Sharnbasva University, Kalaburagi
Scheme of Teaching and Examination 2021-20
Outcome Based Education(OBE) and Choice Based Credit System (CBCS)
(Effective from the academic year 2021-22)

I SEMSTER M.Tech : Digital Communication & Networking

Sl. No	Course Code		Course Title	Teaching Dept. & Paper Setting Board	Teaching Hours/week			Examination				Credits
					L	T	P	Duration in hours	CIE Marks	SEE Marks	Total Marks	
1	HCC-I	21LDN11	Advanced Digital Communication		3			3	50	50	100	03
2	HCC-II	21LDN12	Optical Networks		3			3	50	50	100	03
3	CEC-I	21LXX13X	Core Elective Course-I		3			3	50	50	100	03
4	CEC-II	21LXX14X	Core Elective Course-II		3			3	50	50	100	03
5	SCC-I	21RM15	Research Methodology		2			3	50	50	100	02
6	LAB-I	21LDNL16	Advanced Communication Lab				4	3	50	50	100	02
7	LAB-II	21LDNL17	Network Simulation Lab – I				4	3	50	50	100	02
8	PW-I	21LDN18	Project –I				4	3	50	50	100	02
9	AC -I	21AD1X	Audit – 1		1			3	50	50	100	NCMC*
Total					**15**	**-**	**12**	**27**	**450**	**450**	**900**	**20**

NCMC* : Non Credit Mandatory Course

Core Elective Course-I		**Core Elective Course-II**	
21LDN131	Wireless & Mobile Networks	21LDE141	Advanced Engineering Mathematics
21LVE132	VLSI Design For Signal Processing	21LDE142	Pattern Recognition and Machine Learning
21LDN133	Advances In Image Processing	21LDN143	Wireless Security

Audit Course – I	
21AD11/21	English for Research Paper Writing
21AD12/22	Disaster Management
21AD13/23	Sanskrit for Technical Management
21AD14/24	Value Education
21AD15/25	Constitution of India
21AD16/26	Pedagogy Studies
21AD17/27	Stress Management
21AD18/28	Personality Development through Life Enlightenment Skills

Sharnbasva University, Kalaburagi Scheme
of Teaching and Examination 2021-20
Outcome Based Education(OBE) and Choice Based Credit System (CBCS)
(Effective from the academic year 2021-22)

II SEMSTER M.Tech : Digital Communication & Networking

Sl. No	Course Code		Course Title	Teaching Dept. & Paper Setting Board	Teaching Hours/week			Examination				Credits
					L	T	P	Duration in hours	CIE Marks	SEE Marks	Total Marks	
1	HCC-III	21LDE21	Advanced DSP		3	-	-	3	50	50	100	03
2	HCC-IV	21LDE22	Error Control Coding		3	-	-	3	50	50	100	03
3	CEC-III	21LXX23X	Core Elective Course-III		3	-	-	3	50	50	100	03
4	CEC-IV	21LXX24X	Core Elective Course-IV		3	-	-	3	50	50	100	03
5	LAB-III	21LDNL25	Advanced DSP Lab				4	3	50	50	100	02
6	LAB-IV	21LDNL26	Network Simulation Lab – II				4	3	50	50	100	02
7	PW-I	21LDN27	Project-II				4	3	50	50	100	02
8	AC-II	21AD2X	Audit – 2		1			3	50	50	100	NCMC*
Total					**13**	**-**	**12**	**24**	**400**	**400**	**800**	**18**

NCMC* : Non Credit Mandatory Course

Core Elective Course-III		**Core Elective Course-IV**	
21LDN231	RF And Microwave Circuit Design	21LDN241	MIMO Systems
21LDN232	Advanced Computer Network	21LDN242	Antenna Theory & Design
21LDN233	Wireless Sensor Networks	21LDN243	IOT and its Applications

Audit Course – II	
21AD11/21	English for Research Paper Writing
21AD12/22	Disaster Management
21AD13/23	Sanskrit for Technical Management
21AD14/24	Value Education
21AD15/25	Constitution of India
21AD16/26	Pedagogy Studies
21AD17/27	Stress Management
21AD18/28	Personality Development through Life Enlightenment Skills

Sharnbasva University, Kalaburagi
Scheme of Teaching and Examination 2021-20
Outcome Based Education(OBE) and Choice Based Credit System (CBCS)
(Effective from the academic year 2021-22)

III SEMSTER M.Tech : Digital Communication & Networking

Sl. No	Course Code		Course Title	Teaching Dept. & Paper Setting Board	Teaching Hours/week			Examination				Credits
					L	T	P	Duration in hours	CIE Marks	SEE Marks	Total Marks	
1	CEC-V	21LXX31X	Core Elective Corse-V		3	-	-	3	50	50	100	03
2	OEC-I	21LOE32X	Open Elective Cousce-I		3	-	-	3	50	50	100	03
3	PW-I	21LDN33	Project-III		-	-	4	3	50	50	100	08
Total					**06**	**-**	**4**	**09**	**150**	**150**	**300**	**14**

Core Elective Corse –V	
21LDN311	Cognitive Radio Networks.
21LVE312	CMOS RF Circuits Design
21LVE313	Advanced Embedded System

Open Elective Course – I	
21LOE321	Bussiness Analytics
21LOE322	Industrial safety
21LOE323	Operation Research
21LOE324	Cost Management of Engineering Projects
21LOE325	Composite Materials
21LOE326	Waste to Energy

Sharnbasva University, Kalaburagi
Scheme of Teaching and Examination 2021-20
Outcome Based Education(OBE) and Choice Based Credit System (CBCS)
Effective from the academic year 2021-22)

IV SEMSTER M.Tech : Digital Communication & Networking

Sl. No	Course Code		Course Title	Teaching Dept. & Paper Setting	Teaching Hours/week			Examination				Credits
					L	T	P	Duration in hours	CIE Marks	SEE Marks	Total Marks	
1	PW-IV	21LDN41	Project -IV (Final Desertion and Publication)		-	-	40	3	100	200	300	12
2	PW-V	21LDN42	Internship		-	-	20	3	50	50	100	04
Total					**-**	**-**	**60**	**06**	**150**	**250**	**400**	**16**

Note: Internship comprises following sub components:

1. Presentation on Internship (after 8 weeks from the date of commencement) (CIE) for 25 marks.
2. Evaluation of Internship Report (CIE) for 25 marks.

Viva-voce on Internship (SEE) for 50 marks.

Project evaluation: valuation shall be taken up at the end of the IVth semester (SEE)

a) Internal examiner shall carry out the evaluation for 100 marks
b) External examiner shall carry out evaluation for 100 marks
c) The average of marks allotted by the internal and external examiner shall be the final marks of the project evaluation.
d) Viva-voce examination of the project work shall be conducted jointly by internal and external examiner for 100 marks

ADVANCED DIGITAL COMMUNICATION

[As per Choice Based Credit System (CBCS) Scheme]

SEMESTER-I

Subject Code	21LDN11	CIE Marks	50
Number of Lecture Hour/Week	04	SEE Marks	50
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS-03

Course Objectives: Students shall be able to

1. Understand different modulation, demodulation and equalization techniques and use them to analyze the error performance of digital modulation techniques in presence of AWGN noise.
2. Analyze and demonstrate the model of discrete time channel with ISI & the model of discrete time channel by equalizer.
3. Apply various types of equalizers used for channel modeling and adjusting the filter coefficients
4. Develop the concept of Spread Spectrum Communications over wideband channels.

Modules	**Teaching Hours**	**Revised Bloom's Taxonomy (RBT) Level**
Module -1		
Modulation: Representation of digitally modulated Signals, Modulation Schemes without memory (Band Limited Schemes - PAM, BPSK, QPSK, MPSK, MQAM, Power Limited Schemes – FSK, MFSK, DPSK, DQPSK), modulation schemes with memory (Basics of CPFSK and CPM – Full Treatment of MSK), Transmit PSD for Modulation Schemes. (Section 3.4) [Text 1, Chapter 3:3.1, 3.2 and 3.3].	**08 Hours**	**L1,L2,L3**
Module -2		
Demodulation - Optimum Receivers for AWGN channels: Waveform and Vector channel models, Waveform and Vector AWGN channels- Optimal detection, Implementation, Optimal Detection and Error Probability for Band limited signaling, Optimal detection and error probability for power limited signaling. Non Coherent Detection (without derivations (Chapter 4: 4.1, 4.2 - 4.2.1, 4.2.2, 4.3, 4.4, 4.5.1, 4.5.2, eqn 4.5.45 to 4.5.47, 4.5.5 upto eqn 4.5.62 of Text).	**08 Hours**	**L1,L2,L3**
Module -3		
Bandlimited Channels: Bandlimited channel characterization, signalling through band limited linear filter channels, Sinc, RC, Duobinary and Modified Duobinary signaling schemes, Optimum receiver for channel with ISI	**08 Hours**	**L1,L2,L3**

and AWGN. **Linear Equalizers:** Zero forcing Equalizer, MSE and MMSE, Baseband and Passband Linear Equalizers. Performance of ZFE and MSE.(Excluding 9.4-3, 9.4-4)[Text 1, Chapter 9: 9.1, 9.2 - 9.2.1, 9.2.2, 9.2.3, 9.3-9.3.1, 9.3.2 and 9.4]		
Module -4		
Non-Linear Equalizers: Decision - feedback equalization, Predictive DFE, Performance of DFE.[Text 1, Chapter 9: 9.5: 9.5-1 only] **Adaptive equalization:** Adaptive linear equalizer, adaptive decision feedback equalizer, Adaptive Fractionally spaced Equalizer (Tap Leakage Algorithm), Adaptive equalization of Trellis - coded signals.[Text 1, Chapter 10: 10.1, 10.1-1, 10.1-2, 10.1-3, 10.1-6,10.1-7, 10.2, 10.3]	**08 Hours**	**L1, L2**
Module-5		
Spread spectrum signals for digital communication: Model of spread spectrum digital communication system, Direct sequence spread spectrum signals, some applications of DS spread spectrum signals , generation of PN sequences, Frequency hopped spread spectrum signals , Time hopping SS, Synchronization of SS systems. [Text 1, Chapter 12: 12.1, 12.2 (except 12.2-1), 12.2-2, 12.2-5, 12.3, 12.4, 12.5]	**08 Hours**	**L1,L2,L3**

Course outcomes:

After going through this course the student will be able to:

1. Explain the concept of low pass and Bandpass signals representations at the Transmitter, the process of Detection and Estimation at the receiver in the presence of AWGN only.
2. Evaluate Receiver performance for various types of single carrier symbol modulations through ideal and AWGN Non-bandlimited and bandlimited channels.
3. Design single carrier equalizers for various symbol modulation schemes and detection methods for defined channel models, and compute parameters to meet desired rate and performance requirements.
4. Design and Evaluate Non band limited and Non power limited spread
5. spectrum systems for communications in a Jamming environment, multiuser situation and low power intercept environment.

Text Books:

1. John G. Proakis, MasoudSalehi, "Digital Communications ",5e, Pearson Education(2014), ISBN:978-9332535893, PEARSON, 2010.

Reference Books:

1. Bernard Sklar, "Digital Communications: Fundamentals and Applications: Fundamentals & Applications "2e, Pearson Education (2009), ISBN:978-8131720929.
2. Simon Haykin ,"Digital Communications Systems", 1e, Wiley(2014), ISBN:978-8126542314.

OPTICAL NETWORKS

[As per Choice Based Credit System (CBCS) Scheme]

SEMESTER-I

Subject Code	21LDN12	CIE Marks	50
Number Lecture Hour/Week	03	SEE Marks	50
Number of Lecture Hours	40	Exam Hours	03

CREDITS-03

Course Objectives: This course will enable students to:

1. To learn the basic elements of optical fiber transmission link, fiber modes configurations and structures.
2. Static and dynamic network topology design.
3. To learn the fiber optical network components, variety of networking aspects, FDDI, SONET/SDH and operational principles WDM .
4. Identify the methods to increase the capacity of a network through wavelength routing.

Modules	**Teaching Hours**	**Revised Bloom's Taxonomy (RBT) Level**
Module -1		
SONET/SDH: optical transport network, Ethernet,IP, routing and forwarding, multiprotocol label Switching, Storage Area Networks.	**08 Hours**	**L1,L2**
Module -2		
WDM network elements: optical line terminals and amplifiers, optical add/drop multiplexers, OADM architectures, reconfigurable OADM, optical cross connects.Network management functions, optical layer services and Interfacing.	**08 Hours**	**L1,L2**
Module -3		
Performance and fault management, configuration management, optical safety. **Network Survivability:** protection in SONET/SDH & client layer.	**08 Hours**	**L1,L2, L3**
Module-4		
Optical layer protection schemes. WDM network design: LTD and RWA problems, dimensioning wavelength routing networks.	**08 Hours**	**L1, L2, L3**
Module-5		
Statistical dimensioning models.Access networks: Optical time division multiplexing, synchronization, header. processing,buffering, burst switching, test beds, Introduction to PON.	**08 Hours**	**L1,L2, L3**

Course outcomes: After studying this course, students will be able to:

1. Gain Knowledge on fundamentals of optical network.
2. Explore optical network architectures ranging from optical access networks to backbone optical transport networks.
3. Choose approaches and methodologies of optical network for design effective optimization;
4. Apply Techniques of optical network survivability.

· Gain knowledge on Problem solving skills and critical thinking in the discipline of optical networks.

Text Book:

1. C.Siva Ram Murthy and Mohan Guruswamy, "WDM Optical Networks: Concepts, Designs And Algorithms", Prentice Hall of India, 2002.
2. Optical Networks by Rajeev Ramaswamy, Kumar N Sivarajan, Galen H Sasaki, Elsevier Publication 3 rd Edition, 2009.

Reference Books:

1) Uyless Black, Optical Networks-Third generation transport system: Pearson 2013

WIRELESS & MOBILE NETWORKS

[As per Choice Based Credit System (CBCS) Scheme]

SEMESTER-I

Subject Code	21LDN131	CIE Marks	50
Number Lecture Hour/Week	03	SEE Marks	50
Number of Lecture Hours	40	Exam Hours	03

CREDITS-03

Course Objectives: This course will enable students to:

1. Concepts and Protocols provides an explanation on the wireless network concepts, architectures, protocols, and applications.
2. It covers the wireless networks such as wireless body area network (WBAN), wireless local area networks (WLANs),
3. wireless metropolitan area networks (WMANs), wireless wide area network (WWAN), wireless sensor networks, wireless vehicle networks, and research challenges in wireless networks.
4. Addresses the design issues and explores various emerging protocols for wireless networks
5. Develop an awareness towards the network control and traffic management

Modules	**Teaching Hours**	**Revised Bloom's Taxonomy(RBT) Level**
Module -1		
Module-1 : Review of fundamentals of wireless communication and Networks: Wireless communicati on channel specifications, Wireless communication systems, Wireless networks, Switching technology, Communication problems, Wireless network issues and standards.	**08 Hours**	**L1, L2**
Module -2		
Wireless body area networks: Properties, Network architectures, Components, Technologies, Design issues, Protocols and applications. **Wireless personal area networks:** Architectures, Components, Requirements,Technologies and protocols, Bluetooth and Zigbee.	**08 Hours**	**L2,L3**
Module -3		
Wireless LANs: Network components, design requirements, Architectures, IEEE-802.11x, WLAN protocols, 802.11p and applications.	**08 Hours**	**L1, L2, L3**
Module -4		
WMANs, IEEE-802.16: Architectures, Components, WiMax mobility support, Broadband networks and applications, WWANs, cellular networks, Satellite Network, Applications.	**08 Hours**	**L1,L2, L3, L4**
Module -5		
Wireless ad-hoc networks: Mobile ad-hoc networks:	**08 Hours**	**L2, L3**

Features, Architecture, protocol (MACA ,MACAW, PCM, **Routing protocols: Proactive and reactive** ,AODV,DSR,DSDV), Applications , Technologies, wireless Sensor network : Architecture, protocols (EAR, Routing protocols, LEACH, directed Diffusion), Technologies, Applications. VANETs: Architecture, characteristics, Technologies, Applications.		

Course outcomes After studying this course, students will be able to

1. Develop an understanding on the basic and advanced principles of Wireless Communications and Mobile Networks.
2. The unit addresses the issues of wireless communications and mobile networks in physical, link and network layers. The wireless channels will be explained with existing mitigation techniques.
3. Multi-user communication systems will also be studied with an emphasis on the broadcast nature of wireless communications.
4. Mobile networks modelling, design and optimisation will be covered, as well as existing and future mobile networks standard

Text Book:

1. S. S. Manvi, and M. S. Kakkasageri, "Wireless and Mobile network concepts and Protocols", Wiley, 1st edition, 2010.
2. P. Kaveh, Krishnamurthy, "Principles of Wireless network: A unified approach", PHI, 2006.

Reference Books:

1. Iti Saha Mitra, "Wireless communication and network: 3G and Beyond", McGraw Hill, 2009.
2. Ivan Stojmenovic, "Handbook of Wireless networks and Mobile Computing", Wiley, 2009.
3. P. Nicopolitidis, M. S. Obaidat, et al, "Wireless Networks", Wiley, 2009.

VLSI DESIGN FOR SIGNAL PROCESSING

[As per Choice Based Credit System (CBCS) Scheme]

SEMESTER-I

Subject Code	21LVE132	CIE Marks	50
Number of Lecture Hour/Week	03	SEE Marks	50
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS-03

Course Objectives: This course will enable students to:

1. Learn several high-level architectural transformations that can be used to design families of architectures for a given algorithm.
2. Deal with high-level algorithm transformations such as strength reduction, look-ahead and relaxed look-ahead.

Modules	**Teaching Hours**	**Revised Bloom's Taxonomy (RBT) Level**
Module -1		
Introduction to DSP Systems: Typical DSP Algorithms, DSP Application Demands and Scaled CMOS Technologies, Representations of DSP Algorithms. **Iteration Bounds:** Data flow graph Representations, loop bound and Iteration bound.	**08 Hours**	**L1,L2,L3,**
Module -2		
Iteration Bounds: Algorithms for Computing Iteration Bound, Iteration Bound of multi rate data flow graphs. **Pipelining and Parallel Processing:** pipelining of FIR Digital Filters, parallel processing, Pipelining and parallel processing for low power.	**08 Hours**	**L1,L2,L3,**
Module -3		
Timing: Definition and Properties, Solving Systems of Inequalities, Retiming Techniques, **Unfolding**: An Algorithm for Unfolding, Properties of Unfolding, Critical path, Unfolding and Retiming, Application of Unfolding. **Systolic Architecture Design:** systolic array design Methodology, FIR systolic array.	**08 Hours**	**L2,L3,L4**
Module -4		
Systolic Architecture Design: Selection of Scheduling Vector, Matrix-Matrix Multiplication and 2D systolic Array Design, Systolic Design for space representation containing Delays. **Fast convolution**: Cook-Toom Algorithm, Winograd Algorithm, Iterated convolution, cyclic convolution Design of fast convolution Algorithm by Inspection.	**08 Hours**	**L1, L2,L3**

Module-5		
Pipelined and Parallel Recursive and Adaptive Filter: Pipeline Interleaving in Digital Filter, first order IIR digital Filter, Higher order IIR digital Filter, parallel processing for IIR filter, Combined pipelining and parallel processing for IIR Filter, Low power IIR Filter Design Using Pipelining and parallel processing, pipelined adaptive digital filter.	**08 Hours**	**L1,L2, L3**

Course outcomes: After studying this course, students will be able to:

1. Illustrate the use of various DSP algorithms and addresses their representation using block diagrams, signal flow graphs and data-flow graphs
2. Use pipelining and parallel processing in design of high-speed /low-power applications
3. Apply unfolding in the design of parallel architecture
4. Evaluate the use of look-ahead techniques in parallel and pipelined IIR Digital filters.
5. Develop an algorithm or architecture or circuit design for DSP applications

Text Books:

1. Keshab K.Parthi, "VLSI Digital Signal Processing systems, Design and implementation ", Wiley 1999.

Reference Books:

1. Mohammed Isamail and Terri Fiez, "Analog VLSI Signal and Information Processing ", Mc Graw-Hill,1994.
2. S.Y. Kung, H.J. White House, T. Kailath, " VLSI and Modern Signal Processing ", Prentice Hall, 1985.
3. Jose E. France, Yannis Tsividis, " Design of Analog - Digital VLSI Circuits for Telecommunication and Signal Processing ", Prentice Hall, 1994.
4. Lars Wanhammar, ―DSP Integrated Circuits‖, Academic Press Series in Engineering, 1st Edition.

Advances in Image Processing

[As per Choice Based Credit System (CBCS) Scheme]

SEMESTER-I

Subject Code	21LDN133	CIE Marks	50
Number Lecture Hour/Week	03	SEE Marks	50
Number of Lecture Hours	40	Exam Hours	03

CREDITS-03

Course Objectives: This course will enable students to:

- Understand the representation of the digital image and its properties
- Learn pre-processing techniques required to enhance the image.
- Understand Image segmentation techniques and learn representation and description.
- Learn image compression techniques.

Modules	**Teaching Hours**	**Revised Bloom's Taxonomy (RBT) Level**
Module -1		
The image, its representations and properties: Image representations a few concepts, Image digitization, Digital image properties, Color images.	**08 Hours**	**L1, L2**
Module -2		
Image Pre-processing: Pixel brightness transformations, geometric transformations. **Segmentation:** Thresholding, Edge-based segmentation – Edge image thresholding, Edge relaxation, Border tracing, Hough transforms; Region – based segmentation – Region merging, Region splitting, Splitting and merging.	**08 Hours**	**L1,L2,L3**
Module -3		
Shape representation and description: Region identification; Contour-based shape representation and description – Chain codes, Simple geometric border representation, Fourier transforms of boundaries, Boundary description using segment sequences, Bspline representation; Region-based shape representation and description – Simple scalar region descriptors, Moments, Convex hull.	**08 Hours**	**L1,L2,L3**
Module -4		
Mathematical Morphology: Basic morphological concepts, Four morphological principles, Binary dilation and erosion, Skeletons and object marking, Morphological segmentations and watersheds.	**08 Hours**	**L1, L2,L3**
Module-5		
Image data compression: Image data properties, Discrete image transforms in image data compression, Predictive compression methods, Vector quantization, Hierarchical and progressive compression methods,	**08 Hours**	**L1,L2,L3**

Comparison of compression methods, JPEG and MPEG image compression- JPEG still image compression, JPEG 2000 compression, MPEG full-motion video compression.		

Course Outcomes: After studying this course, students will be able to:

- Describe the properties of digital images.
- Apply pre-processing techniques required to enhance the image for its further analysis and use segmentation techniques required for the region of interest selection in order to carry out the image analysis.
- Represent the image and describe the objects present in the image based on its properties and structure.
- Use morphological operations for image simplification.
- Apply different compression techniques required for image processing.

Text Book:

1. Milan Sonka, Vaclav Hlavac, Roger Boyle, "Image Processing, Analysis, and Machine Vision", Cengage Learning, 2013, ISBN: 978-81-315-1883-0

Reference Book:

1. Geoff Doughertry, Digital Image Processing for Medical Applications, Cambridge university Press, 2010.
2. S.Jayaraman, S Esakkirajan, T.Veerakumar, Digital Image Processing, Tata Mc Graw Hill, 2011.

ADVANCED ENGINEERING MATHEMATICS

[As per Choice Based Credit System (CBCS) Scheme]
SEMESTER-I

Subject Code	21LDE141	CIE Marks	50
Number Lecture Hour/Week	03	SEE Marks	50
Number of Lecture Hours	40	Exam Hours	03

CREDITS-03

Course Objectives: This course will enable students to:

1. Acquaint with principles of linear algebra, calculus of variations, probability theory and random process.
2. Apply the knowledge of linear algebra, calculus of variations, probability theory and random process in the applications of electronics and communication engineering sciences.

Modules	**Teaching Hours**	**Revised Bloom's Taxonomy (RBT) Level**
Module -1		
Linear Algebra-I Introduction to vector spaces and sub-spaces, definitions, illustrative examples and simple problems. Linearly independent and dependent vectors-definition and problems. Basis vectors, dimension of a vector space. Linear transformations- definition, properties and problems. Matrix form of linear transformations- Illustrative examples. Gaussian Elimination.	**08 Hours (Text1& Ref 1)**	**L1,L2**
Module -2		
Linear Algebra-II Computation of Eigen values and Eigen vectors of real Symmetric matrices. Orthogonal vectors and orthogonal bases. Gram-Schmidt orthogonalization process. QR decomposition, singular value decomposition, least square Approximations, Diagonalization Method.	**08 Hours (Text1 &Ref1)**	**L1,L2**
Module -3		
Calculus of Variations Concept of functional-Euler's equation. Functional dependent on first and higher order derivatives, functional on several dependent variables.	**08 Hours (Text2& Ref 2)**	**L1,L2**
Module -4		
Probability Theory Review of basic probability theory. 1Definitions of random variables and probability distributions, probability mass and density functions, expectation, moments, central moments, characteristic functions, probability generating and moment generating	**08 Hours (Text3& Ref 3)**	**L1, L2**

functions-illustrations. Binomial, Poisson Exponential, Gaussian and Rayleigh distributions-examples.		
Module-5		
Joint probability distributions Definition and properties of CDF, PDF, PMF, conditional distributions. Expectation, covariance and correlation. Independent random variables. Random process- Classification, stationary and ergodic random process. Auto correlation function-properties, Gaussian random process, Binomial process.	**08 Hours (Text3& Ref 3)**	**L1,L2**

Course outcomes: After studying this course, students will be able to:

1. Understand vector spaces, basis, linear transformations and the process of obtaining matrix of linear transformations arising in magnification and rotation of images.
2. Apply the techniques of QR and singular value decomposition for data compression, least square approximation in solving inconsistent linear systems.
3. Utilize the concepts of functional and their variations in the applications of communication systems, decision theory, synthesis and optimization of digital circuits.
4. Learn the idea of random variables (discrete/continuous) and probability distributions in analyzing the probability models arising in control systems and system communications.
5. Apply the idea of joint probability distributions and the role of parameter dependent random variables in random process.

Graduate Attributes (as per NBA):

- Engineering Knowledge.
- Problem Analysis.
- Design / development of solutions (partly).
- Interpretation of data.

Question paper Pattern:

- The question paper will have 10 full questions carrying equal marks.
- Each full question consists of 16 marks with a maximum of four sub questions.
- There will be 2 full questions from each module covering all the topics of the module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. David C.Lay, Steven R. Lay and J.J.McDonald: Linear Algebra and its applications, 5th Edition, Pearson Education Ltd., 2015.
2. E. Kreyszig, "Advanced Engineering Mathematics", 10th edition, Wiley, 2015.
3. Scott L.Miller, DonaldG. Childers: "Probability and Random Process with application to Signal Processing", Elsevier Academic Press, 2nd Edition,2013.

Reference Books:

1. Richard Bronson: "Schaum's Outlines of Theory and Problems of Matrix Operations", McGraw-Hill, 1988.
2. Elsgolts, L.:"Differential Equations and Calculus of Variations", MIR Publications, 3rd Edition, 1977.

3. T.Veerarajan: "Probability, Statistics and Random Process", 3rd Edition, Tata McGraw Hill Co.,2008.

PATTERN RECOGNITION and MACHINE LEARNING
[As per Choice Based Credit System (CBCS) Scheme]
SEMESTER-I

Subject Code	21LDE142	CIE Marks	50
Number Lecture Hour/Week	03	SEE Marks	50
Number of Lecture Hours	40	Exam Hours	03

CREDITS-03

Course Objectives: The objective of the course is to discusses

- Main and modern concepts for model selection and parameter estimation in recognition, decision making and statistical learning problems.
- Special emphasis will be given to regression, classification, regularization, feature selection and density estimation in supervised mode of learning.

Modules	**Teaching Hours**	**Revised Bloom's Taxonomy(RBT) Level**
Module -1		
Introduction: Probability Theory, Model Selection, The Curse ofDimensionality, Decision Theory, Information TheoryDistributions: Binary and Multinomial Variables, The GaussianDistribution, The Exponential Family, Nonparametric Methods.Vectors, Inner product, Outer product, Inverse of a matrix, Eigenanalysis, Singular value decomposition, Probability distributions – Discrete distributions and Continuous distributions; Independence of events.Conditional probability distribution and Joint probability distribution	**08 Hours**	**L1, L2**
Module -2		
Supervised LearningLinear Regression Models: Linear Basis Function Models, The BiasVarianceDecomposition, Bayesian Linear Regression, Bayesian ModelComparisonClassification&Linear Discriminant Analysis: DiscriminantFunctions, Probabilistic Generative Models, Probabilistic DiscriminativeMode	**08 Hours**	**L1,L2**
Module -3		
Supervised Learning Kernels: Dual Representations, Constructing Kernels, Radial Basis Function Network, Gaussian **Processes Support Vector Machines:** Maximum Margin Classifiers, Relevance Vector Machines Neural Networks: Feed-forward Network, Network Training, Error Back propagation	**08 Hours**	**L1, L2**
Module -4		
Unsupervised Learning: **Mixture Models:** K-means Clustering, Mixtures of Gaussians,Maximum likelihood,EM for Gaussian	**08 Hours**	**L2, L3**

mixtures, Alternative View ofEM. **Dimensionality Reduction:** Principal Component Analysis,Factor/Component Analysis, Probabilistic PCA, Kernel PCA,Nonlinear Latent Variable Models		
Module -5		
Probabilistic Graphical Models: Bayesian Networks, ConditionalIndependence, Markov Random Fields, Inference in GraphicalModels, Markov Model, Hidden Markov Models	**08 Hours**	**L2, L3**
Course outcomes: At the end of this course, students will be able to • Identify areas where Pattern Recognition and Machine Learning can offer a solution. • Describe the strength and limitations of some techniques used in computational Machine Learning for classification, regression and density estimation problems. • Describe and model data. • Solve problems in Regression and Classification.		
Text Book: 1. Pattern Recognition and Machine Learning. Christopher Bishop. Springer, 2006		

WIRELESS SECURITY

[As per Choice Based Credit System (CBCS) Scheme]

SEMESTER- I

Subject Code	21LDN143	CIE Marks	50
Number of Lecture Hour/Week	03	SEE Marks	50
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS-03

Course Objectives: This course will enable students to:

1. Study the system security issues in wireless systems, including satellite, terrestrial microwave, military tactical communications, and public safety, cellular and wireless LAN networks.
2. Security topics include confidentiality/privacy, integrity, availability, and control of fraudulent usage of networks. Issues addressed include jamming, interception and means to avoid them.
3. Understand the various ways in which wireless networks can be attacked and tradeoffs in protecting networks.
4. Understand of underlying system applications and potential security issues early in the design process.

Modules	**Teaching Hours**	**Revised Bloom's Taxonomy (RBT) Level**
Module -1		
Introduction:Wireless Threats: Protecting the Means of Communication, Protecting Privacy, Promoting Safety,Understanding Wireless Forecasts, and Reasonable Degrees of Security. Security issues and Economic tradeoffs. Cellular Networks and Bearer Technologies.	**08 Hours**	**L1,L2,L3**
Module -2		
Air-ground-interface and vulnerabilities: Telephone System Vulnerabilities, unintentional Interruptions, Cell Phone Vulnerabilities, Issue of Privacy, Satellite Communications: Global Positioning System, Wide Area Augmentation System, Satellite Search and Rescue, Communications: Voice, Video, and Data. Satellite Internet, Earth Sensing: Commercial Imaging, Landsat, SPOT,.	**08 Hours**	**L1,L2,L3**
Module -3		
European Remote Sensing: IKONOS. Computer crime, Security of Information Systems, Balancing Information Technology Information Vulnerability, Importance of Information Lock-and-Key Analogy, Classical Cryptanalysis, Digital Cryptography, Brute Force Attacks,	**08 Hours**	**L1,L2,L3**
Module -4		
Wireless Attacks: Standard Attacks, Advanced Attacks, Two Limits of Encryption Block versus stream Ciphers.	**08 Hours**	**L1, L2,L3**

The Stream Cipher Synchronization Problem, Non-Keyed Message Digests, SHA-1 in the Encryption Mode, HORNET, Entropy Accumulator Description, Sync, pad, and Data Encryption Key Advanced Encryption Standard, Key Management-Generation and Distribution of Keys.		
Module-5		
Wireless Security protocols: The Wireless Local Area Network (WLAN). Wireless Application Protocol (WAP), Wireless Transport Layer Security Bluetooth.	**08 Hours**	**L1,L2,L3**
Course outcomes: After studying this course, students will be able to: 1. Address wireless security issues and Economic tradeoffs. 2. Analyze Air-ground-interface and vulnerabilities. 3. Apply digital cryptography in wireless transmission. 4. List the Limits of Encryption Block and stream Ciphers. 5. Describe various wireless security protocols.		
Text Books: 1. Nichols and Lekkas "Wireless Security – Models, Threats, and Solutions," by, McGraw-Hill, 2002. 2. Jon Edney and William A. Arbaugh. "Real 802.11 Security: Wi-Fi Protected Access and 802.11i", Addison-Wesley Professional, 2003		
Reference Books: 1. Andrew Vladimirov, Konstantin V. Gavrilenko, and Andrei A. Mikhailovsky. "Wi-Foo: The Secrets of Wireless Hacking", Addison-Wesley Professional, 2004. 2. Johnny Cache and Vincent Liu "Hacking Exposed Wireless'', McGraw Hill Companies, 2007.		

RESEARCH METHODOLOGY

[As per Choice Based Credit System (CBCS) Scheme]

SEMESTER-I

Subject Code	21RM15	CIE Marks	50
Number Lecture Hour/Week	03	SEE Marks	50
Number of Lecture Hours	40	Exam Hours	03

CREDITS-02

Course objectives:

- To give an overview of the research methodology and explain the technique of defining a research problem.
- To explain the functions of the literature review in research.
- To explain carrying out a literature search, its review, developing theoretical and conceptual frameworks and writing a review.
- To explain various research designs and their characteristics.
- To explain the details of sampling designs, and also different methods of data collections.
- To explain the art of interpretation and the art of writing research reports.

Modules	**Teaching Hours**	**Revised Bloom's Taxonomy (RBT) Level**
Module -1		
Research Methodology: Introduction, Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Importance of Knowing How Research is Done, Research Process, Criteria of Good Research, and Problems Encountered by Researchers in India.	**08 Hours**	**L1,L2**
Module -2		
Defining the Research Problem: Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem, An Illustration. **Reviewing the literature:** Place of the literature review in research, Bringing clarity and focus to your research problem, Improving research methodology, Broadening knowledge base in research area, Enabling contextual findings, How to review the literature, searching the existing literature, reviewing the selected literature, Developing a theoretical framework, Developing a conceptual framework, Writing about the literature reviewed.	**08 Hours**	**L1,L2**
Module -3		
Research Design: Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs, Important Experimental Designs. **Design of Sample Surveys:** Introduction, Sample Design, Sampling and Non-sampling Errors, Sample Survey versus Census Survey, Types of Sampling Designs.	**08 Hours**	**L1,L2, L3**
Module-4		
Data Collection: Collection of Primary Data, Collection of data through questionnaires, Collection of data through schedules, Difference between questionnaires and schedules,	**08 Hours**	**L1, L2, L3**

Some other methods of data collection, Collection of Secondary Data, Selection of Appropriate Method for Data Collection, Case Study Method.		
Module-5		
Interpretation and Report Writing: Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports.	**08 Hours**	**L1, L2, L3**

Course outcomes:

At the end of the course the student will be able to:

- Discuss research methodology and the technique of defining a research problem
- Understand the functions of the literature review in research, carrying out a literature search.
- Explain various research designs and their characteristics.
- Understand the significance of data collection in research.
- Explain the art of interpretation and the art of writing research reports.

Textbooks:

1. Research Methodology: Methods and Techniques C.R. Kothari, Gaurav Garg New Age International 4th Edition, 2018.
2. Research Methodology step-by- Research Methodology step-by- Ranjit Kumar, SAGE Publications Ltd, 3rd Edition, 2011.
3. Study Material (For the topic Intellectual Property under module 5) Professional Programme Intellectual Property Rights, Law and Practice, The Institute of Company Secretaries of India, Statutory Body under an Act of Parliament, September 2013.

Reference Books:

2) Research Methods: the concise knowledgebase Trochim, Atomic Dog Publishing 2005.
3) Conducting Research Literature Reviews: From the Internet to Paper, Fink A Sage Publications 2009.

ADVANCED COMMUNICATION LAB

As per choice based credit system(CBCS)scheme

Semester – I

Laboratory Code	21LDNL16	CEE	50
Number of Lecture Hours/Week	06	SEE	50
		Exam hours	3Hrs
Credits :01			

Course objectives: This laboratory course enables students to get practical experience

- Radiation pattern of antennas.
- Determining gain and directivity of a given antenna.
- Working of Klystron source.
- S-parameters of some microwave passive devices.

1. Generation and Detection on ASK.
2. Generation and Detection on FSK.
3. Generation and Detection on PSK.
4. Modulation and Demodulation of DPSK.
5. Modulation and Demodulation of QPSK.
6. Analog and digital communication link using optical fiber.
7. Determine the directivity of different antenna.
8. Determine the gain of different antenna.
9. Study of radiation pattern of dipole antenna.
10. Analysis of pattern multiplication.
11. Simulation of array of isotropic source in-phase, out of phase, broadside array, end fire array.
12. Generation of PN sequence and its properties.

Course Outcomes

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

a. Plot the radiation pattern of some antennas using matlab and wave guide setup
b. Obtain the S-parameters of Magic tee and directional couplers.
c. Test the IC CD4051 for modulation techniques.
d. Study multiplexing techniques using OFC kit..

Conduction of Practical Examination:

All laboratory experiments (nos) are to be included for practical examination. Students are allowed to pick one experiment from each part and execute both Strictly follow the instructions as printed on the cover page of answer script for break up Of Marks

PART –A: Procedure + Conduction + Viva: 10 + 20 +10 (40)

PART –B: Procedure + Conduction + Viva: 10 + 20 +10(40)Change of experiment is allowed only once and marks allotted to the procedure part to be made zero

Network Simulation LAB - I

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – I

Laboratory code	**21LDNL17**	CIE Marks	50
Number Lecture Hour/Week	01Hr Tutorial (Instructions) + 02 HoursLaboratory	SEE Marks	50
		Exam Hours	03

CREDITS-02

Course Objectives: This laboratory course enables students to get practical experience on the

1. To get some exposure to one of the most useful tools in Network research and development.
2. Understand and design network topology using NS2.
3. Understand and design wireless and wired network using NS2.
4. Understand the scenario and study the performance of various network protocols through simulation.
5. Understand the concept of Routing algorithm using Distance vector algorithm. .
6. Understand the basic concepts of cyclic codes, and explain how cyclic redundancy check works

Part – A: Experiments to be done using Network Simulators 1. Demonstrate Concepts of fundamental Network Topology - Star, Bus, Ring. 2. Implementation of High Level Data Link Control 3. To create scenario and study the performance of network with CSMA / CA protocol and compare with CSMA/CD protocols. 4. Implementation of distance vector routing algorithm. 5. Implementation of Link state routing algorithm. 6. Implementing a wireless sensor network. 7. Simulate a Mobile Adhoc Network. 8. Implement Transport Control Protocol in Sensor Network.	**L1, L2, L3**
Part – B: Experiments to be done using using C/C++ or equivalent with LINUX/Windows environment 9. Write a program for error detecting code using CRC. 10. Write a program for a HLDC frame to perform the following. i) Bit stuffing ii) Character stuffing. 11. Implementation of Stop and Wait Protcol and sliding window. 12. Implementation and study of Goback-N and selective repeat protocols.	**L2, L3**

Course outcomes: On the completion of this laboratory course, the students will be able to:

1. Learn the basic idea about open source network simulator NS2 and how to download, install and work with NS2 using TCL programming.
2. Understand the performance of network with CSMA/CA protocol and CSMA/CD protocol

3. Understand the basic concepts Mobile Adhoc Network.
4. Students get exposure to the real implementation of the computer network scenarios.
5. Understand the basic concepts of link layer properties including error-detection.

Reference Books:

1. S. S. Manvi, and M. S. Kakkasageri, "Wireless and Mobile network concepts and Protocols", Wiley, 1st edition, 2010.

ADVANCED DSP

[As per Choice Based Credit System (CBCS) Scheme]

SEMESTER-II

Subject Code	21LDE21	CIE Marks	50
Number of Lecture Hour/Week	03	SEE Marks	50
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS-03

Course Objectives: This course will enable students to:

1. Understand Multirate digital signal processing principles and its applications.
2. Estimate the various spectral components present in the received signal using different spectral estimation methods such as Parametric and Nonparametric.
3. Design and implement an optimum adaptive filter using LMS and RLS algorithms.
4. Understand the concepts and mathematical representations of Wavelet transforms.

Modules	**Teaching Hours**	**Revised Bloom's Taxonomy (RBT) Level**
Module -1		
Multirate Digital Signal Processing: Introduction, decimation by a factor 'D', Interpolation by a factor 'I', sampling rate conversion by a factor 'I/D', Implementation of sampling rate conversion, Multistage implementation of sampling rate conversion, Applications of multirate signal processing, Digital filter banks, two channel quadrature mirror filter banks. (Text 1)	**08 Hours**	**L1,L2,L3**
Module -2		
Linear prediction and Optimum Linear Filters: Random signals, Correlation Functions and Power Spectra, Innovations Representation of a Stationary Random Process. Forward and Backward Linear Prediction. Solution of the Normal Equations The Levinson-Durbin Algorithm. Properties of the Linear Prediction-Error Filters. (Text 1)	**08 Hours**	**L1,L2,L3**
Module -3		
Adaptive filters: Applications of adaptive filters, Adaptive channel equalization,, Adaptive noise cancellation, Linear Predictive coding of Speech Signals, Adaptive direct form FIR filters-The LMS algorithm, Properties of LMS algorithm. Adaptive direct form filters- RLS algorithm. (Text 1).	**08 Hours**	**L1,L2,L3**
Module -4		
Power Spectrum Estimation: Power Spectrum Estimation: Non parametric Methods for Power Spectrum Estimation - Bartlett Method, Welch Method, Blackman and Tukey Methods. Parametric Methods for	**08 Hours**	**L1, L2,L3**

Power Spectrum Estimation: Relationship between the auto correlation and the model parameters, Yule and Walker methods for the AR Model Parameters, Burg Method for the AR Model parameters, MA Model for Power Spectrum Estimation, ARMA Model for Power Spectrum Estimation. (Text 1)		
Module-5		
Wavelet Transforms: The Age of Wavelets, The origin of Wavelets, Wavelets and other reality transforms, History of wavelets, Wavelets of the future. Continuous Wavelet and Short Time Fourier Transform: Wavelet Transform, Mathematical preliminaries, Properties of wavelets. Discrete Wavelet Transform: Haar scaling functions, Haar wavelet function, Daubechies Wavelets. (Chapters 1, 3 & 4 of Text 2)	**08 Hours**	**L1,L2,L3**

Course outcomes: After studying this course, students will be able to:

1. Design adaptive filters for a given application
2. Design linear predictive filters
3. Implement adaptive signal processing algorithm
4. Study of power spectrum estimation methods
5. Understand advanced signal processing techniques and time-frequency analysis techniques

Text Books:

1. "Digital Signal Processing, Principles, Algorithms and Applications", John G.Proakis, Dimitris G.Manolakis, Fourth edition, Pearson-2007.
2. Insight into Wavelets- from Theory to Practice", K.P Soman, Ramachandran, Resmi- PHI Third Edition-2010.

Reference Books:

1. "Modern Digital signal processing", Robert. O. Cristi, Cengage Publishers, India, 2003.
2. "Digital signal processing: A Practitioner's approach", E.C. Ifeachor, and B. W. Jarvis, , Second Edition, Pearson Education, India, 2002, Reprint.
3. "Wavelet Transforms, Introduction to Theory and applications", Raghuveer. M. Rao, Ajit S.Bopardikar, Pearson Education, Asia, 2000

ERROR CONTROL CODING
[As per Choice Based Credit System (CBCS) Scheme]
SEMESTER-II

Subject Code	21LDE22	CIE Marks	50
Number Lecture Hour/Week	03	SEE Marks	50
Number of Lecture Hours	40	Exam Hours	03

CREDITS-03

Course Objectives: This course will enable students to:

1. Understand the concept of the Entropy, information rate and capacity for the Discrete memoryless channel.
2. Apply modern algebra and probability theory for the coding.
3. Implement different Block code encoders and decoders such as Linear Block Codes, Cyclic codes etc.
4. Detect and correct errors for different data communication and storage systems.
5. Analyze and implement convolutional encoders and decoders.

Modules	**Teaching Hours**	**RBT Level**
Module -1		
Information theory: Introduction, Entropy, Source coding theorem, discrete memoryless channel, Mutual Information, Channel Capacity Channel coding theorem. (Chap. 5 of Text **Introduction to algebra:** Groups, Fields, binary field arithmetic, Construction of Galois Fields GF (2m) and its properties, (Onlystatements of theorems without proof) Computation using Galois filed GF (2m) arithmetic, Vector spaces and Matrices. (Chap. 2 of Text 2)	**10 Hours**	**L1, L2, L3**
Module -2		
Linear block codes: Generator and parity check matrices, Encoding circuits, Syndrome and error detection, Minimum distance considerations, Error detecting and error correcting capabilities, Standard array and syndrome decoding, Single Parity Check Codes(SPC), Repetition codes, Self dual codes, Hamming codes, Reed-Muller codes. Product codes and Interleaved codes. (Chap. 3 of Text 2)	**10 Hours**	**L1,L2, L3**
Module -3		
Cyclic codes: Introduction, Generator and parity check polynomials, Encoding of cyclic codes, Syndrome computing and error detection, Decoding of cyclic codes, Error trapping Decoding, Cyclic hamming codes, Shortened cyclic codes. (Chap. 4 of Text 2)	**08 Hours**	**L1,L2**

Module -4		
BCH codes: Binary primitive BCH codes, Decoding procedures, Implementation of Galois field arithmetic, implementation of error correction, (Chap. 6 of Text 2), Reed -Solomon codes (Chap. 7 of Text 2). **Majority Logic decodable codes:** One -step majority logic decoding, One -step majority logic decodable codes, Two -step majority logic, decoding (Chap. 8 of Text 2).	**10 Hours**	**L1, L2,L3**
Module-5		
Convolution codes: Convolutional Encoding, Convolutional Encoder Representation, Formulation of the Convolutional Decoding Problem (7.3.1, 7.3.3, 7.3.4 of Chap. 7 – Text 3), Properties of Convolutional Codes: Distance Property of Convolutional Codes, Systematic & Non systematic Convolutional Codes, Performance bounds for Convolutional Codes, Coding Gain, Other Convolutional Decoding Algorithms (7.5.1 & 7.5.2 of Chap.7 – Text 3)	**10 Hours**	**L1,L2,L3**

Course Outcomes: After studying this course, students will be able to:

1. Apply the concept of modern linear algebra for the error control coding technique.
2. Construct and Implement efficient linear block codes for encoders and decoders.
3. Construct and Implement efficient cyclic codes for encoders and decoders.
4. Apply decoding algorithms for efficient decoding of BCH codes.
5. Apply decoding algorithms for efficient decoding of Convolutional codes.

Text Book:

1. Simon Haykin, ‖Digital Communication systems‖, First edition, Wiley India Private. Ltd, 2014. ISBN 978-81-265-4231-4
2. Shu Lin and Daniel J. Costello. Jr, "Error control coding", Pearson, Prentice Hall, 2nd edition, 2004.
3. Bernard Sklar, ‖Digital Communications - Fundamentals and Applications‖, 2nd Edition Pearson Education (Asia) Ptv. Ltd, 2001.

Reference Book:

1. Blahut. R. E, "Theory and practice of error control codes", Addison Wesley, 1984.
2. Salvatore Gravano, ―Introduction to Error control coding‖, Oxford university press, 2007.

RF AND MICROWAVE CIRCUIT DESIGN [As per Choice Based Credit System (CBCS) Scheme] SEMESTER-II			
Subject Code	21LDN231	CIE Marks	50
Number Lecture Hour/Week	03	SEE Marks	50
Number of Lecture	40	Exam Hours	03

Hours			

CREDITS-03

Course Objectives: This course will enable students to:

1. Understand waves propagating in Networks.
2. Use the Smith Chart for various applications.
3. Understand the basic considerations in active networks
4. Design active networks.
5. Understand RF/MW Frequency Mixer and Phase Shifter Design

Modules	**Teaching Hours**	**Revised Bloom's Taxonomy (RBT) Level**
Module -1		
Wave propagation in networks: Introduction, Reasons for Using RF/Microwaves, Applications, RF Waves, RF and Microwave circuit design, Introduction to Components Basics, Analysis of Simple Circuit in Phasor Domain, RF Impedance Matching, Transmission Media, High Frequency Parameters, Formulation of S-parameters, Properties of S-Parameters, Transmission Matrix.	**08 Hours**	**L1,L2,L3**
Module -2		
Smith chart and its Applications: Introduction, Smith Chart, Derivation of Smith Chart, Smith Chart Circular and Radial Scales, Application of Smith chart.	**08 Hours**	**L1,L2, L3**
Module -3		
Basic consideration in active networks: Stability Considerations, Gain Considerations and Noise Considerations.	**08 Hours**	**L1,L2**
Module -4		
RF/Microwave Amplifiers: Small Signal Design: Introduction, Types of amplifier, Design of different types of amplifiers. **RF/Microwave Frequency Conversion**: Mixers: Introduction, Mixer Types, Conversion Losses for SSB Mixers, SSB versus DSB mixers, One diode mixers.	**08 Hours**	**L1, L2,L3**
Module-5		
RF/Microwave Control Circuit Design: Introduction, PN Junction Devices, Phase shifters, Digital phase shifters, Semiconductor phase shifters, PIN diode attenuators. **RF and Microwave IC design:** MICs, MIC materials, Types of MICs, Hybrid verses Monolithic ICs, Chip mathematics	**08 Hours**	**L1,L2,L3**

Course outcomes: After studying this course, students will be able to:

1. Discuss and analyse waves propagation in Networks
2. Apply the Smith Chart for finding various parameters in transmission Lines
3. Analyse the basic considerations in active networks
4. Describe and design active networks

5. Design RF/MW Frequency Mixers and phase shifters

Text Books:

1. Matthew M. Radmanesh, "RF and Microwave Electronics Illustrated", Pearson Education edition, 2004.

Reference Book:

Reinhold Ludwig, and Pavel Bretchko, "RF circuit design theory and applications", Pearson Education edition, 2004.

ADVANCED COMPUTER NETWORKS

[As per Choice Based Credit System (CBCS) Scheme]

SEMESTER-II

Subject Code	21LDN232	CIE Marks	50
Number of Lecture Hour/Week	03	SEE Marks	50
Total Number of Lecture Hours	40 **3**	Exam Hours	03

CREDITS-03

Course Objectives: This course will enable students to:

1. Overview of Internet-Concepts.
2. Packet Scheduling Algorithms-requirements, Scheduling guaranteed service.

3. Control theoretic analysis of active queue management. 4. Concept of Effective bandwidth. 5. IPV4, IPV6, IP tunnelling		
Modules	**Teaching Hours**	**Revised Bloom's Taxonomy (RBT) Level**
Module -1		
Internet Concepts: Overview of Internet-Concepts, challenges and history. Overview of -ATM. TCP/IP Congestion and Flow Control in Internet-Throughput analysis of TCP congestion control. TCP for high bandwidth delay networks. Fairness issues in TCP**.**	**08 Hours**	**L1,L2,L3**
Module -2		
Real Time Communications over Internet. Adaptive applications. Latency and throughput issues. Integrated Services Model (intServ). Resource reservation in Internet. RSVP, Characterization of Traffic by Linearly Bounded Arrival Processes (LBAP). Leaky bucket algorithm and its properties	**10 Hours**	**L1,L2,L3**
Module -3		
Packet Scheduling Algorithms: Requirements and choices. Scheduling guaranteed service connections. GPS, WFQ and Rate proportional algorithms. High speed scheduler design. Theory of Latency Rate servers and delay bounds in packet switched networks for LBAP traffic. Active Queue Management - RED, WRED and Virtual clock. Control theoretic analysis of active queue management.	**10 Hours**	**L1,L2,L3**
Module -4		
IP address lookup-challenges: Packet classification algorithms and Flow Identification-Grid of Tries, Cross producting and controlled prefix expansion algorithms. Admission control in Internet. Concept of Effective bandwidth. Measurement based admission control. Differentiated Services in Internet (DiffServ). DiffServ architecture and framework.	**08 Hours**	**L1, L2,L3**
Module-5		
IPV4, IPV6: IP tunneling, IPswitching and MPLS, Overview of IP over ATM and its evolution to IP switching. MPLS architecture and framework. MPLS Protocols. Traffic engineering issues in MPLS. **Control of Networks:**Objectives and methods of control, routing optimization in circuit and datagram networks, Queuing models in circuit and datagram networks (Text 2).	**10 Hours**	**L1,L2,L3**
Course outcomes: After studying this course, students will be able to: 1. Acquire knowledge of characteristics of mobile/wireless communication channels		

2. Understand advanced concepts in Communication Networking.
3. Design and develop protocols for Communication Networks.
4. Understand the mechanisms in Quality of Service in networking.
5. Optimise the Network Design.

Text Books:

1. Jean Wairand and PravinVaraiya, "High Performance Communications Networks", 2nd edition, 2000
2. Jean Le Boudec and Patrick Thiran, "Network Calculus A Theory of Deterministic Queueing Systems for the Internet", Springer Veriag, 2001.
3. Zhang Wang, "Internet QoS", Morgan Kaufman, 2001

Reference Books:

1. Anurag Kumar, D. Manjunath and Joy Kuri, "Communication Networking: An Analytical Approach" , Morgan Kaufman Publishers, 2004.

WIRELESS SENSOR NETWORKS

[As per Choice Based Credit System (CBCS) Scheme]

SEMESTER- II

Subject Code	21LDN233	CIE Marks	50
Number of Lecture Hour/Week	04	SEE Marks	50
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS-03

Course Objectives: This course will enable students to:

1. Depth of Wireless sensor networks, architecture and its applications
2. Wireless sensor networks design and its different layers technologies and its challenges.
3. Different algorithms for routing and hierarchical protocols.
4. Understanding the time synchronization and localization.

3

Modules	**Teaching Hours**	**Revised Bloom's Taxonomy (RBT)Level**

Module -1		
Introduction: Sensor Mote Platforms, WSN Architecture and Protocol Stack. WSN Applications: Military Applications, Environmental Applications, Health Applications, Home Applications, Industrial Applications	**08 Hours**	**L1,L2,L3**
Module – 2		
Factors Influencing WSN Design: Hardware Constraints Fault Tolerance Scalability Production Costs WSN Topology, Transmission Media, Power Consumption **Physical Layer:** Physical Layer Technologies, Overview of RF Wireless Communication, Channel Coding (Error Control Coding), Modulation, Wireless Channel Effects, PHY Layer Standards	**08 Hours**	**L1,L2,L3**
Module – 3		
Medium Access Control: Challenges for MAC, CSMA Mechanism, Contention-Based Medium Access, Reservation-Based Medium Access, Hybrid Medium Access. **Network Layer:** Challenges for Routing, Data-centric and Flat Architecture Protocols, Hierarchical Protocols, Geographical Routing Protocols.	**08 Hours**	**L1,L2,L3**
Module – 4		
Transport Layer: Challenges for Transport Layer, Reliable MultiSegment Transport (RMST) Protocol, Pump Slowly, Fetch Quickly (PSFQ) Protocol, Congestion Detection and Avoidance (CODA) Protocol, Event-to-Sink Reliable Transport (ESRT) Protocol, GARUDA **Application Layer:** Source Coding (Data Compression) Query Processing, Network Management.	**08 Hours**	**L1, L2,L3**
Module – 05		
Time Synchronization: Challenges for Time Synchronization, Network Time Protocol, Timing-Sync Protocol for Sensor Networks (TPSN), Reference- Broadcast Synchronization (RBS), Adaptive Clock Synchronization (ACS) **Localization:** Challenges in Localization, Ranging Techniques, Range-Based Localization Protocols, Range-Free Localization Protocols.	**08 Hours**	**L1,L2,L3**
Course outcomes: After studying this course, students will be able to: 1. Acquire knowledge of characteristics of mobile/wireless communication channels 2. Apply statistical models of multipath fading 3. Understand the multiple radio access techniques, radio standards and communication protocols to be used for wireless sensor 4. Design wireless sensor network system for different applications under consideration. 5. Understand the hardware details of different types of sensors and select right type of sensor for various applications.		

Text Books: 1. 'Wireless Sensor Networks', Ian F. Akyildiz and Mehmet Can Vuran, John Wiley & Sons Ltd. ISBN 978-0-470-03601-3 (H/B), 2010		
Reference Books: 1.Wireless Sensor Networks : Signal Processing and Communications Perspectives', Ananthram Swami, et. al., John Wiley & Sons Ltd., ISBN 978-0470-03557-3, 2007		

MIMO SYSTEMS [As per Choice Based Credit System (CBCS) Scheme] SEMESTER- II			
Subject Code	21LDN241	CIE Marks	50
Number of Lecture Hour/Week	04	SEE Marks	50
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS-03			

Course Objectives: This course will enable students to:

1. To make students familiar with fundamentals of wireless communication systems.
2. To understand the diversity and spatial multiplexing phenomenon in MIMO system.
3. To understand the receiver system design for MIMO.
4. Gain enough knowledge of emerging issues for implementing MIMO wireless channels.
5. Different fading channel distributions in multipath wireless channel.
6. OSTBC design for multiple antenna system. Computation of performance parameters of MIMO wireless system.

Modules	**3**	**Teaching Hours**	**Revised Bloom's Taxonomy (RBT) Level**
Module -1			

Introduction to Multi-antenna Systems: Motivation, Types of multi-antenna systems, MIMO vs. multi- antenna systems. Diversity, Exploiting multipath diversity, Transmit diversity, Space-time codes, The Alamouti scheme, Delay diversity, Cyclic delay diversity, Space-frequency codes, Receive diversity, The rake receiver,.	**08 Hours**	**L1,L2,L3**
Module -2		
Combining techniques: Spatial Multiplexing, Spectral efficiency and capacity, Transmitting independent streams in parallel, Mathematical notation. The generic MIMO problem, Singular Value Decomposition, Eigen values and eigenvectors, Equalizing MIMO systems, Disadvantages of equalizing MIMO systems, Predistortion in MIMO systems, Pre- coding and combining in MIMO systems, Advantages & Disadvantages of precoding and combining,	**08 Hours**	**L1,L2,L3**
Module -3		
Codebooks for MIMO : Beamforming its principles, Increased spectrum efficiency, Interference cancellation, Switched beamformer, Adaptive beamformer, Narrowband beamformer, Wideband beamformer Case study: MIMO in LTE, Codewords to layers mapping, Pre-coding for spatial multiplexing, Pre- coding for transmit diversity, Beamforming in LTE, Cyclic delay diversity based pre-coding, Pre-coding Codebooks.	**08 Hours**	**L1,L2,L3**
Module -4		
Propagation Channels : Time & frequency channel dispersion, AWGN and multipath propagation channel, Delay spread values and time variations, Fast and slow fading environments, Complex baseband multipath channels, Narrowband and wideband channels, MIMO channel models.	**08 Hours**	**L1, L2,L3**
Module-5		
Channel Estimation: Channel estimation techniques, Estimation and tracking, Training based channel estimation, Blind channel estimation, Iterative channel estimation, MMSE channel estimation, Correlative channel sounding, Channel estimation for single carrier systems, CDMA and OFDM	**08 Hours**	**L1,L2,L3**
Course outcomes: After studying this course, students will be able to: 1. Understand channel modelling and propagation, MIMO Capacity, space-time coding, MIMO receivers, MIMO for multi-carrier systems (e.g. MIMO- OFDM), multi-user communications, multi-user MIMO. 2. Understand cooperative and coordinated multi-cell MIMO, introduction to MIMO in 4G (LTE, LTE-Advanced,		

WiMAX). 3. Perform Mathematical modelling and analysis of MIMO systems. 4. Channel estimation techniques, Estimation and tracking		
Text Books: 1. Kwang-Cheng Chen and Ramjee Prasad, "Cognitive Radio Networks", John Wiley & sons, 2009.		
Reference Books: 1. Mohinder Janakiraman, "Space - Time Codes and MIMO Systems", Artech House Publishers, 2004.		

ANTENNA THEORY AND DESIGN

[As per Choice Based Credit System (CBCS) Scheme]

SEMESTER- II

Subject Code	21LDN242	CIE Marks	50
Number of Lecture Hour/Week	03+01	SEE Marks	50
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS-03

Course Objectives: This course will enable students to:

1. Study of fundamentals of antenna, different types of Antennas, Radiation Pattern and Polarization .
2. Study of Antenna Arrays, Pattern-multiplication, Feeding techniques.
3. Study of broadband antennas, evaluating the gain of aperture antennas, Reflector antennas.
4. Define, describe, and illustrate principle behind antenna synthesis and Method of moments.
5. Study of smart antennas and MIMO system.

Modules **3**	**Teaching Hours**	**Revised Bloom's Taxonomy (RBT) Level**
Module -1		

Antenna Fundamentals and Definitions : Radiation Mechanisms, Overview, EM Fundamentals, Solution of Maxwell's Equations for Radiation Problems, Ideal Dipole, Radiation patterns, Directivity and Gain, Antenna impedance, Radiation efficiency, Antenna polarization.	**08 Hours**	**L1,L2,L3**
Module -2		
Antenna Arrays: Array factor for linear arrays, Uniformly excited equally spaced linear arrays, Pattern multiplication, Directivity of linear arrays, Mutual coupling, Phased Arrays and Array Feeding Techniques. **Resonant Antennas:** Wires and Patches, Dipole antenna, Yagi-Uda antennas, Micro-strip antenna.	**08 Hours**	**L1,L2,L3**
Module -3		
Broadband Antennas: Traveling wave antennas , Helical antennas, Biconical antennas, Sleeve antennas, Principles of frequency independent antennas, Spiral antennas, Log - periodic antennas. **Aperture Antennas:** Techniques for evaluating gain, Reflector antennas- Parabolic reflector antenna principles, Axi-symmetric parabolic reflector antenna, Offset parabolic reflectors, Dual reflector antennas.	**08 Hours**	**L2,L3,L4**
Module -4		
Antenna Synthesis: Formulation of the synthesis problem, Synthesis principles, Line sources shaped beam synthesis, Linear array shaped beam synthesis. **Methods of Moments :** Introduction to methods of moments, Pocklington's Integrals equation and Kirchoff Networking equation.	**08 Hours**	**L1, L2,L3**
Module-5		
Smart Antennas: Smart Antennas, Multiple Input and Multiple Output, Multiuser Antennas (Text 2: Chapter 20).	**08 Hours**	**L1,L2,L3**
Course outcomes: After studying this course, students will be able to: 1. Classify different types of antennas. 2. Define and illustrate various types of array antennas. 3. Design antennas like Yagi-Uda, Helical antennas and other broad band antennas. 4. Describe different antenna synthesis methods. Apply methods like MOM. 5. Realization of Smart Antennas and MIMO system.		
Text Books: 1. Stutzman and Thiele, "Antenna Theory and Design", 2nd Edition, John Wiley, 2010. 2. Andreas Molisch, 'Wireless Communication'. 2nd Edition, John Wiley.		

Reference Books:

1. C. A. Balanis, "Antenna Theory Analysis and Design", John Wiley, 2nd Edition 2007.
2. J. D. Krauss, "Antennas and Wave Propagation", McGraw Hill TMH, 4th Edition, 2010.
3. A.R.Harish, M.Sachidanada, "Antennas and propagation", Pearson Education, 2015

IOT & ITS APPLICATIONS

[As per Choice Based Credit System (CBCS) Scheme]
SEMESTER-II

Subject Code	21LDN243	CIE Marks	50
Number Lecture Hour/Week	03	SEE Marks	50
Number of Lecture Hours	40	Exam Hours	03

CREDITS-03

Course Objectives: This course will enable students to:

1. Introduce concept of IOT and its applications in today's scenario.
2. Understand IOT content generation and transport through networks
3. Understand the devices employed for IOT data acquisition and
4. communication access technologies
5. Introduce some use cases of IOT

Modules	**Teaching Hours**	**Revised Bloom's Taxonomy (RBT) Level**
Module -1 3		
What is IOT: Genesis, Digitization, Impact, Connected Roadways, Buildings,Challenges **IOT Network Architecture and Design:** Drivers behind new network Architectures, Comparing IOT	**08 Hours**	**L1,L2**

Architectures, M2M architecture, IOT world forum standard, IOT Reference Model, Simplified IOT Architecture.		
Module -2		
IOT Network Architecture and Design: Core IOT Functional Stack, Layer1(Sensors and Actuators),Layer 2(Communications Sublayer), Access network sublayer,Gateways and backhaul sublayer, Network transport sublayer,IOT Network management. Layer 3(Applications and Analytics) – Analytics vs Control, Data vs Network Analytics,IOT Data Management and Compute Stack	**08 Hours**	**L2,L3**
Module -3		
Engineering IOT Networks Things in IOT – Sensors, Actuators, MEMS and smart objects. Sensor networks, WSN, Communication protocols for WSN Communications Criteria, Range Frequency bands, power consumption, Topology, Constrained Devices, Constrained Node Networks, IOT Access Technologies, IEEE 802.15.4. Competitive Technologies–Overview only of IEEE 802.15.4g, 4e, IEEE 1901.2a Standard Alliances LTE Cat0, Cat-M, NB-IOT	**08 Hours**	**L2,L3**
Module -4		
Engineering IOT Networks: IP as IOT network layer, Key Advantages, Adoption, Optimization, Constrained Nodes, Constrained Networks, IP versions, Optimizing IP for IOT. Application Protocols for IOT – Transport Layer, Application.Transport layer, Background only of SCADA, Generic web based protocols, IOT Application Layer Data and Analytics for IOT – Introduction, Structured and Unstructured data, IOT Data Analytics overview and Challenges.	**08 Hours**	**L3,L4**
Module-5		
IOT in Industry (Three Use cases) IOT Strategy for Connected manufacturing, Architecture for Connected Factory Utilities – Power utility, IT/OT divide, Grid blocks reference model, Reference Architecture, Primary substation grid block and automation. Smart and Connected cities –Strategy, Smart city network Architecture, Street layer, city layer, Data center layer, services layer, Smart city security architecture, Smart street lighting.	**08 Hours**	**L3,L4**
Course outcomes: After studying this course, students will be able to: 1. Understand the basic concepts IOT Architecture and devices employed. 1. Analyze the sensor data generated and map it to IOT protocol stack for transport. 2. Apply communications knowledge to facilitate transport of IOT data over various available communications media. 3. Design a use case for a typical application in real life ranging from sensing		

devices to analyzing the data available on a server to perform tasks on the device.
Text Books: 1. CISCO, IOT Fundamentals – Networking Technologies, Protocols, Use Cases for IOT, Pearson Education; First edition (16 August 2017). ISBN-10: 9386873745, ISBN-13: 978-9386873743
Reference Books: 1. Arshdeep Bahga and Vijay Madisetti, 'Internet of Things – A Hands on Approach', Orient Blackswan Private Limited - New Delhi; First edition (2015), ISBN-10: 8173719543, ISBN-13: 978-8173719547

ADVANCED DSP LAB [As per Choice Based Credit System (CBCS) scheme] SEMESTER – II			
Laboratory code	21LDNL25	CIE Marks	50
Number Lecture Hour/Week	01Hr Tutorial (Instructions) + 02 HoursLaboratory	SEE Marks	50
		Exam Hours	03
CREDITS-02			
Course Objectives: This laboratory course enables students to get practical experience on 1. Compute the DFT for a discrete signal 2. Find solution to the difference equations and computation of convolution 3. Evaluate Sampling rate conversion 4. Matlab implementation of LTI systems using DSP processor			
PART-A: Experiments to be done using MATLAB 1. Computation of Linear convolution, Circular convolution, Linear convolution using circular convolution 2. Computation of DFT, IDFT, Circular convolution in frequency domain 3. Determination of power spectrum density of a given sequence 4. Implementation of Decimation Process and Implementation of Interpolation Process 5. Time-Frequency Analysis with the Continuous Wavelet Transform 6. Signal Reconstruction from Continuous Wavelet Transform Coefficients 7. Denoising Signals and Images 8. Haar Wavelet Image Compression			**L1,L2,L3**

Part – B: Experiments to be done using the DSP processor 1. Write an ALP to obtain the response of a system using linear convolution whose input and impulse response are specified. 2. Write an ALP to obtain the impulse response of the given system, given the difference equation. 3. Computation of FFT when N is not a power of 2.	**L1,L2,L3**
Course outcomes: On the completion of this laboratory course, the students will be able to: 1. Realize the Response of LTI systems using Matlab 2. Understand the concepts of frequency domain representation of signals. 3. Provide a solution for a given difference equation. 4. Understand the concepts of frequency domain up/down sampling of signals. 5. Implement the of LTI system using DSP processor	

NETWORK SIMULATION LAB - II [As per Choice Based Credit System (CBCS) scheme] SEMESTER – II			
Laboratory code	21LDNL26	CIE Marks	50
Number Lecture Hour/Week	01Hr Tutorial (Instructions) + 02 HoursLaboratory	SEE Marks	50
		Exam Hours	03
CREDITS-02			
Course Objectives: This laboratory course enables students to get practical experience on the 1. Understand the scenario and study the performance of various network protocols through simulation. 2. Understanding the congestion control technique and encryption algorithm. 3. Understand the concept of Routing algorithm to find suitable path using Distance vector algorithm.			
Part – A: Experiments to be done using Network Simulators 1. Simulate a three node point to point network with duplex links between them. Set queue size and vary the bandwidth and find number of packets dropped. 2. Simulate a four node point to point network with the links connected as follows: n0 – n2, n1 – n2 and n2 – n3. Apply TCP agent between n0 – n3 and UDP agent between n1 – n3. Apply relevant applications over TCP and UDP agents changing the parameter and determine the number of packets sent by TCP / UDP.			**L1, L2, L3**

3. A network consists of seven(n0-n6) nodes. The links between n0 –n2 and n1-n2 is duplex in nature. Link between n2-n3 is simplex in nature. Simulate the local area network with CSMA/CD as medium access control protocol. 4. Simulate multicast protocol for network consists of six (n0-n6) nodes. 5. Simulate Adhoc on demand distance vector (AODV) as routing protocol. 6. For a wireless network simulate dynamic source routing (DSR) protocol.	
Part – B: Experiments to be done using using C/C++ or equivalent with LINUX/Windows environment 7. Write a program for simple RSA algorithm to encrypt and decrypt the data. 8. Write a program for congestion control using leaky bucket algorithm. 9. Write a program for distance vector algorithm to find suitable path for transmission. 10. Implement Dijkstra's algorithm to compute shortest path for transmission	**L2, L3**
Course outcomes: On the completion of this laboratory course, the students will be able to: 1. Defining the different agents and their applications like TCP/UDP 2. Understand the network routing protocol using AODV and DSR protocol 3. Understand the basic concepts of link layer properties including error detection. 4. Implement the data link and routing protocols using C programming. 5. Students get exposure to the real implementation of the computer network scenarios.	

English For Research Paper Writing

[As per Choice Based Credit System (CBCS) Scheme]
SEMESTER-I/II

Subject Code	21AD11/21	CIE Marks	50
Number of Lecture Hour/Week	02	SEE Marks	50
Total Number of Lecture Hours	01	Exam Hours	03

CREDITS-00

Course Objectives: This course will enable students to:

1. Understand that how to improve your writing skills and level of readability
1. Learn about what to write in each section
2. Understand the skills needed when writing a Title Ensure the good quality of paper at very first-time submission

Modules	**Teaching Hours**	**Revised Bloom's Taxonomy (RBT) Level**
Module -1		
Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness	**04 Hours**	**L1,L2**
Module -2		
Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction	**04 Hours**	**L1,L2**
Module -3		
Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.	**04 Hours**	**L1,L2**
Module -4		
key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature.	**04 Hours**	**L1, L2,L3**

Module-5		
Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions. useful phrases, how to ensure paper is as good as it could possibly be the first- time submission	**04 Hours**	**L1, L2,L3**
Text Books: 1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)		
Reference Books: 1. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press		

DISASTER MANAGEMENT

[As per Choice Based Credit System (CBCS) Scheme]
SEMESTER-I/II

Subject Code	21AD12/22	CIE Marks	50
Number Lecture Hour/Week	01	SEE Marks	50
Number of Lecture Hours	20	Exam Hours	03

CREDITS-00

Course Objectives:-Students will be able to:

1. Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
2. Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
3. Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
4. Critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in

Modules	**Teaching Hours**	**Revised Bloom's Taxonomy (RBT) Level**
Module -1		
Introduction Disaster: Definition, Factors And Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude.	**04 Hours**	**L1,L2**
Module -2		
Repercussions Of Disasters And Hazards: Economic Damage, Loss Of Human And Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.	**04 Hours**	**L1,L2**
Module -3		

Disaster Prone Areas In India Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics	**04 Hours**	**L1,L2**
Module -4		
Disaster Preparedness And Management Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.	**04 Hours**	**L1, L2,L3**
Module-5		
Risk Assessment Disaster Risk: Concept And Elements, Disaster Risk Reduction, Global And National Disaster Risk Situation. Techniques Of Risk Assessment, Global Co-Operation In Risk Assessment And Warning, People's Participation In Risk Assessment. Strategies for Survival. **Disaster Mitigation** Meaning, Concept And Strategies Of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation And Non-Structural Mitigation, Programs Of Disaster Mitigation In India.	**8 Hours**	**L1,L2,L3**
Course outcomes: After learning the course the students should be able to: 1. Understand disasters, disaster preparedness and mitigation measures 2. Understand role of IT, remote sensing, GIS and GPS in risk reduction 3. Understand disaster management acts and guidelines along with role of various stackholders during disasters.		
Text Books: 1. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company. 2. Sahni, PardeepEt.Al. (Eds.)," Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi.		
Reference Books: 1.Goel S. L., Disaster Administration And Management Text And Case Studies",Deep &Deep Publication Pvt. Ltd., New Delhi.		

SANSKRIT FOR TECHNICAL KNOWLEDGE

[As per Choice Based Credit System (CBCS) Scheme]
SEMESTER-I/II

Subject Code	21AD13/23	CIE Marks	50
Number Lecture Hour/Week	01	SEE Marks	50
Number of Lecture Hours	20	Exam Hours	03

CREDITS-00

Course Objectives:-Students will be able to:

1. To get a working knowledge in illustrious Sanskrit, the scientific language in the world
2. Learning of Sanskrit to improve brain functioning
3. Learning of Sanskrit to develop the logic in mathematics, science & other subjects
4. enhancing the memory power
5. The engineering scholars equipped with Sanskrit will be able to explore the
6. huge knowledge from ancient literature

Modules	**Teaching Hours**	**Revised Bloom's Taxonomy (RBT) Level**
Module -1		
Alphabets in Sanskrit	**04 Hours**	**L1,L2**
Module -2		
Past/Present/Future Tense, Simple Sentences	**04 Hours**	**L1,L2**
Module -3		
Order, Introduction of roots	**04 Hours**	**L1,L2**
Module -4		
Technical information about Sanskrit Literature	**8 Hours**	**L1, L2,L3**
Module-5		
Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics	**8 Hours**	**L1,L2,L3**

Course outcomes: Students will be able to

1. Understanding basic Sanskrit language
2. Ancient Sanskrit literature about science & technology can be understood
3. Being a logical language will help to develop logic in students.

Text Books:

1. "Abhyaspustakam" – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi
2. "Teach Yourself Sanskrit" Prathama Deeksha-VempatiKutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication
3. "India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., New Delhi.

VALUE EDUCATION

[As per Choice Based Credit System (CBCS) Scheme]
SEMESTER-I/II

Subject Code	21AD14/24	CIE Marks	50
Number Lecture Hour/Week	01	SEE Marks	50
Number of Lecture Hours	20	Exam Hours	03

CREDITS-00

Course Objectives:-Students will be able to:

1. Understand value of education and self- development
2. Imbibe good values in students
3. Let the should know about the importance of character

Modules	**Teaching Hours**	**Revised Bloom's Taxonomy (RBT) Level**
Module -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	**04 Hours**	**L1,L2**
Module -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.	**04 Hours**	**L1,L2**
Module -3		
Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness. Avoid fault Thinking. Free from anger, Dignity of labour. Universal brotherhood and religious tolerance. True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation.	**04 Hours**	**L1,L2**
Module -4		
Character and Competence –Holy books vs Blind faith. Self-management and Good health. Science of reincarnation. Equality, Nonviolence,Humility, Role of Women.	**8 Hours**	**L1, L2,L3**

Module-5		
All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively	**8 Hours**	**L1,L2,L3**
Course outcomes: Students will be able to 1. Knowledge of self-development 2. Learn the importance of Human values 3. Developing the overall personality		
Text Books: 1. Chakroborty, S.K. "Values and Ethics for organizations Theory and practice", Oxford University Press, New Delhi		

CONSTITUTION OF INDIA [As per Choice Based Credit System (CBCS) Scheme] SEMESTER-I/II			
Subject Code	21AD15/25	CIE Marks	50
Number Lecture Hour/Week	01	SEE Marks	50

Number of Lecture Hours	40	Exam Hours	03

CREDITS-00

Course Objectives:-Students will be able to:

1. Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
2. To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

Modules	**Teaching Hours**	**Revised Bloom's Taxonomy (RBT) Level**
Module -1		
History of Making of the Indian Constitution: History Drafting Committee, (Composition & Working)	**04 Hours**	**L1,L2**
Module -2		
Philosophy of the Indian Constitution: Preamble Salient Features	**04 Hours**	**L1,L2**
Module -3		
Contours of Constitutional Rights & Duties: Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy	**04 Hours**	**L1,L2**
Module -4		
Organs of Governance: Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers Judiciary, Appointment and Transfer of Judges, Qualifications	**04 Hours**	**L1, L2,L3**
Module-5		

Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Pachayati raj: Introduction, PRI: ZilaPachayat. Elected officials and their roles, CEO ZilaPachayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Election Commission: Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.	**8 Hours**	**L1,L2,L3**

Course outcomes: Students will be able to

1. Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
2. Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
3. Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.

Text Books:

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.

Reference Books:

1. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
2. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

PEDAGOGY STUDIES

[As per Choice Based Credit System (CBCS) Scheme]
SEMESTER-I/II

Subject Code	21AD16/26	CIE Marks	50
Number Lecture Hour/Week	01	SEE Marks	50
Number of Lecture Hours	40	Exam Hours	03

CREDITS-00

Course Objectives:-Students will be able to:

1. Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers.
2. Identify critical evidence gaps to guide the development.

Modules	**Teaching Hours**	**Revised Bloom's Taxonomy (RBT) Level**
Module -1		
Introduction and Methodology: Aims and rationale, Policy background, Conceptual framework and terminology Theories of learning, Curriculum, Teacher education. Conceptual framework, Research questions. Overview of methodology and Searching.	**04 Hours**	**L1,L2**
Module -2		
Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. Curriculum, Teacher education.	**04 Hours**	**L1,L2**
Module -3		
Evidence on the effectiveness of pedagogical practices Methodology for the in depth stage: quality assessment of included studies. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? Theory of change. Strength and nature of the body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches.	**04 Hours**	**L1,L2**
Module -4		

Professional development: alignment with classroom practices and follow-up support Peer support Support from the head teacher and the community. Curriculum and assessment Barriers to learning: limited resources and large class sizes	**04 Hours**	**L1, L2,L3**
Module-5		
Research gaps and future directions Research design Contexts Pedagogy Teacher education Curriculum and assessment	**8 Hours**	**L1,L2,L3**

Course outcomes: Students will be able to

1. What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?
2. What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?
3. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

Text Books:

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.

Reference Books:

1.Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.

2.Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.

3.Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign.

STRESS MANAGEMENT BY YOGA

[As per Choice Based Credit System (CBCS) Scheme]
SEMESTER-I/II

Subject Code	21AD17/27	CIE Marks	50
Number Lecture Hour/Week	01	SEE Marks	50
Number of Lecture Hours	40	Exam Hours	03

CREDITS-00

Course Objectives:-Students will be able to:

1. To achieve overall health of body and mind
2. To overcome stress

Modules	**Teaching Hours**	**Revised Bloom's Taxonomy (RBT) Level**
Module -1		
Definitions of Eight parts of yog. (Ashtanga)	**04 Hours**	**L1,L2**
Module -2		
Ahinsa, satya, astheya, bramhacharya andaparigraha	**04 Hours**	**L1,L2**
Module -3		
Shaucha, santosh, tapa, swadhyay, ishwarpranidhan	**04 Hours**	**L1,L2**
Module -4		
Various yog poses and their benefits for mind & body	**04 Hours**	**L1, L2,L3**
Module-5		
Regularization of breathing techniques and its effects-Types of pranayam	**04 Hours**	**L1,L2,L3**

Course outcomes: Students will be able to

1. Develop healthy mind in a healthy body thus improving social health also
2. Improve efficiency

Text Books:

1. 'Yogic Asanas for Group Tarining-Part-I" :Janardan Swami Yogabhyasi Mandal, Nagpur

Reference Books:

1."Rajayoga or conquering the Internal Nature" by Swami Vivekananda,AdvaitaAshrama (Publication Department), Kolkata

PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

[As per Choice Based Credit System (CBCS) Scheme]
SEMESTER-I/II

Subject Code	21AD18/28	CIE Marks	50
Number Lecture Hour/Week	01	SEE Marks	50
Number of Lecture Hours	40	Exam Hours	03

CREDITS-00

Course Objectives:-Students will be able to:

1. To learn to achieve the highest goal happily
2. To become a person with stable mind, pleasing personality and determination
3. To awaken wisdom in students

Modules	**Teaching Hours**	**Revised Bloom's Taxonomy (RBT) Level**
Module -1		
Neetisatakam-Holistic development of personality	**04 Hours**	**L1,L2**
Module -2		
Approach to day to day work and duties.	**04 Hours**	**L1,L2**
Module -3		
Shrimad BhagwadGeeta	**04 Hours**	**L1,L2**
Module -4		
Shrimad BhagwadGeeta:	**04 Hours**	**L1, L2,L3**
Module-5		
Personality of Role model. Shrimad BhagwadGeeta:	**04 Hours**	**L1,L2,L3**

Course outcomes: Students will be able to

1. Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life
2. The person who has studied Geeta will lead the nation and mankind to peace and prosperity and Study of Neetishatakam will help in developing versatile personality of students.

Text Books:

1."Srimad Bhagavad Gita" by Swami SwarupanandaAdvaita Ashram (Publication Department), Kolkata

Reference Books:

1. Bhartrihari's Three Satakam (Niti-sringar-vairagya) by P.Gopinath,
2. Rashtriya Sanskrit Sansthanam, New Delhi.

[As per Choice Based Credit System (CBCS) Scheme] SEMESTER- III			
Subject Code	21LDN311	CIE Marks	50
Number of Lecture Hour/Week	03	SEE Marks	50
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS-03			

Course Objectives: This course will enable students to:

1. Depth knowledge of Cognitive wireless networks.
2. Explore current cognitive radio technology by researching key areas such as Cognitive Radio
3. Relay Networks, SDR, Architectures and applications.
4. Understand the issues involved in synchronization and security

Modules	**Teaching Hours**	**Revised Bloom's Taxonomy (RBT) Level**
Module -1		
Introduction: Aware, Adaptive and Cognitive Radios. Cognitive Radio Technology, Cognitive Radio Network Architectures, Cognitive Radio Networks Applications.	**08 Hours**	**L1,L2,L3**
Module -2		
Network Coding for Cognitive Radio Relay Networks: Cognitive Radio Networks Architecture. Terminal Architecture for CRN. Mathematical Models Toward Networking Cognitive Radios. Scaling Laws of CRN. Primary user detection techniques – energy detection, feature detection, matched filtering, cooperative detection , Optimum spectrum sensing - KullbackLeibler Divergence and other approaches, Fundamental Tradeoffs in spectrum sensing, Spectrum Sharing Models of Dynamic Spectrum Access - Unlicensed and Licensed Spectrum Sharing, Fundamental Limits of Cognitive Radio	**08 Hours**	**L1,L2,L3**
Module -3		
Spectrum Sensing And Spectrum Management: Spectrum Sensing to detect specific Primary System. Spectrum Sensing for Cognitive Radio OFDMA Systems and Cognitive Multi-Radio Networks. Spectrum Management- Spectrum Sharing, Spectrum Pricing, Mobility Management to Heterogeneous Wireless Networks, Regulatory Issues and International Standards	**08 Hours**	**L1,L2,L3**
Module -4		
MAC and Network Layer Design & Trusted Cognitive Radio Networks: Spectrum Sensing to detect specific Primary System. Spectrum Sensing for Cognitive Radio OFDMA Systems and Cognitive Multi-Radio Networks. **Spectrum Management**- Spectrum Sharing, Spectrum	**08 Hours**	**L1, L2,L3**

Pricing, Mobility Management to Heterogeneous Wireless Networks, Regulatory Issues and International Standards**.**		
Module-5		
Advanced Topics In Cognitive Radio: Cognitive radio for Internet of Things - Features and applications – Enabling technologies and protocols – M2M technologies - Data storage and analysis techniques - Requirement and challenges of IoT – Energy efficiency– MIMO Cognitive Radio – Power allocation algorithms	**08 Hours**	**L1,L2,L3**
Course outcomes: After studying this course, students will be able to: 1. Compare MAC and network layer design for cognitive radio 2. Discuss cognitive radio for Internet of Things and M2M technologies 3. Calculation of Energy Efficiency. 4. Realize and analyze the protocols.		
Text Books: 1. Kwang-Cheng Chen and Ramjee Prasad, "Cognitive Radio Networks", John Wiley & sons, 2009.		
Reference Books: 1. Ahmed Khattab, Dmitri Perkins, MagdyBayoumi, "Cognitive Radio Networks : From Theory to Practice", Springer, 2013. 2. Walter Tuttlebee, "Software Defined Radio- Baseband Technology for 3. Alexander M. Wyglinski, MaziarNekovee, Thomas Hou, "Cognitive Radio Communications and Networks", Academic Press, Elsevier, 2010. 4. Bruce Fette, "Cognitive Radio Technology", Newnes, 2006. 5. HuseyinArslan (Ed.), "Cognitive Radio, Software Defined Radio, and Adaptive Wireless Systems, Springer, 2007. 6. S.Shanmugavel, M.A.Bhagyaveni, R.Kalidoss, "Cognitive Radio-An Enabler for Internet of things", River Publishers, 2017		

CMOS RF CIRCUIT DESIGN [As per Choice Based Credit System (CBCS) Scheme] SEMESTER-III			
Subject Code	21LVE312	CIE Marks	50
Number Lecture	03	SEE Marks	50

Hour/Week			
Number of Lecture Hours	40	Exam Hours	03

CREDITS-03

Course Objectives: This course will enable students to:

1. Learn basic concepts in RF and microwave design emphasizing the effects of nonlinearity and noise.
2. Able to appreciate communication system, multiple access and wireless standards necessary for RF circuit design.
3. Able to deal with transceiver architecture, various receiver and transmitter designs, their merits and demerits
4. Understand the design of RF building blocks such as Low Noise Amplifiers and Mixers

Modules	**Teaching Hours**	**Revised Bloom's Taxonomy (RBT) Level**
Module -1		
Introduction to RF Design and Wireless Technology: Basic concepts in RF design (I): General considerations, Effects of Nonlinearity, Noise, Sensitivity and dynamic range.	**08 Hours**	**L1,L2,L3**
Module -2		
Basic concepts in RF design (II): Passive impedance transformation, scattering parameters, analysis of nonlinear dynamic systems	**08 Hours**	**L1,L2,L3**
Module -3		
Communication Concepts: General concepts, analog modulation, digital modulation, spectral re-growth, Mobile RF communications, Multiple access techniques, Wireless standards.	**08 Hours**	**L1,L2,L3**
Module -4		
Transceiver Architecture (I): General considerations, Receiver architecture.	**08 Hours**	**L1, L2,L3**
Module-5		
Transceiver Architecture (II): Transmitter architectures **Low Noise Amplifiers:** LNA topologies: common-source stage with inductive load, common-source stage with resistive feedback. **Mixers:** General considerations, passive down conversion mixers.	**08 Hours**	**L1,L2,L3**

Course Outcomes: After studying this course, students will be able to:

- Analyse the effect of nonlinearity and noise in RF and microwave design.
- Exemplify the approaches taken in actual RF products.
- Minimize the number of off-chip components required to design mixers and Low-Noise Amplifiers.
- Explain various receivers and transmitter topologies with their merits and drawbacks.

- Demonstrate how the system requirements define the parameters of the circuits and how the performance of each circuit impacts that of the overall transceiver.

Text Book:

1. B. Razavi, "RF Microelectronics", PHI, second edition.

Reference Book:

1. R. Jacob Baker, H.W. Li, D.E. Boyce "CMOS Circuit Design, layout and Simulation", PHI 1998.
2. Thomas H. Lee "Design of CMOS RF Integrated Circuits" Cambridge University press 1998.
3. Y.P. Tsividis, "Mixed Analog and Digital Devices and Technology", TMH 1996

ADVANCED EMBEDDED SYSTEM

[As per Choice Based Credit System (CBCS) Scheme]

SEMESTER-III

Subject Code	21LVE313	CIE Marks	50
Number of Lecture Hour/Week	03	SEE Marks	50
Total Number of Lecture Hours	40 **6**	Exam Hours	03

CREDITS-03

Course Objectives: This course will enable students to:

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT) Level
Module -1		
Embedded System: Embedded vs General computing system, classification, application and purpose of ES. Core of an Embedded System, Memory, Sensors, Actuators, LED, Opto coupler, Communication Interface, Reset circuits, RTC, WDT, Characteristics and Quality Attributes of Embedded Systems (Text 1: Selected Topics from Ch -1, 2, 3).	**08 Hours**	**L1,L2,L3,**
Module -2		
Hardware Software Co-Design. embedded firmware design approaches, computational models, embedded firmware development languages, Integration and testing of Embedded Hardware and firmware.(Text 1: Selected Topics from Ch -7, 9, 12)	**08 Hours**	**L1,L2,L3,**
Module -3		
RTOS Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling, How to choose an RTOS, Device Drivers ,Components in embedded system development environment (IDE), Files generated during compilation, simulators, emulators and debugging (Text 1: Selected Topics from Ch-10, 13).	**08 Hours**	**L2,L3,L4**
Module -4		
ARM-32 bit Microcontroller: Thumb-2 technology and applications of ARM, Architecture of ARM Cortex M3, Various Units in the architecture, General Purpose Registers, Special Registers, exceptions, interrupts, stack operation, reset sequence (Text 2: Ch 1, 2, 3)**.**	**08 Hours**	**L1, L2,L3**
Module-5		
Instruction Sets: Assembly basics, Instruction list and description, useful instructions, Memory Systems, Memory maps, Cortex- M3 Programming using assembly and C language, CMSIS (Text 2: Ch-4, 5, 10).	**08 Hours**	**L1,L2, L3**
Course outcomes: At the end of the course the student will be able to:		

1. Understand the basic hardware components and their selection method based on the characteristics and attributes of an embedded system. 2. Explain the hardware software co-design and firmware design approaches. 3. Understand about RTO's and Basic types of RTO's 4. Acquire the knowledge of the architectural features of ARM CORTEX M3, register set, interrupts, Exceptions, and Stack memory Operation.32-bit microcontroller . 5. Understand the suitability of the instruction sets of ARM processors to design of embedded systems including memory map, Apply the knowledge gained for Programming ARM CORTEX M3 for different applications.
Text Books: 1. 'Introduction to embedded systems', K. V. Shibu, TMH education Pvt. Ltd., 2009 2. 'The Definitive Guide to the ARM Cortex-M3', Joseph Yiu, Newnes, (Elsevier), 2nd edn, 2010.
Reference Book: **'Embedded systems - A contemporary design tool', James K. Peckol, John Wiley, 2008**

BUSSINESS ANALYTICS [As per Choice Based Credit System (CBCS) Scheme] SEMESTER-III			
Subject Code	21LOE321	CIE Marks	50
Number of Lecture Hour/Week	03	SEE Marks	50
Total Number of Lecture Hours	40	Exam Hours	03
CREDITS-03			
Course Objectives: This course will enable students to: 3. The main objective of this course is to give the student a comprehensive understanding of business analytics methods.			
Modules		**Teaching Hours**	**Revised Bloom's**

		Taxonomy (RBT) Level
Module -1		
Business Analysis: Overview of Business Analysis, Overview of Requirements, Role of the Business Analyst. Stakeholders: the project team, management, and the front line, Handling, Stakeholder Conflicts.	**08 Hours**	**L1,L2,L3**
Module -2		
Trendiness and Regression Analysis: Modelling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology.	**08 Hours**	**L1,L2,L3**
Module -3		
Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring contribution of Business analytics, Managing Changes. Descriptive Analytics, predictive analytics, predicative Modelling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization.	**08 Hours**	**L1,L2,L3**
Module -4		
Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models. Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.	**08 Hours**	**L1, L2,L3**
Module-5		
Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making. Recent Trends in : Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.	**08 Hours**	**L1,L2,L3**
1. **Course outcomes:** Students will demonstrate knowledge of data analytics.		

2. Students will demonstrate the ability of think critically in making decisions based on data and deep analytics. 3. Students will demonstrate the ability to use technical skills in predicative and prescriptive modeling to support business decision-making. 1. Students will demonstrate the ability to translate data into clear, actionable insights..
REFERENCE BOOKS: 1. Business analytics Principles, Concepts, and Applications by Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Pearson FT Press. 2. Business Analytics by James Evans, persons Education.

INDUSTRIAL SAFETY [As per Choice Based Credit System (CBCS) Scheme] SEMESTER-III			
Subject Code	21LOE322	CIE Marks	50
Number Lecture Hour/Week	03	SEE Marks	50
Number of Lecture Hours	40	Exam Hours	03
CREDITS-03			
Course Objectives: This course will enable students to: 1.To know about Industrial safety programs and toxicology, Industrial laws , regulations and source models 2.To understand about fire and explosion, preventive methods, relief and its sizing methods. 3. To analyse industrial hazards and its risk assessment			
Modules		**Teaching Hours**	**Revised Bloom's Taxonomy**

		(RBT) Level
Module -1		
Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1940 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.	**08 Hours**	**L1,L2**
Module -2		
Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment	**08 Hours**	**L1,L2**
Module -3		
Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.	**08 Hours**	**L1,L2**
Module -4		
Fault tracing: Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic,automotive, thermal and electrical equipment's like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.	**08 Hours**	**L1, L2,L3**
Module-5		
Periodic and preventive maintenance: Periodic inspection-concept and need, decreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance.	**08 Hours**	**L1,L2,L3**

Repair cycle concept and importance		

Course outcomes: By the end of the course the students will be able to

1. Analyze the effect of release of toxic substances
2. Understand the industrial laws, regulations and source models.
3. Apply the methods of prevention of fire and explosions.
4. Understand the relief and its sizing methods.
5. Understand the methods of hazard identification and preventive measures.

Text Books:

2. Digital signal processing – Principles Algorithms & Applications, Proakis & Monalakis, Pearson education, 4th Edition, New Delhi, 2007.
3. Digital signal processing-Theory and Lab practice, D.Ganesh Rao, Vineeta P.Gejji, Second addition, PEARSON, 2010.

Reference Books:

1. Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.
2. Maintenance Engineering, H. P. Garg, S. Chand and Company.
3. Pump-hydraulic Compressors, Audels, Mcgrew Hill Publication.
4. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London.

OPERATION RESEARCH

[As per Choice Based Credit System (CBCS) Scheme]

SEMESTER-III

Course Code	21LOE323	CIE Marks	50
Number of Lecture Hours/Week	03	SEE Marks	50
Total Number of Lecture Hours	40	Exam Hours	03hrs

CREDITS– 03

Course Learning Objectives:

1. Analyze any real life systems with limited constraints and depict it in model form.
2. Understand variety of problems such as Assignment, Transportation, Travelling sales man etc.
3. Formulate and solve problems as Networks and Graphs.
4. Construct Linear Integer Programming Models and discuss the solution Techniques.
5. Set up Decision Models and use some Solution Methods for Nonlinear Optimization

Problems. 6. Propose the best Strategy using Decision making methods under Uncertainty.		
Modules	**Teaching Hours**	**Revised Bloom's Taxonomy (RBT) Level**
Module -1		
Introduction: What is Operation Research, Operation Research Models, Solving the OR Model, Art of Modeling, More than Just Mathematics, Phases of an OR Study. **Modeling with Linear Programming**: Two Variable LP Model, Graphical LP Solution, Selected LP Applications, Computer Solution with Excel Solver and AMPL.	**08 Hours**	**L1,L2, L3**
Module -2		
Simplex method and sensitivity analysis: LP Model in Equation Form, Transition from Graphical to Algebraic Solution, the Simplex Method, Artificial Starting Solution, Special Cases in Simplex Method, Sensitivity Analysis.	**08 Hours**	**L1,L2, L3**
Module -3		
Duality and post –optimal analysis: Definition of the Dual Problem, Primal-Dual Relationships, Economic Interpretation of Duality, Additional Simplex Algorithms, Post Optimal Analysis.	**08 Hours**	**L1,L2, L3**
Module –4		
Transportation model and its variable: Definition of the Transportation Model, Nontraditional Transportation Models, the Transportation Algorithm, the Assignment Model, the Transshipment Model. **Network Models:** Scope and Definition of Network Models, Minimal Spanning Tree Algorithm, Shortest-Route Problem, Maximal Flow Model, CPM and PERT.	**08 Hours**	**L1,L2, L3**
Module -5		
Classical optimization theory: Unconstrained problem, constrained problem. **Nonlinear programming algorithms:** Unconstrained algorithm, constrained algorithm.	**08 Hours**	**L1,L2, L3**

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

1. Understand the given problem as transportation and assignment problem and solve.
2. Solve problems as Networks and Graphs.
3. Construct Linear Integer Programming Models.
4. Solve the problems on Strategy using Decision making methods under Uncertainty.
5. Solve the problems on Decision Models and use some Solution Methods for Nonlinear Optimization Problems.

Text Book:

1. H.A Taha, Operations Research, An Introduction, PHI, 2008.
2. D.S Hira and PK Gupta, Operations Research, (Revised Addition), published by S. Chand and company Ltd. 2014.

Reference Books:

1. S Kalavathy, operation Research, Vikas Publishing House Pvt Limited, 01-Aug-2002.
2. S D Sharma, Operation Research, KedarNath Ram Nath Publishers.

COST MANAGEMENT OF ENGINEERING PROJECTS

[As per Choice Based Credit System (CBCS) Scheme]

SEMESTER-III

Subject Code	21LOE324	CIE Marks	50
Number of Lecture Hour/Week	03	SEE Marks	50
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS-03

Course Objectives: This course will enable students to:

1. Recognize and apply appropriate theories, principles and concepts relevant to cost accounting.
2. Exercise appropriate judgment in selecting and presenting information using various methods relevant to cost accounting.
3. Plan, design and execute practical activities using techniques and procedures appropriate to cost accounting .
4. Respond to change within the external and internal business environments and its effect on cost accounting. **7**
5. Develop appropriate effective written and oral communication skills relevant to cost accounting.
6. Use organization skills (including task and time management) relevant to cost accounting systems both individually and in a group situation.

7. Solve problems relevant to cost accounting systems using ideas and techniques some of which are at the forefront of the discipline.		
Modules	**Teaching Hours**	**Revised Bloom's Taxonomy (RBT) Level**
Module -1		
Introduction and Overview of the Strategic Cost Management Process	**08 Hours**	**L1,L2,L3**
Module -2		
Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.	**08 Hours**	**L1,L2,L3**
Module -3		
Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and non- technical activities. Detailed Engineering activities. Pre project execution main clearances and documents Project team: Role of each member. Importance Project site: Data required with significance. Project contracts. Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process	**08 Hours**	**L1,L2,L3**
Module -4		
Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector. Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis. Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.	**08 Hours**	**L1, L2,L3**

Module-5		
Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.	**08 Hours**	**L1,L2,L3**
Course outcomes: Students will demonstrate knowledge of data analytics. 1. On completion of this course, students should be able to identify, use and interpret the results of costing techniques appropriate to different activities and decisions. 2. Formulate and use standards and budgets for planning and control purposes; understand the role of responsibility accounting and performance .		
REFERENCE BOOKS: 1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi 2. Charles T. Horngren and George Foster, Advanced Management Accounting 3. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting 4. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher 5. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.		

COMPOSITE MATERIALS [As per Choice Based Credit System (CBCS) Scheme] SEMESTER-III			
Subject Code	21LOE325	CIE Marks	50
Number Lecture Hour/Week	03	SEE Marks	50
Number of Lecture Hours	40	Exam Hours	03
CREDITS-03			
Course Objectives: This course will enable students to: 1. Identify, describe and evaluate the properties of fibre reinforcements, polymer matrix materials and commercial composites. 2. Develop competency in one or more common composite manufacturing techniques, and be able to select the appropriate technique for manufacture of fibre-reinforced composite products.			
Modules		**Teaching Hours**	**Revised Bloom's Taxonomy (RBT) Level**
Module -1 **7**			
INTRODUCTION: Definition – Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size,		**08 Hours (Text 1 & Ref 1)**	**L1,L2**

shape, distribution, volume fraction) on overall composite performance.		
Module -2		
REINFORCEMENTS: Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions.	**08 Hours (Text1 &Ref1)**	**L1,L2**
Module -3		
Manufacturing of Metal Matrix Composites: Casting – Solid State diffusion technique, Cladding – Hot isostatic pressing. Properties and applications. Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications.	**08 Hours (Text2& Ref 2)**	**L1,L2**
Module -4		
Manufacturing of Polymer Matrix Composites: Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications.	**08 Hours (Text3& Ref 3)**	**L1, L2,L3**
Module-5		
Strength: Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygro thermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.	**08 Hours (Text3& Ref 3)**	**L1,L2,L3**
Course outcomes: After studying this course, students will be able to: 1. Explain the mechanical behavior of layered composites compared to isotropic materials. 2. Apply constitutive equations of composite materials and understand mechanical behavior at micro and macro levels..		
Text Books: 1. Material Science and Technology – Vol 13 – Composites by R.W.Cahn – VCH, West Germany. 2. Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R. Balasubramaniam, John Wiley & Sons, NY, Indian edition, 2007.		
Reference Books: 1. Hand Book of Composite Materials-ed-Lubin. 2. Composite Materials – K.K.Chawla. 3. Composite Materials Science and Applications – Deborah D.L. Chung. 4. Composite Materials Design and Applications – Danial Gay, Suong V. Hoa, and Stephen W. Tasi.		

WASTE TO ENERGY [As per Choice Based Credit System (CBCS) Scheme] SEMESTER-III			
Subject Code	21LOE326	CIE Marks	50
Number Lecture Hour/Week	03	SEE Marks	50
Number of Lecture Hours	40	Exam Hours	03
CREDITS-03			

Course Objectives: This course will enable students to:

1. The objective of the course is to provide insights into waste management options by reducing the waste destined for disposal and encouraging the use of waste as a resource for alternate energy production
2. . This course is designed to provide an understanding of the various aspects of Waste to Energy.

Modules	**Teaching Hours**	**Revised Bloom's Taxonomy (RBT) Level**
Module -1		
Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors	**08 Hours**	**L1,L2**
Module -2		
Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and	**08 Hours**	**L1,L2**

application – Manufacture of pyrolytic oils and gases, yields and applications.		
Module -3		
Biomass Gasification: Gasifiers Fixed bed system Downdraft and updraft gasifiers Fluidized bed gasifiers Design, construction and operation Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.	**08 Hours**	**L1,L2**
Module -4		
Biomass Combustion: Biomass stoves Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.	**08 Hours**	**L1, L2,L3**
Module-5		
Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.	**08 Hours**	**L1,L2,L3**
Course outcomes:. After studying this course, students will be able to: 1.To provide insights into waste management options by reducing the waste destined for disposal and encouraging the use of waste as a resource for alternate energy production. 2.To provide an understanding of the various aspects of Waste to Energy.		
Reference Books: 1. Non Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990. 2. Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983. 3. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991. 4. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996.		