspectives - Introduction, cybercrime and the legal landscape around the world, why do we need cyber laws: Indian context, The Indian Act, challenges of Indian law and cyber crime scenario in India, consequences of not adverting the weakness in Information Technology ACT, digital signature and the Indian ACT, Amendments to the Indian ACT, cybercrime and punishment, cyber laws, technology and student: Indian Scenario.

Text Books:

1. Naina Godbole, Sunil Belapure, "Cyber Security - Understanding Cybercrime, Computer forensic and legal perspective", Wiley India Pvt. Ltd.

Reference Books:

1. Thomas J. Mowbray, "Cyber security Managing systems- Conducting, Testing and Investigating Intrusion", Wiley

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ELECTIVE: IV

BEIT804T2 CLOUD COMPUTING

(Theory Credit: 05)

Teaching Scheme:	**Examination Scheme:**
Lecture: 4 Hours/week	**Theory: T (U): 80 Marks T (I): 20 Marks**
Tutorial: 1 Hour/week	**Duration of University Exam. : 03 Hours**

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UNIT I:

Defining Cloud Computing: Cloud computing in a nutshell, cloud type - NIST Model, cloud cube model, deployment model, service model, Characteristics of cloud computing, cloud computing stack, open stack.

UNIT II:

Understanding Services and Virtualization Technology:

Understanding services and applications, defining Infrastructure as a Service (IaaS), Platform as a service, Software as a Service, Identity as a Service, Compliance as a Service, Using virtualization technologies, Load balancing and virtualization, understanding Hypervisors, understanding machine Imaging, porting applications, Salesforce.com versus Force.com, SaaS versus PaaS.

UNIT III:

Using Cloud Platform:

Using Google web services, using Amazon web services, using Microsoft cloud services, Aneka integration of private and public cloud

UNIT IV:

Cloud Migration:

Broad approaches to migration, seven steps model of migration, mobbing applications to the cloud, Applications in the cloud, Application in cloud API

UNIT V:

Cloud Security and Storage:

Securing the cloud, securing data, working with cloud based storage - measuring the digital universe, provisioning cloud storage, Exploring cloud back-up solutions

UNIT VI:

Cloud Computing Tools and Future Cloud:

Open source cloud computing platform - Eucalyptus, Open Nebula, Programming in the cloud Map Reduce Dryad. Future cloud - Future trends in cloud computing, defining the mobile market, using Smart phones with the cloud.

Text Books:

1. "Cloud Computing Bible", Barrie Sosinsky; Wiley India Pvt. Ltd.
2. "Cloud Computing - Principals and Paradigms", Rajkumar Buyya, James Broberg, Andrzej Goscinski; Wiley India Pvt. Ltd.
3. Cloud Computing, A Hands on Approach, Bahga, Madisetti, University Press,
4. "Mastering Cloud Computing", Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, Tata McGraw Hill.

Reference Books:

1. "Cloud Computing - A practical approach for learning and implementation", A. Shrinivasan, J. Suresh; Pearson
2. "Cloud Computing - Fundamentals, Industry approach and trends", Rishabh Sharma; Wiley India Pvt. Ltd.

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ELECTIVE: IV

BEIT804T3 E-COMMERCE AND ENTERPRISE RESOURCE PLANNING

(Theory Credit: 05)

Teaching Scheme:	**Examination Scheme:**
Lecture: 4 Hours/week	**Theory: T (U): 80 Marks T (I): 20 Marks**
Tutorial: 1 Hour/week	**Duration of University Exam. : 03 Hours**

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UNIT I:

Introduction to electronics-commerce: The scope of E-COM, definition of E-COM, E-COM and trade cycle, electronic market, electronic data interchange, internet commerce, E-Commerce in perspective, the value chain, supply chains. Electronic Commerce Software: What kind of software solutions do you need? Marketing smarts, hosting services, basic packages, midrange package, enterprise solutions for large firms.

UNIT II:

Business to Business Electronics-commerce: Inter-organizational transactions, electronics markets, electronic data interchange (EDI), EDI-technology, EDI and business, inter organizational e-com. Business to consumer electronic commerce: consumer trade transactions, the elements of e-commerce– elements, e-visibility, the e-shop, online payment, delivering the goods, after sales service, internet e-com security, a website evolution mode.

UNIT III:

Electronics payment system: The basics of electronic payment systems. Electronics cash, electronics wallets, smart cards, credit and charge cards. The environment of electronic commerce: international legal, ethical and tax issues: International nature of electronic commerce, the legal environment of electronic commerce, taxation and E-COM, business plans for implementing E-COM: Planning the E-Commerce project, managing electronic commerce implementation.

UNIT IV:

Introduction to ERP: ERP: An Overview, Enterprise – An Overview, ERP architecture, ERP 2 tier and 3 tier Architecture, Benefits of ERP, Risks of ERP, ERP and Related Technologies, Business Process Reengineering (BPR), Data Warehousing, Data Mining, OLAP, SCM,CRM

UNIT V:

ERP Implementation Lifecycle, Implementation Methodology, ERP project Teams, Vendors, Consultants and Users, Contracts with Vendors, Consultants and Employees, Project Management and Monitoring , Success and Failure Factors of an ERP Implementation.

UNIT VI:

The Business Module: Business Modules of an ERP package, Finance, Manufacturing Human Resources, Plant maintenance, Materials Management, Quality management Sales and Distribution, Case study for Architecture and integration of SAP ERP, ERP PRESENT AND FUTURE :-ERP and e-Commerce, ERP Internet and WWW, ERP and E-Business

Text Books:

1. E-Commerce by David Whitely (McGrew Hill Pub.)
2. Electronics-Commerce by Gary P. Schneider and James T. Perry. (COURSE TECHNOLOGY Thomson Learning)
3. Alexis Leon, "ERP Demystified", Tata McGraw Hill, New Delhi, 2000
4. E-business and E-commerce management strategy, implementation and practice, 5th Edition, Dave Chaffey, Pearson Education
5. Enterprise Resource Planning by Parag Diwan and Sunil Sharma (Pentagon Press.)

Reference Books:

1. Vinod Kumar Garg and Venkitakrishnan N K, "Enterprise Resource Planning – Concepts and Practice", PHI, New Delhi, 2003
2. Business on the net by K. N. Agarwal, A. Lal, Deekjha Agarwal (Macmillan Pub.)
3. The Architecture of SAP ERP: Understand how successful software works by Jochen Boeder, Bernhard Groene

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ELECTIVE: IV

BEIT804T4 WIRELESS SENSOR NETWORKS

(Theory Credit: 05)

Teaching Scheme:	**Examination Scheme:**
Lecture: 4 Hours/week	**Theory: T (U): 80 Marks T (I): 20 Marks**
Tutorial: 1 Hour/week	**Duration of University Exam. : 03 Hours**

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UNIT I:

Introduction to wireless Sensor Network:

Network Characteristics, Network application, Network design challenges, Sensor network architectural elements, WSN standards, IEEE 802.15.4, Zig-bee.

UNIT II:

Basic Wireless Sensor Technology:

Sensor node structures, Sensor network architecture, Classification of WSN, Protocol Stack for WSN.

UNIT III:

Medium Access Control:

Fundamental MAC Protocol, MAC design for WSN, S-MAC, DS-MAC, MS-MAC, Traffic adaptive medium access, Self organizing MAC.

UNIT IV:

Routing in WSN:

Data dissemination and gathering, Routing challenges and design issues in WSN, Routing strategies, Flooding and it's variants, Low energy adaptive clustering, Geographical routing.

UNIT V:

Transport Protocol:

Traditional transport protocol, Transport protocol design, Authenticity: Message authentication code, Signature, Authenticating public key, Broadcast and Multicast authentication.

UNIT VI:

Network Management and Operating System for WSN:

Traditional network management models, network management design issues, Example of management architecture: MANNA, Operating system design issues, Operating System: Tiny OS, Mate OS, Magnet OS.

Text Books:

1. Kazem Sohraby, Daniel Minoli, Taieb Znati, “Wireless Sensor Networks Technology, Protocols & Application”, Wiley Student Edition
2. Jun Zheng, Abbas Jamalipour, “Wireless Sensor Network, A Network Perspective”, Wiley Student Edition.

References Books:

1. Waltenegus Dargie, Christian Poellabauer, “Fundamentals of Wireless Sensor Networks, Theory and Practice”, Wiley Student Edition.

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BEIT805P **PROJECT**

(Practical Credit: 04)

Teaching Scheme:
Practical: 2 Hours/week

Examination Scheme:
Practical: P (U): 75 Marks P (I): 75 Marks
Duration of University Exam. : 02 Hours

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Note:

1. The topic of the project decided in seventh semester should be considered and extended to implementation and testing phases.

2. The research paper publication / presentation in reputed national and international journals / conferences should be given some weightage while evaluation.

3. The project report should be written using technical research writing tools (e.g. Latex) and submitted to the department for internal as well as external evaluation.

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