Regulation - R21

Curriculum Structure & Syllabus

for

M.TECH

in

ELECTRONICS AND COMMUNICATION ENGINEERING

(Effective from 2021-22 admission batch)

Issued by

GURU NANAK INSTITUTE OF TECHNOLOGY (AUTONOMOUS)

Panihati, Kolkata, West Bengal 700114

M. Tech. in Electronics & Communication Engineering (ECE)

PG-Syllabus,Guru Nanak Institute of Technology, Panihati, Kolkata, West Bengal

CURRICULUM and SYLLABUS (2021 Regulation)

SEMESTER I

SL No.	Core/Elective	Code	Subject Name	Contact Hours/Week				Credit
				L	T	P	Total	
1	Core 1	MCE 101	ADVANCED DIGITAL COMUNICATION	3	0	0	3	3
2	Core 2	MCE 102	COMPUTER COMMUNICATION & NETWORKING	3	0	0	3	3
3	PE1	MCE 103	PROGRAM SPECIFIC ELECTIVE-I (A)STATISTICAL SIGNAL ANALYSIS (B)DETECTION AND ESTIMATION THEORY (C) ADVANCED INFORMATION THEORY	3	0	0	3	3
4	PE2	MCE 104	PROGRAM SPECIFIC ELECTIVE-II (A)MICROWAVE INTEGRATED CIRCUITS (B)PHOTONICS AND OPTICAL COMMUNICATION NETWORKS (C)ADVANCED RADIO PROPAGATION AND REMOTE SENSING	3	0	0	3	3
5	MLC	MLC 101	RESEARCH METHODOLOGY AND IPR	2	0	0	2	2
	PRACTICAL							
6	Lab 1	MCE 191	ADVANCED COMUNICATION LAB	0	0	3	3	2
7	Lab 2	MCE 192	COMPUTER COMMUNICATION & NETWORKING LAB	0	0	3	3	2
	SESSIONAL							
8	Aud-I	MCE 181	AUDIT COURSE-I (A)CONSTITUTION OF INDIA (B)PERSONALITY DEVELOPMENT (C)STRESS MANAGEMENT BY YOGA	2	0	0	2	0
Total Credit								**18**

**MLC – Mandatory Learning Course

SEMESTER II

SL No.	Core/Elective	Code	Subject Name	Contact Hours/Week				Credit
				L	T	P	Total	
1	Core 1	MCE 201	ADVANCED DIGITAL SIGNAL PROCESSING	3	0	0	3	3
2	Core 2	MCE 202	WIRELESS AND MOBILE COMMUNICATION	3	0	0	3	3
3	PE3	MCE 203	PROGRAM SPECIFIC ELECTIVE-III (A) MIMO AD HOC AND COGNITIVE RADIO NETWORKS (B) SATELLITE AND SPACE COMMUNICATION (C)CRYPTOGRAPHY & NETWORK SECURITY	3	0	0	3	3
4	PE4	MCE 204	PROGRAM SPECIFIC ELECTIVE-IV (A)MULTIMEDIA COMMUNICATION (B) ARTIFICIAL INTELLIGENCE & MACHINE LEARNING (C) IMAGE PROCESSING AND PATTERN RECOGNITION	3	0	0	3	3
5	Minor Project	MCE 281	MINI PROJECT AND SEMINAR	0	0	4	4	2
	PRACTICAL							
6	Lab 1	MCE 291	DESIGN AND SIMULATION LAB	0	0	3	3	2
7	Lab 2	MCE 292	WIRELESS AND MOBILE COMMUNICATION LAB	0	0	3	3	2
	SESSIONAL							
8	Aud-II	MCE 282	AUDIT COURSE-II (A) PEDAGOGY STUDIES (B)ENGLISH FOR RESEARCH PAPER WRITING (C) DISASTER MANAGEMENT	2	0	0	2	0
Total Credit								**18**

SEMESTER III:

SL No.	Core/Elective	Code	Subject Name	**Contact Hours/Week**				
				L	T	P	Total	Credit points
1	PE5	MCE 301	PROGRAM SPECIFIC ELECTIVE-V A)AUTOMATION IN VLSI DESIGN B)IOT TECHNOLOGY C)DEEP LEARNING IN COMPUTER VISION	3	0	0	3	3
2	OE	MCE 302	A)DATA ANALYTICS B)OPERATIONS RESEARCH C)INFORMATION SECUIRITY AND RISK MANAGEMENT	3	0	0	3	3
3	Major Project	MCE 381	DISSERTATION (PART-1)	0	0	20	20	10
				Total				**16**

SEMESTER IV:

SL No.	Core/ Elective	Code	Subject Name	Contact Hours/Week				
				L	T	P	Total	Credit points
	SESSIONAL							
1	Major Project	MCE 481	DISSERTATION (COMPLETION)	0	0	32	32	16
				Total			**32**	**16**

Advanced Digital Communication
Code: MCE 101
Contacts: 3-0-0
Total Contact Hours: 40
Credits: 3

Perquisites:

o Fourier Expansion, Fourier transform, Normalized power spectrum, Power spectral density, Effect of transfer function on output power spectral density, Perseval's theorem.
o Autocorrelation & cross correlation between periodic signals, cross correlation power.
o Relation between power spectral density of a signal, its autocorrelation function and its spectrum.
o Distinction between a random variable and a random process.
o Probability, sample space, Venn diagram, joint probability, bay's theorem, cumulative probability distribution function, probability density function, joint cumulative probability distribution function, joint probability density function.
o Mean/average/expectation of a random variable and of sum of random variables.
o Standard deviation, variance, moments of random variables, - explanation with reference to common signals.
o Gaussian probability density function – error function & Q function.

COURSE OUTCOMES
On completion of the course students will be able to

1. Apply the knowledge of probability and statistical calculations on random signal analysis.
2. Analyse signal vector representation of various digitally modulated signals by creating signal constellation.
3. Demonstrate the concepts of sampling, Pulse Modulation techniques and their comparison.
4. Design Optimum (Matched) filter, demonstrate the effects of Inter Symbol Interference (ISI) and compare Eye pattern analysis.
5. Illustrate various types of coherent and non-coherent digital modulation techniques, analyse immunity parameters and calculate their error probabilities.

Course Content:

Spectral analysis of signals:
Orthogonal & orthonormal signals. Gram-Schmidt procedure to represent a set of arbitrary signals by a set of orthonormal components; - numerical examples. The concept of signal-space coordinate system, representing a signal vector by its orthonormal components, measure of distinguishability of signals. **[4L]**

Characteristics of random variables and random processes:
Common probability density functions, - Gaussian, Rayleigh, Poisson, binomial, Rice, Laplacian, log-normal, etc. Probability of error in Gaussian Binary symmetric channel. Random processes – time average, ensemble average, covariance, autocorrelation, cross correlation, stationary process, ergodic process, wide sense stationary process. Power spectral density and autocorrelation, power spectral density of a random binary signal. Linear mean square estimation methods. **[4L]**

Revision of source coding:
Sampling theorem, instantaneous/ flat top/ natural sampling, band width of PAM signal, quantization, quantization noise, principle of pulse code modulation, delta modulation & adaptive delta modulation. **[3L]**

Line codes:
UPNRZ, PNRZ, UPRZ, PRZ, AMI, Manchester etc. Calculation of their power spectral densities. Bandwidths and probabilities of error Pe for different line codes. **[2L]**

Revision of digital modulation:
Principle, transmitter, receiver, signal vectors, their distinguish ability (d) and signal band width for BPSK, QPSK, M-ARY PSK, QASK, MSK, BFSK, M-ARY FSK. **[4L]**

Spread spectrum modulation:
Principle of DSSS, processing gain, jamming margin, single tone interference, principle of CDMA, MAI and limit of number of simultaneous users. Digital cellular CDMA system: model of forward link, reverse link, error rate performance of decoder using m-sequence chip codes. Properties of m-sequences, their generation by LFSR, their PSDs, limitations of m-sequences. Gold sequence, Kasami sequence – generating the sequences, their characteristic mean, cross correlation and variance of cross correlation, their merits and limitations as chip codes in CDMA. [**5L]**

Multiplexing & multiple access:
TDM/TDMA, FDM/FDMA, Space DMA, Polarization DMA, OFDM, ALOHA, Slotted ALOHA, Reservation ALOHA, CSMA-CD, CSMA-CA – basic techniques and comparative performances e.g. signal bandwidth, delay, probability of error etc. **[4L]**

Noise:
Representation of noise in frequency domain. Effect of filtering on the power spectral density of noise – Low pass filter, band pass filter, differentiating filter, integrating filter. Quadrature components of noise, their power spectral densities and probability density functions. Representation of noise in orthogonal components. **[4L]**

Band limited channel:
Characteristics of band limited channel, inter symbol interference (ISI) - it's mathematical expression. Niquist's theorem for signal design for no ISI in ideal band limited channel, Niquist's criteria, raised cosine pulse signals. Signal design for controlled ISI in ideal band limited channel, partial response signals, duobinary & partial duobinary signals – their methods of generation and detection of data. Concept of maximum likelihood detection, log likely hood ratio. Detection of data with controlled ISI by linear transverse filters. Performance of minimum mean square estimation (MMSE) detection in channels with ISI. **[4L]**

Base band signal receiver and probabilities of bit error: 6L
Peak signal to RMS noise output ration, probability of error. Optimum filter, it's transfer function. Matched filter, it's probability of error. Probability of error in PSK, effect of imperfect phase synchronization or imperfect bit synchronization. Probability of error in FSK, QPSK. Signal space vector approach to calculate probability of error in BPSK, BFSK, QPSK. Relation between bit error rate and symbol error rate. Comparison of various digital modulation techniques vis-a-vis band width requirement and probabilities of bit error]

TEXT BOOKS

1. Simon Haykin, *Communication Systems*, John Wiley & Sons
2. John. G. Proakis, *Digital Communications*, McGraw Hill

REFERENCE BOOKS

1. B. P. Lathi, *Modern Digital and Analog Communication Systems*, Oxford
2. L. W. Couch, *Digital and Analog Communication Systems*, Prentice Hall

CO-PO Mapping:

CO Codes	**Program Outcomes (POs)**											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3		1	1			2		3	3
CO2	3			3	3		2			1	3	3
CO3	3	3	3	3	2	2			1		3	3
CO4	3	3	3	2	3		2			2	2	3
CO5	3	3	3			2	2	3	1	2		3

Computer Communication and Networking

Course Code: MCE 102

Contacts: 3-0-0
Total contact hours: 36
Credit: 3

Prerequisite:

The candidates should have the basic knowledge of communication and hardware.

Course Outcome:

After successful completion of this course, students should be able to:
CO1: Know about computer network organization and protocol implementation
CO2: Learn how securely data can be transmitted from one place to another using various protocols
CO3: Understand the benefits of latest technologies and know about modern internet services

Course Content:

Module I [8L]

Introduction; network criteria, physical structure and topologies, categories of network (LAN, MAN, WAN); Internet: brief history, Protocols and standards; Reference models: OSI reference model, TCP/IP reference model, their comparative study. Transmission media: Guided (mainly optical fiber- construction and advantages) & Unguided (including waves); switching techniques: circuit switching, message switching and packet switching; multiplexing: TDM, FDM and WDM

Module II [8L]

Bit communication between DTE and DCE, RS232; Types of errors, framing (character and bit stuffing), error detection & correction methods; Framing and Flow control; Protocols: Stop & wait ARQ, Go-Back-N ARQ, Selective repeat ARQ, HDLC. Point to Point Protocol, Token Ring; Multiple access protocols: Pure ALOHA, Slotted ALOHA, CSMA, CSMA/CD, CSMA/CA Ethernet: Types and Frame formats

Module III [8L]

Internetworking & devices: Repeaters, Hubs, Bridges, Switches, Router, Gateway; IP Addressing: IPv4 and IPv6; Subnet and Supernet; Routing techniques: static vs. dynamic routing, Routing delivery schemes, Source and Hop-by-Hop routing (Dijkastra, Bellman Ford Algorithm), Routing Protocols: RIP, OSPF, BGP; Other Protocols: ARP, RARP, ICMP, Process to Process delivery; UDP; TCP; Congestion Control: Open Loop, Closed Loop choke packets; Leaky bucket algorithm, Token bucket algorithm

Module IV [6L]

Application layer protocols: DNS, SMTP, SNMP, FTP, HTTP & WWW; Modern technologies: ATM, DSL technology, Wireless LAN: IEEE 802.11(WSN), Introduction to blue-tooth and WiFi, Overview of Mobile IP: Tunnelling and Encapsulation, advantages and limitations (in brief)

Module V [6L]

Different aspects of network security: Privacy, Authentication, Integrity and Non-Repudiation. Introduction to Cryptography: Public and Private Key cryptography, Algorithms- DES, AES, RSA,

Digital Signature, VPN, Firewalls- types and comparison. Internet services: Email, Internet telephony, Short Messaging Services (SMS), Internet Fax, Video Conferencing

Reference Books

1) B. A. Forouzan – "Data Communications and Networking (3rd Ed.) " – TMH
2) A. S. Tanenbaum – "Computer Networks (4th Ed.)" – Pearson Education/PHI
3) W. Stallings – "Data and Computer Communications" – PHI/ Pearson Education
4) Zheng & Akhtar, Network for Computer Scientists & Engineers, OUP
5) Black, Data & Computer Communication, PHI
6) Shay, Understanding Data Communication & Network, Vikas

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	1	2	3	2	1	2	3	1	2
CO2	2	3	1	2	3	1	2	1	2	1
CO3	2	3	3	2	2	1	3	2	3	2

Statistical Signal Analysis

Course Code: MCE103A

Contacts: 3-0-0

Credit: 3

Prerequisite: Basics of Digital signal processing, Digital communication

Course Outcomes: After this course students will be able to

CO1: Understand role of random process in ststistical signal processing

CO2: Understand signal modelling techniques

CO3: Comprehend the role of Binary Symmetric Channels

CO4: Understand the theory of hypothesis testing

CO5: Comprehend various digital filter design approaches

Course Content:

Module 1: Random Process: Definition and description of random processes with practical examples. Time average, ensemble average, covariance, autocorrelation, cross correlation, Stationary process, ergodic process, WSS process, power spectrum of random processes. Filtering of random processes – filtering of white noise, spectral shaping filter, spectral factorization. **9L**

Module 2: Signal Modeling: Least square method, Filter design using Padé approximation, Prony's method of signal modeling, filter design using Prony's method, FIR least square inverse filter, Stochastic models – MA model, AR model, ARMA model **7L**

Module 3:Binary Symmetric Channel: Principle, Properties, Probability of bit error calculation,Cascade of two Binary Symmetric Channels **5L**

Module 4: Theory of Hypothesis: Decision theory, Bay's likihood ratio, ideal observer strategy, Neyman-Pearson strategy, Bay's strategy for single and multiple sample values, optimum linear estimation composite hypothesis testing, optimum detection with incomplete knowledge of the signal. **8L**

Module 5: Filter Theory: Principle of optimum filter, matched filter, achievable bit error rate. FIR Wiener filter – principle and design. Forward and Backward linear prediction,Lattice Filter,Linear prediction in noise, noise cancellation IIR Wiener filter , Kalman filter. **7L**

Text Books:

1. Statistical digital signal processing and modeling, - Monson N. Hays – Wiley.
2. Algorithms for Statistical signal processing -Proakis et.el -Pearson
3. Statistical Signal Processing,Scharf,Pearson

Reference Books:

1. Digital communication, 4th ed. - J. G. Proakis, MGH International Edition
2. Digital and Analog Communication Systems, 7th ed. – Leon W. Couch, PHI.

CO-PO Mapping:

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

Detection and Estimation Theory
Paper Code: MCE103B
Contacts: 3-0-0
Total Contact Hours: 40
Credit: 3

Course Content:
MODULE 1 **13L**
Overview of the course, Classical Decision Theory: Binary hypothesis testing: Bayes criterion, Neyman-Pearson criterion, min-max test, M-ary hypothesis testing: General rule, minimum probability of error decision rule, Gaussian case and associated geometric concepts, Erasure decision problem, Random parameter estimation.

MODULE 2 **14 L**

Non – random parameter estimation: CRLB for non-random parameters, ML estimation rule, asymptotic properties of ML estimates. Linear minimum variance estimation, Least squares methods CRLB for random parameter estimation, condition for statistical efficiency, Multiple parameter estimation, Composite and non-parametric hypothesis testing, Applications, Detection of signals.

MODULE 3 **13L**

Mathematical preliminaries: K-L expansion and its application to Detection of known and unknown (i.e. with unknown, parameters) signals in AWGN., Detection of signals in colored noise. Linear estimation, Wiener filters and solution of Wiener Hopf Equations, Kalman- Bucy filters, Miscellaneous estimation techniques.

References:

1. Detection , Estimation and Modulation Theory , Part I ,H. L. Van Trees.
2. Decision and Estimation Theory, Melsa & Cohn , MGH publications.
3. Detection of Signals in Noise, A.D. Whalen (Academic Press,1971).

Course Outcomes:

1. Understand the mathematical background of signal detection and estimation
2. Use classical and Bayesian approaches to formulate and solve problems for signal detection and parameter estimation from noisy signals.
3. Derive and apply filtering methods for parameter estimation

CO-PO Mapping:

CO Codes	**Program Outcomes (POs)**											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3		1	1			2		3	3
CO2	3			3	3		2			1	3	3
CO3	3	3	3	3	2	2			1		3	3

Advanced Information Theory

Course Code: MCE103C

Contacts: 3-0-0

Credit: 3

Course Outcomes: After this course students will be able to

CO1: Understand role of random process in statistical signal processing

CO2: Understand signal modelling techniques

CO3: Comprehend the role of Binary Symmetric Channels

CO4: Understand the theory of hypothesis testing

CO5: Comprehend various digital filter design approaches

Course Content

Module 1: Introduction:2L

Brief description of a digital communication system, Cause of errors and need for error control coding, broad classes of error and classes of error correcting codes, general expression of the probability of error in a binary symmetric Gaussian channel, Principle of maximum likelihood decoding

Module 2: Linear algebra: **3L**

Groups- definition, order of a group, modulo-m addition and multiplication tables, modulo-m subtraction and division. Fields- Definition, binary field, Galois field. Polynomials- The concept of polynomial expression, addition/subtraction/multiplication/division of polynomials over GF(2). Irreducible polynomials, primitive polynomials. Vector space, subspace, dual space – their properties and interrelations. Numerical exercises with manual computation and by using MATLAB.

Module 3:Linear block code: 6L

Definition of linear block code. Generator matrix, properties of generator matrix. Parity check matrix and its properties. Encoding circuit- operating principle. Syndrome- definition, most likelihood principle of error detection. Syndrome circuit- operating principle. Hamming distance, minimum distance, minimum weight, error detecting & error correcting capabilities. Standard array- construction, error detection with syndrome. Decoder-operating principle.

Module 4: Cyclic code: 7L

Definition, generator polynomial, properties of cyclic code and generator polynomial. Generator matrix, parity check matrix, their properties and interrelations. Design and operation of encoder. Design and operation of syndrome circuit. Design & operation of Meggitt decoder. Simulation test of above for data transmission through Gaussian binary symmetric channel. Cyclic Hamming code.

Module 5: BCH code: 5L

Construction of Galois field GF(2m)- power representation, polynomial representation, n-tupple representation. Properties of GF(2m), conjugate roots, minimal polynomial, determining minimal polynomials. Description of BCH code, encoding, parity check matrix, error trapping and decoding.

Module 6: Convolutional code: 7L

Definition, encoder, generator sequences, generator matrix, principle of constructing code words, numerical examples, code rate, constraint length, fractional rate loss. Finite state machine analysis of coder, state diagramme, code tree, Trellis. Principle of maximum likelihood decoding of convolutional code, Viterbi algorithm, Numerical examples of decoding and error detection/correction using Trellis, numerical examples using Trellis by MATLAB. Simulation test of above for data transmission through Gaussian binary symmetric channel. Distance properties of convolutional codes.

Module 7: Burst error correcting codes: 4L

Burst –Error-Correcting Codes: Decoding of Single-Burst error Correcting Cyclic codes, Single Burst-Error-Correcting Cyclic codes, Burst-Error-Correcting Convolutional Codes, Bounds on Burst Error-Correcting Capability, Interleaved Cyclic and Convolutional Codes, Phased-Burst –Error Correcting Cyclic and Convolutional codes.

Module 8: Application:2L

Brief qualitative discussion of practical application of error control in processors, data storage, data exchange between CPU and peripherals, in CDMA etc.

Text Books:

1. Error Control Coding-Fundamentals and Applications –Shu Lin, Daniel J.Costello,Jr, Prentice Hall, Inc.
2. Error Correcting Coding Theory-Man Young Rhee-1989, McGraw-Hill Publishing.
3. Cryptography and Network Security: Principles and Practice -William Stallings, 2000, PE

Reference Books:

1. Digital Communications-Fundamental and Application -Bernard Sklar, PE.
2. Digital Communications-John G. Proakis, 5th Ed., 2008, TMH.
3. Introduction to Error Control Codes-Salvatore Gravano-Oxford
4. Error Correction Coding – Mathematical Methods and Algorithms – Todd K.Moon, 2006, Wiley India.
5. Information Theory, Coding and Cryptography –Ranjan Bose, 2nd Edition, 2009, TMH.
6. Principles of Network and Systems Administration, Mark Burgess, John Wiely Remote
7. Fundamentals of Convolutional Coding. - Roft Johannesson and K. S. Zigangirov. - OUP.
8. Information and Coding Theory. – Gareth A. Jones & J. Mary Jones. - Springer.
9. Error Correcting Codes. - Paterson, W. W. and Weldon, Jr. E. J. - Prentice Hall.
10. Applied Coding and Information Theory for Engineers. – Richard B. Wells. – Pearson Education

CO-PO Mapping:

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

Microwave Integrated Circuits
Course Code: MCE 104A
Contacts: 3:0:0
Total contact hours: 36
Credit: 3

Course Outcome:

After successful completion of this course, students should be able to:

CO1: Explain the different planar strip line techniques
CO2: Understand the MIC fabrication and measurement techniques.

CO3: Learn the design concepts MIC using various numerical analysis technique and applications of MIC

CO4: Acquire a knowledge about Microwave Semiconductor Devices

Course Content:

1. MIC Fabrication And Measurement Techniques 8L

Introduction to MICs-Fabrication technology, Advantages and applications. Measurement techniques: Test fixture measurements, probe station measurements, thermal and cryogenic measurements, experimental field probing techniques and anechoic chamber measurement, MIC applications, Hybrid MICs, Monolithic MIC technology.

2. Planar Transmission Lines and Lumped Elements for MICs: 9L

Fundamentals of the theory of transmission lines, Foundations of Microstrip lines, Striplines, Higher modes in microstrips and striplines, Slotlines, Coplanar waveguides, Coplanar strips; Launching Techniques: Coaxial line to microstrip transition, Rectangular waveguide to microstrip transition, microstrip to slot-line transition, microstrip to coplanar waveguide (CPW) transition; Lumped Components: Capacitors, Inductors and Resistors.

3. Microwave Planar Filters: 5L

Periodic structures, Filter design by the Image Parameter method, Filter design by the Insertion Loss method, Filter transformations, Filter implementation, Coupled line filters.

4. 4-Port Network Design: 7L

Introduction; Even-and odd-mode analysis; Introduction to Branch-line coupler, Hybrid-ring couplers, Analysis of hybrid-ring couplers, Introduction to parallel-coupled lines and directional couplers; Even-and odd-analysis of parallel-coupled lines; Coupled-line parameters; Multiple section directional couplers.

5. Nonlinear RF Circuits: 7L

Introduction; Power Gain Relations; Power gain for matched, unmatched, unilateral conditions; Noise characterization and design options; Switches: Pin Diode switches, FET switches, MEMS switches; Variable attenuators, Phase shifters, Detectors and Mixers; Amplifiers: Small signal amplifiers, Low noise amplifiers, Power amplifiers; Oscillators.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1	1	-	-	-	-	-	-	-	-
CO2	3	3	3	3	3	-	-	-	-	2	-	2
CO3	3	3	3	3	2	-	-	-	-	-	2	-
CO4	3	1	1	1	-	-	-	-	-	-	-	-

Photonics and Optical Communication

Code: MCE 104 B

Contacts: 3-0-0

Total Contact hours: 36

Credits: 4

Course Outcome:

After the successful completion of the course the students will be able to:

1. Summarize the basic concepts of Photonics and describe the connections between physics and technology that underlies many areas of laser physics.
2. Describe the principle and operation of the optical sources and detectors such as LASER & APD and optical connectors.
3. Perform modest mathematical analysis of Photonics and Optical Communication
4. Describe about the SONET/SDH and architecture of Optical Transport Network.
5. Discuss the elements of WDM networks and its potential applications.

Course Content:

Module I: Photonics: 6L

Light and Optical properties of materials,Photons and Light,Optical Spectra of Atoms, Molecules, and Solids,Derivation (simple) of Einstein A and B coefficients, Refractive index, brief introduction to simple optics, Polarization properties of light.

Module II: Optical Fiber: 8L

Materials, Fabrication Process, Types of fibers, Wave guiding fundamentals:
Analog and Digital Optical Transmitters and Receivers concepts :NAs, Acceptance angle, Modes, V number, Number of modes. Transmission characteristics: Attenuation and Dispersion mechanism and their effects. Special type Fibers, Loss- limited and dispersion- limited lightwave systems,Long-haul systems with In-Line Amplifiers,Dispersion compensation techniques in optical communication systemsPower budget and rise-time

Module III:**Optical Sources and Detectors: 5L**

LEDs and ILDs, Characteristics, Drive circuits; Optical detection principle, P-N, P-I-N and APD, Photo transistor, Receiver Structure, SNR, Sensitivity. Introduction to lasers,Simple rate equation modelling of: saturation, gain, amplifiers, Examples of types of lasers: HeNe, Nd:YAG, diode, Ti:Sapphire

Module IV: Inter-Connecting Devices:5L

Couplers, Isolators, Polarizers, Circulators, Filters, Add/Drop Mux/Demux, Fiber Optic Repeaters, Optical Amplifiers.

Module V: Communication System and Optical Network: 12L

System design issues, Link analysis, Intensity modulation/ direct detection system. Digital systems: coding and multiplexing mechanism

Coherent lightwave systems:

Modulation and Demodulation schemes for coherent communication,System performance issues.

Multichannel Lightwave systems:

WDM components and devices,Multiplexing techniques and system performance issues.

Optical Networks:

Network topologies,SONET/SDH,Broadcast-and- Select WDM Networks- single-hop networks, multihop Networks,Wavelength routed networks,

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	3	2	3	3	2	2	-	-	1	2	-	3
CO2	2	1	3	3	2	1	-	-	1	3	-	3
CO3	3	1	3	2	1	1	-	-	1	1	-	3
CO4	2	3	1	2	3	3	-	-	1	1	-	3
CO5	3	2	3	2	1	1	-	-	1	1	-	3

Advanced Radio Propagation And Remote Sensing

Code: MCE104C

Contacts: 3-0-0

Total Contact hours: 36

Credits: 3

Prerequisites: E.M Theory, Microwave Engineering, Sensor

Course Outcomes:

CO1: Understand fundamentals of Radio wave propagation.

CO2: Analyze different models and fading phenomena of Radio wave propagation

CO3: Analyze the mechanism of Remote sensing.

CO4: Analyze working principle of various remote sensors.

CO5: Design remote sensors for real life problems.

Course Content:

Module 1 **[4L]**

Fundamentals of Radio wave propagation, Free space propagation model, Basic Propagation Mechanisms- Reflection, 2-Ray Model, Diffraction and Scattering, Multipath and Spatial Interference.

Module 2 **[2L]**

Physical Phenomena and Frequency dependence: Path propagation, Fresnel Ellipsoids, Fee space attenuation, Frequency selectivity.

Module 3 **[4L]**

Radio Propagation Model- Path Loss Model, Ray Model, Exponential Decay Model, Rice Model, Karam-Fung Model, Knife Edge Model

Module 4 **[6L]**

Introduction to Small- scale Fading, Small-scale Fading Distribution, Log-Normal Fading, Channel Transfer Function and Impulse Response, delay speed effect Doppler spectrum. Flat fading channel modeling, frequency selective fading.

Module 5 **[6L]**

Fundamentals of Remote Sensing, Interactions between propagated wave and the atmospheric medium, Scattering absorption and radiation of electromagnetic waves in microwave, Introduction to Remote Sensing, thermal emission and solar refection remote sensing, Atmospheric Widows, imaging spectrometry, Spectral signature of water and soil atmospheric interaction

Module 6 **[6L]**

Types and classification of sensors, imaging modes, Characteristics of optical sensors, sensor resolution-spectral, radiometric and temporal, Characteristics of detectors, Ground station, Data generation, Data processing & correction, Ground truth Instruments and spectral signature, thermal remote sensing – thermal sensors, principle of operation, processing of thermal data, applications, Thermal Scanners-Characteristics and calibration of scanner.

Module 7 **[6L]**

Airborne and Space borne radar systems basis instrumentation, IRS Satellite Sensors, LANDSAT, SPOT, IKONOS, Quickbird, Geoeye, Kompsat, Worldview II & III, Microwave sensors and Image characteristics, Microwave image interpretation, Resolutions - spatial, spectral, radiometric and temporal, signal to noise ratio, laser interaction with objects. Remote Sensing platforms –-ERS, JERS, RADARSAT, RISAT –Scatterometer, Altimeter-LiDAR, Types of LiDAR, Application: Factors of Special Measurement—Sun Angle, Aerosol, Haze Water Vapour

Module 8 **[2L]**

Applications of Remote sensing- Agriculture, Forest, Soil, Geology, LU/LC, Water Resources, Urban.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2										3	2	1
CO2	3	3	3	2	2	1	-	-	-	-	-	-	3	2	1
CO3	3	3	3	3	3	2	-	-	-	-	-	-	3	2	2
CO4	3	3	3	3	3	2	-	-	-	-	-	-	3	2	2
CO5	3	3	3	3	3	3	-	-	-	-	-	-	3	2	3

Research Methodology And IPR

Course Code : MLC101

Contacts: 2-0-0

Total Contact hours: 24

Credits: 2

Course Outcomes:

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

1. Understand research problem formulation
2. Analyze research related information
3. Follow research ethics and understand the ultimate importance of ideas, concept and creativity
4. Importance of IPR for individuals and nations
5. Appreciate that IPR protection provides incentive to inventors for further research work

Course Contents:

Module I (6L)

Meaning of research problem, Sources of research problem, Criteria and characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problems, data collection, analysis, interpretation, necessary instrumentations.

Module II (6L)

Effective literature studies approaches and analysis Plagiarism, Research ethics

Module III (6L)

Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

Module IV (6L)

Nature of Intellectual Property: Patents, Design, Trade and Copyright, Process of Patenting and Development: technological research, innovation, patenting, and development. International Scenario: International cooperation on Intellectual property. Procedure for grants of patents, Patenting under PCT.

CO-PO Mapping:

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

Advanced Communication Lab
Code: MCE 191
Contacts: 0-0-3
Credits: 2
Course Objective:

Experiments on hardware/ kits in order to acquire sufficient knowledge and understand practical limitations/ implications of various communication techniques.

Suggested topics are (not exclusive),
1. Detailed receiver and transmitter parameters of a typical radio communication system – SINAD, fidelity, image rejection, modulation sensitivity, transmission bandwidth etc.
2. Data communication through fiber optic link – losses, power budget, stability etc.
3. Sampling, quantization, coding – sampling rate, quantization error, signal bandwidth etc.
4. QPSK, MPSK – signal bandwidth, distinguishability, effect of noise etc.
5. Binary symmetric channel – noise & Pe etc.
6. PC2PC communication – protocol standards, frame/ packet/ UDP structure etc.
7. Multiple channel DSSS – spreading, dispreading, decoding etc.
8. Important characteristics of different types of transmission lines.
9. Impedance measurement of microwave window applying Smith chart.
10. Microwave phase shifter – calibration.
11. Measurement of dielectric constants – solids & liquids.
12. Horn, microstrip antenna – radiation pattern, gain etc.

Course Outcomes
On completion of the course students will be able to

1. Analyse the concept of advanced communication techniques and their applications.
2. Demonstrate to the practical methods of the use of generating communication signals.
3. Evaluate practical methods of the use of demodulation communication signals.
4. Develop insight into the relations between the input and output signals in various stages of a transmitter and a receiver.
5. Clearly distinguish between contemporary advanced communication techniques.

CO-PO Mapping:

CO Codes	**Program Outcomes (POs)**											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3		1	2			2			3
CO2	3	2		1	3		2			1	3	3
CO3	3	3	3	3	2	2			1		3	3
CO4	3	2	3	2	1		2			3	2	3
CO5	3	3	3			2	3	3	1			3

Computer Communication and Networking Lab

Course Code: MCE 192

Contacts: 0-0-3

Credit: 2

Course Outcome:

After successful completion of this course, students should be able to:

CO1: Understand details and functionality of layered network architecture underlying principles of computer networking.

CO2: Analyze the packet /file transmission between nodes and performance of various communication protocols.

CO3: Analyze and evaluate the network security needs of an organization

List of Experiments:

1. Establish Peer to Peer network connection between two systems using switch and router in a LAN.
2. Configure Host IP, Subnet Mask and Default Gateway in a System in LAN (TCP/IP Configuration).
3. Configure different network topologies using packet tracer software.
4. Configure Internet connection and use IPCONFIG, PING /Tracer and Net stat utilities to debug the network issues.
5. Create piconet using Bluetooth and transfer data to analyze technical specifications.
6. Design and implementation of a simple client/server model and running application using sockets and TCP/IP.
7. Create a Virtual Private Network (VPN) over WAN and realize its operation.
8. Evaluate application response time in the presence and absence of a firewall.
9. Steps to ensure security of any web browsers like Mozilla Firefox, Google Chrome etc.
10. Analysis of the security vulnerabilities of e-mail.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
MCE192.1	3	2	1	1	-	-	1	-	3	3
MCE192.2	2	2	3	3	2	2	-	-	3	3
MCE192.3	2	2	3	2	2	1	3	3	1	3

Constitution of India
Course Code: MCE 181A
Contacts: 2-0-0
Total Contact Hours: 34

Course Outcome: On Completion of this course student will be able to

CO1: Identify and explore the basic features and modalities of Indian constitution.

CO2: Differentiate and relate the functioning of Indian parliamentary system at the centre and state level.

CO3: Differentiate the various aspects of Indian Legal System and its related bodies.

CO4: Understand the role of municipalitites, panchyat and election commission.

Course Content

Module 1: Introduction: 4L

"Constitution"- Historical Background of the Constituent Assembly, Indian Constitution and its Salient Features, the Preamble of the Constitution.

Module 2: Fundamental Rights, Fundamental Duties, Directive Principles of State Policy: 8L

The Right to Equality
The Right to Freedom: I (Article 19)
The Right to Freedom: II (Articles 20, 21 and 22)
The Right against Exploitation
The Right to freedom of Religion
Cultural and Educational rights
The Right to Property
The Right to Constitutional Remedies
The Directive Principles
Fundamental Duties

Module 3: Union Government and its Administration 6L

Structure of the Indian Union, Parliamentary System, Federal System, Centre-State Relations, Amendment of the Constitutional Powers and Procedure, The historical perspectives of the constitutional amendments in India, Emergency Provisions: National Emergency, President Rule, Financial Emergency, and Local Self Government – Constitutional Scheme in India.

Module 4: The Machinery of Government in the State 6L

Powers of Indian Parliament Functions of Rajya Sabha, Functions of Lok Sabha, Powers and Functions of the President, Comparison of powers of Indian President with the United States, Powers and Functions of the Prime Minister, Judiciary – The Independence of the Supreme Court, Appointment of Judges

State Executives – Powers and Functions of the Governor, Powers and Functions of the Chief Minister, Functions of State Cabinet, Functions of State Legislature, Functions of High Court and Subordinate Courts

Module 5: The Machinery of Municipalities and Panchayat 6L

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: Zila Pachayat, Elected officials and their roles, CEO Zila Pachayat: Position and role, Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy

Module 6: Election Commission 4L

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.

Text / Reference Books:

1) Indian Constitution by D.D.Basu, The Publisher, LexisNexis
2) Constitution of India by Subhas C Kasyap, Vitasta Publishing
3) The Constitution of India, P.M Bakshi, Universal Law Publishing Co.Ltd, New Delhi, 2003.
4) Indian Constitution Text Book - Avasthi, Avasthi,Publisher: LAKSHMI NARAIN AGARWAL

CO-PO mapping:

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	-	-	-	-	-	2	-	3		1	-	
CO2	-	-	-	-	-	1	-	2		3	-	
CO3	-	-	-	-	-	3	-	2		1	-	
CO4						3		2		1		

Personality Development

Course Code : MCE181 B

Contacts: 2-0-0

Credit Points : 2

Total Lectures : 24 L

COURSE OUTCOMES

1. Understanding the concepts of personality and self esteem
2. Basic knowledge of attitude and motivation
3. Basic skill development for stress management
4. Development of leadership quality and positive attitude

MODULE I Introduction to Personality Development (5L)

The concept of personality - Dimensions of personality – Theories of Freud & Erickson-Significance of personality development. The concept of success and failure: What is success? - Hurdles in achieving success - Overcoming hurdles - Factors responsible for success – What is failure - Causes of failure. SWOT analysis.

MODULE II: Attitude & Motivation Attitude (5L)

Concept - Significance - Factors affecting attitudes - Positive attitude – Advantages –Negative attitude- Disadvantages - Ways to develop positive attitude - Differences between personalities having positive and negative attitude. Concept of motivation - Significance – Internal and external motives - Importance of self- motivation- Factors leading to de-motivation

MODULE III: Self-esteem (5L)

Term self-esteem - Symptoms - Advantages - Do's and Don’ts to develop positive self-esteem – Low self esteem - Symptoms - Personality having low self esteem - Positive and negative self esteem. Interpersonal Relationships – Defining the difference between aggressive, submissive and assertive behaviours - Lateral thinking.

MODULE IV: Other Aspects of Personality Development (5L)

Body language - Problem-solving - Conflict and Stress Management - Decision-making skills - Leadership and qualities of a successful leader – Character building -Team-work – Time management - Work ethics –Good manners and etiquette

MODULE V: Employability Quotient (4L)

Resume building- The art of participating in Group Discussion – Facing the Personal (HR & Technical) Interview - Frequently Asked Questions - Psychometric Analysis - Mock Interview Sessions.

Text Books:

1. Hurlock, E.B (2006). Personality Development, 28th Reprint. New Delhi: Tata McGraw Hill.
2. Stephen P. Robbins and Timothy A. Judge(2014), Organizational Behavior 16th Edition: Prentice Hall.

Reference Books:

1. Andrews, Sudhir. How to Succeed at Interviews. 21st (rep.) New Delhi.Tata McGraw-Hill 1988.
2. Heller, Robert.Effective leadership. Essential Manager series. Dk Publishing, 2002
3. Hindle, Tim. Reducing Stress. Essential Manager series. Dk Publishing, 2003
4. Lucas, Stephen. Art of Public Speaking. New Delhi. Tata - Mc-Graw Hill. 2001
5. Mile, D.J Power of positive thinking. Delhi. Rohan Book Company, (2004).
6. Pravesh Kumar. All about Self- Motivation. New Delhi. Goodwill Publishing House. 2005.
7. Smith, B . Body Language. Delhi: Rohan Book Company. 2004

CO-PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C1	3	-	-	-	-	3	3	-	-	2	-	-
C2	-	1	-	-	-	-	-	2	-	-	3	2
C3	-	-	2	-	-	-	-	2	3	3	1	-
C4	-	-	-	-	-	-	3	-	3	-	2	3

Stress Management By Yoga

Course Code: MCE181C

Contacts: 2-0-0

Credit: 2

Courseobjectives:

Toprovidestudentsto achieve overall health of body and mind and to overcome stress.

Course Outcome:

CO1: Develop healthy mind in a healthy body thus improving social health also

CO.2: Improve efficiency.

Course Content:

Module1:

Definitions of Eight parts of yog. (Ashtanga) – aims & objectives of yoga – misconception about yoga. Historical perceptive on yoga

Module2:

Yam and Niyam; Do`s and Don'ts in life.

Ahinsa, satya, astheya, bramhacharya and aparigraha, Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

Asan and Pranayam

Module3: Various yog poses and their benefits for mind & body

Module4: Regularization of breathing techniques and its effects-Types of pranayam

Module5: Yoga and development of Social qualities of personality – Co-operation – Simplicity – Tolerance – Social adjustments – Yoga and personal efficiency. Improvement of personal efficiency through yoga.

References

1. 'Yogic Asanas for Group Tarining-Part-I" :Janardan Swami Yogabhyasi Mandal, Nagpur
2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, AdvaitaAshrama (Publication Department), Kolkata

CO-PO Mapping:

CO Codes	Program Outcomes (POs)											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	2	1	1	2	1	3	1	2	1	2
CO2	2	3	1	3	2	3	3	2	3	1	3	1

Advanced Digital Signal Processing

Course Code: MCE 201

Contacts: 3-0-0

Total contact hours: 40

Credit: 3

Prerequisite: Signals & Systems, Digital Signal Processing

Course Outcome:

After successful completion of course, students will be able to

CO1: Analyze and process discrete time signals in different transform domain.
CO2: Design filters to suit specific requirements for specific applications.

CO3: Design multi rate signal processing of signals through systems.
CO4: Learn the different applications of digital signal processing on speech and image signal.

Course Content:

Module I [10L]

Review of basic DSP concepts: The concept of frequency in continuous time and discrete time signals. Concept of Discrete Time Fourier Transform and its properties. Relationship between Fourier Transform and Z-Transform. Properties of Z- Transform: Time reversal, convolution, correlation, Wiener-Khintchine theorem, frequency shifting, modulation, windowing theorem, differentiation in digital frequency domain. Inverse Z-transform, Relation between system function H (z) and frequency response function h(w). Frequency Domain Characteristics of LTI Systems Response to complex exponential signals, steady state and transient response to sinusoidal signals, steady state response to periodic signals, response to aperiodic signals.

Module II [10 L]

Different Transform Characteristics: DFT & FFT. Computation of DFT and it's properties, computation of DFT via FFT, chirp z-transform. Discrete cosine transforms (DCTs), Discrete sine transforms (DSTs), KL transforms, Hadamard transforms, Walsh transforms.

Module III [8L]

Design of Digital Filters: Bilinear transformation method of IIR filter design, Design of Low pass, high-pass, Band-pass, and Band stop- IIR digital filters, Design of FIR filters, Effect of various windows. Adaptive Filters design, FIR adaptive filters, steepest descent adaptive filter, LMS algorithm, convergence of LMS algorithms, Application: noise cancellation, channel equalization, adaptive recursive filters, recursive least squares.

Module IV [8L]

Multirate Signal Processing: Sampling Rate Conversion; Decimation and Interpolation; Time and Frequency Domain Characterization; Filters in Sampling Rate Alteration Systems; Multi-rate Design of Decimator and Interpolator; Fourier Transform and its limitations, Short Time Fourier Transform, Continuous Wavelet Transform, Discretization of the Continuous Wavelet Transform, Multiresolution Approximations; Wavelet and Scaling Function Coefficients.

Module V [4L]

Application of DSP: Speech processing, Speech analysis, Subband coding, Channel vocoder, application in Image Processing.

References:

1. Discrete – Time Signal Processing by A.V. Oppenheim and R. W. Schafer, with J. R. Buck (Prentice-Hall, 1998)

2. Digital Signal Processing Using MATLAB by V. K. Ingle and J. G. Proakis (Books/Cole,2000)

3. Digital Signal Processing: A Computer Based Approach by S.K. Mitra (Second edition , McGraw-Hill, 2001)

4. Digital Signal Processing: Principles, Algorithms and Applications by J. G. Proakis and D. G. Manolakis.

5. Digital Filter Design and Analysis, Antino, TMH. 6. Digital Signal Processing- Rabiner and Gold, PHI

CO-PO Mapping:

	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**P10**	**P11**	**P12**
CO1	3	3	1	2	-	3	-	2	2	2	1	2
CO2	2	3	2	1	2	2	-	2	2	-	2	3
CO3	3	2	1	3	-	3	1	3	1	1	1	2
CO4	3	3	-	2	-	-	1	1	1	2	2	1

WIRELESS AND MOBILE COMMUNICATION

Subject Code: MCE202
Contacts: 3-0-0
Total contact hour- 40
Credits: 3

Course Outcome:

CO1: Students will be able to Design appropriate mobile communication systems and will also be able to apply frequency-reuse concept in mobile communications, and to analyze its effects on interference, system capacity, hand off techniques.

CO2: Students will be able to distinguish various multiple-access techniques for mobile communications e.g. FDMA, TDMA, CDMA, and their advantages and disadvantages.

CO3: Students will be able to alyze path loss and interference for wireless telephony and their influences on a mobile communication system's performance.

CO4: Students will be able to analyze and design CDMA system functioning with knowledge of forward and reverse channel details, advantages and disadvantages of using the technology.

CO5: Students will be able to understanding upcoming technologies like 3G, 4G and 5G.

Course Content:

Module1: Cellular Communication Fundamentals: Evolution of mobile radio communications, mobile radio systems around the world, trends in cellular radio and personal communication, first generation (1G), second generation (2G), third generation (3G) mobile cellular networks, Cellular system design, Frequency reuse, cell splitting, handover concepts, Co channel and adjacent channel interference, interference reduction. Techniques and methods to improve cell coverage, Frequency management and channel assignment, GSM architecture and interfaces, GSM architecture details, GSM subsystems, GSM Logical Channels, Data Encryption in GSM, Mobility Management, Call Flows in GSM.2.5 G Standards:

High speed Circuit Switched Data (HSCSD), General Packet Radio Service (GPRS), 2.75 G Standards: EDGE. [**10L**]

Module2: Spectral efficiency analysis based on calculations for Multiple access technologist, FDMA and CDMA, Comparison of these technologies based on their signal separation techniques,advantages, disadvantages and application areas. Wireless network planning (Link budget and power spectrum calculations). [**6L**]

Module3: Mobile Radio Propagation: Large Scale Path Loss, Free Space Propagation Model, Reflection, Ground Reflection (Two-Ray) Model, Diffraction, Scattering, Practical Link Budget, Design using Path Loss Models, Outdoor Propagation Models, Indoor Propagation Models, Signal Penetration into Buildings. Small Scale Fading and Multipath Propagation, Impulse ResponseModel, Multipath Measurements, Parameters of Multipath channels, Types of Small-Scale Fading:Time Delay Spread; Flat, Frequency selective, Doppler Spread; Fast and Slow fading. [**6L**]

Module4: Equalization, Diversity: Equalizers in a communications receiver, Algorithms for adaptive equalization, diversity techniques, space, polarization, frequency diversity, Interleaving. [**4L**]

Module5: Code Division Multiple Access: Introduction to CDMA technology, IS 95 system Architecture, Air Interface, Physical and logical channels of IS 95, Forward Link and Reverse link operation, Physical and Logical channels of IS 95 CDMA, IS 95 CDMA Call Processing, soft Handoff, Evolution of IS 95 (CDMA One) to CDMA 2000, CDMA 2000 layering structure and channels. [**5L**]

Module6: Higher Generation Cellular Standards:3G Standards: evolved EDGE, enhancements in 4G standard, Architecture and representative protocols, call flow for LTE, VoLTE, UMTS. [**3L**]

Module7: Introduction to 5G. 5G-Key Technologies: Small cells: Past, present, and future trends of cellular networks coverage and capacity of small cell networks Interference management, D2D architecture Towards IoT Spectrum sharing. [**3L**]

Module8: Massive MIMO: Point-to-point MIMO, Virtual MIMO (relaying), multiuse MIMO Massive MIMO [**3L**]

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	3	3	2	-	-	-	2	3	3
CO2	2	3	3	2	3	2	-	-	-	1	2	3
CO3	3	3	2	3	2	3	-	-	-	2	3	2
CO4	3	3	2	3	2	3	-	-	-	1	2	3

REFERENCES:

1. Wireless communication and Networking by V.K. Garg, Morgan Kauffman Publisher, 2009
2. Wireless Communication & Network, 3G & beyond, by Iti Saha Misra, McGrawHill, 2009

3. Wang, Wireless communication System, Pearson Education
4. Talukdar, Mobile computing, TMH
5. J.W.Mark, W. Zhuang, Wireless Communication and Networking, PHI
6. A. Santamaria et al, Wireless LAN systems, Artech House.
7. K. Feher, Wireless digital communications, Prentice Hall of India.
8. Roy Blake, Wireless communication technology, Thomson Delmer.
9. V.K.Garg, J.E.Wilkes, "Principle and Application of GSM", Pearson Education, 5th edition, 2008.
10. V.K.Garg, "IS-95 CDMA & CDMA 2000", Pearson Education, 4th edition, 2009.
11. T.S.Rappaport, "Wireless Communications Principles and Practice", 2nd edition, PHI,2002.
12. William C.Y.Lee, "Mobile Cellular Telecommunications Analog and Digital Systems", 2nd edition, TMH, 1995.
13. Asha Mehrotra, "A GSM system Engineering" Artech House Publishers Bosten, London,1997
14. Wireless communications: principles and practice, by Theodore S. Rappaport, PHI / Pearson education.
15. Mobile communications, J. Schiller, Addison-Wesley.
16. Mobile cellular telecommunication – analog and digital systems, William C. Y. Lee, McGraw Hill, 2nd edition

MIMO AD HOC AND COGNITIVE RADIO NETWORKS

Course Code: MCE203A

Contacts: 3-0-0

Total Contact Hour: 36

Credit: 3

Prerequisite: Knowledge of Wireless Communication

Course Outcome:

CO1: To understand and gain complete knowledge about mimo Ad hoc Networks and the various protocols used in mimo Ad hoc networks.

CO2: An ability to apply knowledge of mathematics, science and engineering in the emerging areas of RF communication

CO3: An ability to analyse a situation and to learn and apply modular approach.

CO4: An ability to understand research work in new areas of cognitive radios and spectrum hole sensing.

Course Content:

Module1:
MIMO Ad hoc wireless Network: **[4L]**
Introduction, Basic concept on mimo ad hoc network, structure of mimo ad hoc network, transmitter-receiver constraints,Applications, MAC protocol: IEEE802.11 in mimo ad hoc mode.

Module2:
Routing protocols in wireless mimo ad hoc network: **[4L]**
Proactive, Reactive and hybrid routing protocol, Destination sequenced distance vector algorithm, Dynamic source routing, Ad hoc on-demand routing, Multipath Routing

Module3:

Analysis of TCP performance in wireless mimo ad hoc network:[5L]
TCP window management and problems, different solution schemes, QoS in wireless mimo ad hoc network
Achieving energy efficiency in wireless mimo ad hoc network: Different schemes to increase the lifetime of the node in mimo ad hoc network – MAC layer protocol, Routing protocol

Module4:
Introduction to software defined radio: [7L]
Definitions and architecture evolution and implications. basic hardware architecture of software defined radio Differences between software enable radio and software defined radio. Essential functions of the software radio, Computational processing resources, software architecture, top level component interfaces and topologies among plug and play modules

Module5:
Cognitive radio technology:[7L]
Introduction, Radio flexibility and capability ,Comparison of Radio capabilities and Properties, Technologies – IEEE 802 Cognitive Radio related activities – Application, position awareness and optimization of radio resources, Artificial Intelligence Techniques.

Module6:
Cognitive radio design and Spectrum Sensing: [9L]
Cognitive Radio – functionalities, components and design rules, Cognition cycle – orient, plan, decide and act phases, Cognitive Radio Architecture on Software defined Radio. Design Challenges associated with cognitive radio. Spectrum sensing, spectrum management, spectrum mobility, spectrum sharing, cross – layer design, spectrum optimization, Energy detector-based sensing – Radio Identifier, Cooperative sensing- other sensing methods.

Text Books

11. Stefano Basagni, Marco Conti, Silvia Giordano and Ivan Stojmenovic, "Mobile Ad Hoc Networking", John Wiley, 2004
12. George Aggelou "Mobile Ad Hoc Networks", McGrawHill, 2004..
13. Amitabh Mishra "Security and Qualityof Service in Ad hocWireless Networks", Cambridge University Press, 2008.
14. Simon Haykin, "Cognitive Radio: Brain-Empowered Wireless Communication", IEEE Journal on selected areas in communications, Feb 2005.

Reference books:

1. Joseph Mitola III, "Software Radio Architecture: Object-Oriented Approaches to wireless system Engineering", John Wiley & Sons Ltd. 2000

2. Thomas W. Rondeau, Charles W. Bostain, "Artificial Intelligence in Wireless communication", ARTECH HOUSE. 2009.

3. Bruce A. Fette, "Cognitive Radio Technology", Elsevier, 2009.

4. Ian F. Akyildiz, Won- Yeol Lee, Mehmet C. Vuran, Shantidev Mohanty, "Next generation / dynamic spectrum access / cognitive radio wireless networks: A Survey" Elsevier Computer Networks, May 2006

5. Sivaram Murthy. C and Manoj. B.S "Ad Hoc Wireless Networks", Pearson Education, Second Edition India, 2001.

CO-PO MAPPING:

CO Codes	Program Outcomes (POs)											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	2	1	1	2	1	3	1	2	1	2
CO2	2	3	1	3	2	3	3	2	3	1	3	1
CO3	2	3	2		1	2	2		1	2	2	3
CO4	1		1	1	1		1	3	1	1	1	1

Satellite and Space Communication
Course Code: MCE203B
Contacts: 3-0-0
Total Contacts Hours: 36
Credit: 3
Prerequisite: Basics of Digital signal processing, Digital communication

Course Outcomes: After this course students will be able to

CO1: Understand role of random process in ststistical signal processing
CO2: Understand signal modelling techniques
CO3: Comprehend the role of Binary Symmetric Channels
CO4: Understand the theory of hypothesis testing
CO5: Comprehend various digital filter design approaches

Course Content:

Module 1: Random Process: Definition and description of random processes with practical examples. Time average, ensemble average, covariance, autocorrelation, cross correlation, Stationary process, ergodic process, WSS process, power spectrum of random processes. Filtering of random processes – filtering of white noise, spectral shaping filter, spectral factorization. **9L**

Module 2: Signal Modeling: Least square method, Filter design using Padé approximation, Prony's method of signal modeling, filter design using Prony's method, FIR least square inverse filter, Stochastic models – MA model, AR model, ARMA model. **7L**

Module 3:Binary Symmetric Channel: Principle, Properties, Probability of bit error calculation,Cascade of two Binary Symmetric Channels **5L**

Module 4: Theory of Hypothesis: Decision theory, Bay's likihood ratio, ideal observer strategy, Neyman-Pearson strategy, Bay's strategy for single and multiple sample values, optimum linear estimation composite hypothesis testing, optimum detection with incomplete knowledge of the signal **8L**

Module 5: Filter Theory: Principle of optimum filter, matched filter, achievable bit error rate. FIR Wiener filter – principle and design. Forward and Backward linear prediction,Lattice Filter,Linear prediction in noise, noise cancellation IIR Wiener filter , Kalman filter. **7L**

Text Books:

1. Statistical digital signal processing and modeling, - Monson N. Hays – Wiley.
2. Algorithms for Statistical signal processing -Proakis et.el -Pearson
3. Statistical Signal Processing,Scharf,Pearson

Reference Books:

1. Digital communication, 4th ed. - J. G. Proakis, MGH International Edition
2. Digital and Analog Communication Systems, 7th ed. – Leon W. Couch, PHI.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	1	-	-	2	-	-	-	-	-	3
CO2	-	3	-	2	-	1	-	-	-	-	-	3
CO3	2	-	-	-	1	-	3	-	-	-	-	3
CO4	3	-	1	-	-	-	2	-	-	-	-	3
CO5	2	-	2	-	-	3	1	-	-	-	-	3

Cryptography & Network Security
Subject Code: MCE203C
Contacts: 3-0-0
Total Contact Hour- 36
Credits: 3

Course Outcome:

CO1: Students will be able to Identify and utilize different forms of cryptography techniques.

CO2: Students will be able to incorporate authentication and security in the network applications.

CO3: Students will know about algorithms applied for encryption

CO4: Students will be able to distinguish among different types of threats to the system

CO5: Students will acquire knowledge about security challenges and some concepts in web security and security systems using VPN and Firewalls

Course Content:

Introduction to Security: [10L]
Principles of security, Overview of network security and cryptography and its need, security services, Attacks, OSI Security Architecture, one-time passwords, Model for Network security, Classical Encryption Techniques like substitution ciphers, block ciphers, Transposition ciphers, Cryptanalysis of Classical Encryption Techniques. Contemporary Symmetric Ciphers, and confidentiality using symmetric encryption; Concept on Virus, Worm, Trojan Horse, Spam etc.

Private-Key (Symmetric) Cryptography: **[6L]**
Block Ciphers, Stream Ciphers, RC4 Stream cipher, Data Encryption Standard (DES), Advanced Encryption Standard (AES), Triple DES, RC5, IDEA, Linear and Differential Cryptanalysis.

Public-Key (Asymmetric) Cryptography: **[6L]**
RSA, Key Distribution and Management, Diffie-Hellman Key Exchange, Elliptic Curve Cryptography, Message Authentication Code, hash functions, message digest algorithms:MD4 MD5, Secure Hash algorithm, RIPEMD-160, HMAC.

Authentication: **[6L]**
Digital Signatures, Digital Signature Standards,Authentication Protocols, Biometric Authentication, Kerberos, IP security Architecture, Encapsulating Security Payload, Key Management, ,Secure Socket Layer and Transport Layer Security, Smart cards and security, Secure Electronic Transaction.

System Security and Web Security: **[8L]**
Intruders, Intrusion Detection, Password Management, Worms, viruses, Trojans,Virus Countermeasures, Firewalls, Firewall Design Principles, Trusted Systems. Web Security Considerations,(SSL and TLS), E – cash and Secure Electronic Transaction (SET), System security using Firewalls and VPNs. Advance Applications of Network Security: Enterprise Application Security, Database Access Control, Security and Privacy Issues in RFIDs

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	3	3	2	-	-	-	1	3	3
CO2	2	3	3	2	3	2	-	-	-	1	2	3
CO3	3	2	3	3	2	3	-	-	-	2	3	2
CO4	3	3	2	3	2	2	-	-	-	1	3	3

REFERENCES:

1. William Stallings, “Cryptography and Network Security, Principles and Practices, Pearson Education, 3rd Edition.

2. Charlie Kaufman, Radia Perlman and Mike Speciner, “Network Security, Private Communication in a Public World”, Prentice Hall, 2nd Edition

3. Atul Kahate, Cryptography and Network Security, Tata McGraw Hill.

4. Trappe & Washington, Introduction to Cryptography with Coding theory, Pearson Education.

5. William Stallings, Network Security Essentials, Pearson Education.

6. Behrouz A. Forouzan, , Cryptography and Network Security, McGraw – Hill

7. Christopher M. King, Ertem Osmanoglu, Curtis Dalton, “Security Architecture, Design Deployment and Operations”, RSA Pres,

8. Stephen Northcutt, LenyZeltser, Scott Winters, Karen Kent, and Ronald W.Ritchey, “Inside Network Perimeter Security”, Pearson Education, 2nd Edition

9. Richard Bejtlich, “The Practice of Network Security Monitoring: Understanding Incident Detection and Response”, William Pollock Publisher, 2013.

Multimedia Communication

Code: MCE204A

Contact Hours: 3:0:0

Total Contact Hours: 36

Credits: 3

Prerequisites: Computer Network, DBMS, Operating system, Information theory and Coding

Course Outcomes:

CO1: Understand fundamentals of Multimedia communication.

CO2: Analyze different compression techniques of multimedia communication

CO3: Analyze the operating system of multimedia communication.

CO4: Develop video and image segmentation and streaming techniques.

CO5: Design effective multimedia communication systems.

Course Content:

Module 1 **[10L]**

Introduction

Concept of Media and Data Streams, Different types of media, Characteristics of multimedia system. Multimedia information representation, Sound, Images & Video communication, Speech synthesis, Speech Recognition, Raster display, Image recognition, TV, HDTV, Speech transmission, Image transmission.

Module 2 **[6L]**

Compression

Huffman Coding, Runlength coding, JPEG, MPEG, DVI, H.261, Audio and video compression: Introduction, Audio compression, video compression, video compression principles, video compression

Module 3 **[4L]**

Multimedia Operating system

Resource Management, Disk Layout, Scheduling, Process Management: EDF, Rate monotonic Algorithms. System Architecture: Quick Time, MDBMS.

Module 4 **[6L]**

Indexing and Segmentation

Indexing Structures, R-trees family, Interval trees family, Special structures for 3D Motion data indexing Metadata Generation-Image & Video Segmentation, Shape-based 3D Retrieval,Video streaming, 3D models streaming, 3D animation streaming,

Module 5 **[6L]**

Multimedia Communication Network

Application of IP networks for multimedia communication, Implementation of DSL for multimedia communication, ADSL, Packet audio/video in the network environment, Video transport across generic networks, Multimedia Transport across ATM Networks.

Module 6 **[4L]**

Qos issues for Multimedia Communication Systems

Delay compensation, QoS negotiation protocols, Architectures and Issues for Distributed Multimedia Systems, Prototype Multimedia systems: Video-on-Demand, Video conferencing. Multimedia Information: Delay-sensitive and Time-based Media data Modeling

Text Books:

1. Ralf Steinmetz and KlaraNahrstedt, "Multimedia: Computing, Communications and Applications", Prentice Hall PTR, 1995.
2. Fred Halsall,Multimedia Communications: Applications, Networks, Protocols And Standards, Pearson Education India, 2001
3. Franklin Kuo, Wolfgnag and J.J. Garsia, "Multimedia Communications, Protocols and Applications", Prentice Hall PTR 1998.

References Books:

1. K. R. Rao, Zoran S. Bojkovic, Dragorad A. Milovanovic, ―Multimedia Communication Systems‖, Pearson education, 2004.
2. Raifsteinmetz, Klara Nahrstedt, ―Multimedia: Computing, Communications and Applications‖, Pearson education, 2002.

CO-PO Mapping:

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

Artificial Intelligence & Machine Learning

Course Code: MCE 204B

Contacts: 3-0-0

Total Contact Hours: 40

Credit: 3

Prerequisite:

• Strong knowledge of mathematics

• Good command over programming languages

• Good Analytical Skills

• Ability to understand complex algorithms

Course Outcome:

After successful completion of course, students will be able to

CO1: Understand the concept of AI

CO2: Demonstrate different types of learning methods.

CO3: Understand a wide variety of Machine learning algorithms.

CO4: Apply different Machine Learning algorithms on real world problem.

Course Content:

Module I [8L]

Definition of AI, Agents and environment, Knowledge, Information, Data, Knowledge based system, Expert System, Data driven and goal driven search- Breadth-first search, Depth first search, Bidirectional search, Greedy Search, A* Search, Hill climbing, simulated annealing, Propositional logic, first order predicate logic (FOPL), Rule of inference, Bayes' rule and Bayesian Networks.

Module II [4L]

Definition of Machine learning system, Goals and applications of machine learning. Aspects of developing a learning system: training data, concept representation, function approximation, concept of different learning systems.

Module III [7L]

Introduction to regression, Simple linear regression, Evaluation metrics in regression model, Multiple linear regression, Non-Linear regression, Sum of squared errors, polynomial regression, Least square method, Weighted Least Squares method, Gradient descent algorithm, Effect of bias and variance, overfitting, underfitting.

Module IV [10L]

Classifiers based on Baye's decision theory: Bayesian classification for normal distribution, Bayesian inference. Estimation of unknown probability distributions. Baye's error. Logistic Regression, Entropy, Information Gain, Decision Tree classifier, K-NN classifier, The peceptron algorithm. Suport Vector Machine (SVM): separable and nonseparable classes. An introduction to nonlinear classifiers: the XOR problem, the two layer perceptron and radial basis function (RBF) network. Confusion matrix, different

measures related to classification.

Module V [6L]

Basic concept of cluster analysis, applications of cluster analysis, Different clustering algorithms: k-Means, Density based clustering, Hierarchical clustering, Cluster validity.

Module VI [5L]

Introduction to recommendation system, Collaborative Filtering, Content based recommender systems. Application Areas: Qualitative discussions on different application areas of A.I and Machine Learning e.g. Image pattern recognition.

TEXT BOOKS:

1. Artificial Intelligence: A Modern Approach, Russell & Norvig, Prentice Hall

2. Pattern recognition and machine learning by Christopher M. Bishop, Springer

3. Understanding Machine Learning by Shai Shalev-Shwartz and Shai Ben-David, Cambridge University Press

4. Pattern Classification by Richard O Duda, Peter E. Hart & David G. Stock,John Wiley.

5. Pattern Recognition by Konstantinos Koutroumbas, Sergios Theodoridis,Elsevier

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	2	-	-	-	1	3	3
CO2	3	3	3	3	3	2	-	-	-	1	3	3
CO3	3	3	3	3	2	3	-	-	-	2	3	3
CO4	3	3	3	3	2	1	-	-	-	1	3	3

IMAGE PROCESSING AND PATTERN RECOGNITION

Course Code: MCE 204C

Contacts: 3-0-0

Total contact hours: 40

Credit: 3

Prerequisite:

The candidates should have the basic knowledge of Engineering Mathematics and Statistics.

Course Outcome:

After completion of the course students will be able to

CO1: Understand the basics of image processing and pattern recognition.

CO2: Able to apply different image processing methodologies.

CO3: Understand the importance of feature selection and generation.

CO4: Able to apply classification and clustering algorithms.

Course Content:

Part – A : Image Processing

Module1: Basics: Image definition, a simple image formation model, basic concepts of image sampling and quantization, representing a digital image, concept of pixel/ pel, spatial and gray level resolution, some basic relationships between pixels : Neighbors of a pixel, Adjacency, Connectivity, Path, Connected component, Connected component labeling. Distance measures: the three essential properties, Euclidean, City-Block and Chess-Board distance, concept of image operations on a pixel basis. **[8L]**

Module2: Popular image processing methodologies: Spatial domain technique : contrast stretching, basic point processing, thresholding function, concept of mask/ sub image, mask processing/ filtering, gray-level slicing, bit-plane slicing. Basics of spatial filtering: convolution mask/kernel, concept of sliding mask throughout the image-space, smoothing (averaging) filter/ low pass filter. Image segmentation by global and local gray level thresholding, region growing, region splitting and merging techniques, Morphological algorithms: thinning, thickening, skeletons. **[8L]**

Module3: Color image processing: Perception of color: color fundamentals. Popular color models: RGB , HSI, CMY, CMYK and their conceptual relationships, Color Transformations,Image segmentation based on color. **[4L]**

Part – B : Pattern Recognition

Module4: Basics: Concept of a pattern: feature, feature vectors and classifiers. Importance of pattern recognition **[2L]**

Module6: Clustering and Classification: Basic concept of cluster analysis. Similarity (Proximity) metrics (indices) and clustering criteria. Partitional clustering: Extraction of natural groups that are inherent in some data set by hard c-means (k-means), fuzzy c-means. Definition of classification. Basic task of a classifier. Concept of training & testing data and overfitting. Bayes classification: Bayes' Theorem, Naïve Bayesian classification **[8L]**

Module7: Feature Selection and Generation: Introduction, Pre-processing, Feature Selection Based on Statistical Hypothesis Testing, Class Separability Measures, Feature Subset Selection, Optimal Feature Generation, Data Transformation and Dimensionality Reduction, Basis Vectors and Images , The Karhunen-Loeve Transform , The Singular Value Decomposition , Independent Component Analysis , Nonnegative Matrix Factorization, Nonlinear Dimensionality Reduction, The Discrete Fourier Transform (DFT) , The Discrete Cosine and Sine Transforms , Discrete Time Wavelet Transform (DTWT). **[8L]**

Module8: Application: Image based face recognition: Basic technique for Eigen face generation & recognition Image based signature verification**. [2L]**

TEXT BOOK:

1. Rafael C. Gonzales, Richard E. Woods, "Digital Image Processing", Third Edition, Pearson Education,2010.

2. S. Annadurai, R. Shanmugalakshmi, "Fundamentals of Digital Image Processing", Pearson Education,2006

3. Digital Video processing, A Murat Tekalp, Prentice Hall 4. Video Processing and Communications, Yao Wang, J. Osternann and Qin Zhang,Pearson Education

4.Pattern Recognition by Sergios Theodoridis and Konstantinos Koutroumbas, Elsevier
5. Pattern Recognition Statistical, Structural and Neural Approaches by Robert Schalkoff, Wiley
6. Pattern Recognition and Machine Learning by Christopher Bishop, Springer

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	2	-	-	-	1	3	3
CO2	3	3	3	3	3	2	-	-	-	1	3	3
CO3	3	3	3	3	2	3	-	-	-	2	3	3
CO4	3	3	3	3	2	1	-	-	-	1	3	3

Design And Simulation Lab
Code: MCE 291
Contacts: 0-0-3
Credits: 2

Design and simulation of various signal processing technique/ communication systems/ subsystems with the help of suitable advanced software e.g. PYTHON/MATLAB/ LABVIEW/ NS/ PUFF/ IE3D/ ANSOFT/ HFSS/ CST/ QUALNET/ MICROWAVE OFFICE etc.

List of experiments (Perform any 10 experiments from the list):

1. Digital filters – ripples in pass band & stop band, slope in transition band, poles & zeros etc.
2. Design of Butterworth filter
3. Design of Chebyshev filter.
4. Effect of upsampling and downsampling in frequency domain,
5. Effect of upsampling on anti-imaging filter
6. Effect of downsampling on anti-aliasing filter
7. Power spectrum estimation using periodogram.
8. Computation of discrete cosine transform and wavelet transform of signal.
9. ADPCM – granular noise & quantization noise.
10. MPSK – signal bandwidth, PSD, distinguishability, scatter plot etc.
11. Digital filters – ripples in pass band & stop band, slope in transition band, poles & zeros etc.
12. Optimum filters for receiving base band random binary data – Pe vs. S/N.
13. Signal bandwidth and Pe vs. S/N in different modes of line coding.
14. Signal bandwidth and Pe vs. S/N in different modes of modulation.
15. Error rates in error control for different types of error control coding.
16. Throughput vs. input density in different MAC protocols.
17. DSSS – error rate due to different types of chip code.
18. Fading channel/ multipath transmission and Rake receiver.
19. Cellular architecture, WiFi, WiMAX using QUALNET.
20. OFDM using QUALNET.
21. Different routing algorithms & protocols.

22. Characterization of micro strip antenna.
23. Characterization of transmission lines.
24. Study of important parameters and practical considerations in microwave circuits.

Wireless And Mobile Communication Lab

Subject Code: MCE292

Contact hour: 0:0:3

Total contact hours: 36

Credits: 2

Course Outcome:

CO1: The students will be able to correlate different theories of wireless communication and fiber optics with practical experiments .

CO2: The students will be able to understand operations of repeater station, GPS and GSM cellular systems

CO3: The students will be able to learn the procedures for testing radio parameters

CO4: The students will be able to learn working of fiber optic links

CO5: The students will be able to understand bending losses, NA

List of Experiments:

1. Study of working of Repeater stations with the help of Satellite communication system

2. Study of GSM handset for various signalling and fault insertion techniques (Major GSM handset sections: clock, SIM card, charging, LCD module, Keyboard, User interface).

3. Study of Global Positioning System (GPS) and plotting of active satellites with SNR etc.

4. Measurement of some important receiver parameters of a radio receiver like:

i) SNR ;ii) Distortion with ISM band radio.

5. Measurement of some important transmitter parameters of a radio receiver like: VSWR for

i) different antennae and ii) at different frequencies with ISM band radio.

6. To learn and develop concepts of Software Radio in real time environment by studying the building blocks like Base band and RF section, convolution encoder, Interleaver and De-Interleaver.

7. Measurement of wavelength of an optical fiber source

8. Measurement of propagation loss, bending loss and connector loss in an optical fiber

9. Study of a fiber optic analog link, study of PAM

10. Study of Frequency Division Multiplexing (FDM) and De multiplexing

11. Study of a fiber optic data link and study of TDM

12. Measurement of numerical aperture of an optical fibre

Pedagogy Studies

Course Code: MCE 282A

Total Contact Hour/Week: 2L

Course Outcome: After successful completion of this course, students should be able to:

CO1: Learn that how pedagogic practices support most effectively support all students to learn at primary and secondary levels in developing countries.
CO2: How can teacher education and guidance materials best support effective pedagogy
CO3: Learn the relation between pedagogy, curriculum and teacher education that support maximum change in teachers' practices and which are more likely to lead to increases in student learning attainment

Module 1: Introduction and Methodology: Aims and rationale, Policy background, Conceptualframework and terminology, Theories of learning, Curriculum, Meaning of Teacher Education, Teaching skills. Professional skills, Theoretical and conceptual framework in research. Overview of methodology and Searching.

Module 2: Thematic overview: Pedagogical practices are being used by teachers in formal andinformal classrooms in developing countries: Overview and aims, Pedagogy, Curriculum,Teacher education.

Module 3: Evidence on the effectiveness of pedagogical practices, Methodology for the in depthstage: quality assessment of included studies. How can teacher education (curriculum andpracticum) 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, Teachers' attitudes and beliefs and Pedagogic strategies.

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

Module 5: Research gaps and future directions, Research design, Contexts, Pedagogy, Teachereducation Curriculum and assessment, Dissemination and research impact.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	1	2	-	1	1	2	3
CO2	-	-	-	-	-	-	2	2	-	1	1	3
CO3	-	-	-	-	-	1	2	-	-	-	2	1

English For Research Paper Writing

Course Code: MCE 282B
Contacts: 2:0:0
Total Contact Hours: 24L

Prerequisite:

The candidates should have the basic knowledge of English literature and communication skill.

Course Outcomes:

Students will be able to:
CO1. Understand that how to improve your writing skills and level of readability.
CO2. Learn about what to write in each section.
CO3. Learn how to summarize the whole work, contributes to the overall field of study.
CO4. Understand the skills needed when writing a Title Ensure the good quality of paper at very first time submission.

Module 1: [5L]
Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding doubts and Imprecision

Module 2: [7L]
Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Forming compact title and keywords,
Learn to write summary of the project as abstracts, collect related information, Introduction, Review of the Literature,

Module 3:[6L]
Methods, Results, Discussion, Conclusions, Introduce figures and tables or charts, The Final Check, Proofing

Module 4: [6L]
Key skills are needed when writing a Title, an Abstract, an Introduction, the Literature Review

Module 5: [6L]
Skills are needed when writing the Methods, able to explain Results and Discussion briefly, sort out the major points of discussion when writing the Conclusions

Module 6: [6L]

Useful phrases, how to ensure paper is as good as it could possibly be the first-time submission

Reference Studies:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books) 2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press

3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman'sbook .

4. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	_	_	1	_	1	_	_	1	1	3	_	1
CO2	_	_	_	_	_	_	_	_	1	3	_	_
CO3	_	_	_	_	_	_	_	1	_	3	_	_

CO4	_	_	_	_	_	_	_	1	_	3	_	_
CO5	_	_	_	_	_	_	_	1	_	3	_	_
CO6	_	_	_	_	_	_	_	_	_	3	_	1

Disaster Management

Course Code: MCE 282C
Contacts: 2:0:0
Total Contact Hours: 24L

Course Outcomes:

Students will be able to:
CO1. Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
CO2. Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
CO3. Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
CO4. 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.

Module 1: [5L]
Disaster: Definition, difference, nature and magnitude, Types of Disaster, Natural (Flood, Cyclone, Earthquakes, Landslides etc) & Man-made Disaster (Fire, Industrial Pollution, Nuclear Disaster, Biological Disasters, Air, Sea, Rail & Road accidents, Structural failures (Building and Bridge), War & Terrorism etc, Factors Contributing to Disaster Impact and Severity

Module 2: [5L]
Repercussions of various types of Disasters, Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem, Outbreaks of Disease and Epidemics, Natural Disaster-prone areas in INDIA, Areas prone to o Earthquake, Floods and Droughts, Landslides and Avalanches, Cyclonic And Coastal Hazards such as Tsunami, Trends of major Disasters and their Impact on India

Module 3: [5L]
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

Module 4: [5L]
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, Tracking of disaster, Warning mechanisms, People's Participation in Risk Assessment, Strategies for Survival.

Module 5: [4L]
Rehabilitation, Reconstructions and RecoveryReconstruction and Rehabilitation as a Means of Development, Post Disaster effects and Remedial Measures, 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.

SUGGESTED READINGS:

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies", New Royal book Company.
2. Sahni, Pardeep et.al. (Eds.)," Disaster Mitigation Experiences And Reflections", Prentice Hall of India, New Delhi.
3. Goel S. L., Disaster Administration And Management Text And Case Studies", Deep & Deep Publication Pvt. Ltd., New Delhi.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	1	_	1	_	1	_	_	1	1	_	_	1
CO2	_	_	_	_	_	_	_	_	1	_	_	_
CO3	1	_	_	_	2	_	_	1	_	_	_	_
CO4	_	_	_	_	_	_	_	1	_	_	_	_
CO5	_	_	_	_	_	_	_	1	_	_	_	_

SEMESTER III

Automation in VLSI Design

Course Code : MCE301A
Contacts: 3:0:0
Total Contact hours: 36
Credits: 3

COURSE OUTCOME:

1. Students will understand MOS Transistor Based Digital VLSI Circuits
2. Students will understand Physical Layout Design of Digital VLSI Design
3. Students will understand VLSI Design Cycle and learn Verilog HDL (Hardware Description Language)
4. Students will learn High level and Logic level Synthesis Algorithm
5. Students will learn Floorplan, Placement and Routing Algorithm

Course Content:

MODULE I: VLSI CIRCUITS AND PHYSICAL LAYOUT: [10L]

Unit 1: MOS Transistor Characteristics, MOS as Digital Switch, NMOS Logic Family,CMOS Logic Family, CMOS Inverter Characteristics (VTC), Inverter Delay, CMOS Gates like NAND and NOR gates,

Pass Transistor Logic and Transmission Gate,CMOS Sequential Circuits, CMOS D-Latch and D-Flip-Flop

Unit 2: CMOS Cross Section, Layout and Mask layers, Inverter Layout, Lambda Rule vs Micron Rule, Std Cell Layout Topology, Stick Diagram, Euler Path Algorithm,Layout Legging.

MODULE II: VLSI DESIGN METHODOLOGY: [6L]

Unit1: Moore's Law, Scale of Integration (SSI, MSI, LSI, VLSI, ULSI, GSI),Technology growth and process Node,

Unit2: Full Custom Design, Std Cell based Semi Custom Design, VLSI Design Cycle, Y-Chart.

MODULE III: EDA TOOLS: HIGH LEVEL SYNTHESIS AND HDL: [8L]

Unit 1: High level Synthesis EDA Flow, Control and Data Flow Graph, Scheduling,Allocation, Binding, RTL

Unit 2: Why HDL ? Frontend Design Flow using HDL (Behavioral, RTL and Gate Level), Verilog Modeling: Behavioral, Data-Flow, Structural and Mixed, Test Bench,

FSM Example: Mealy Machine and Moore Machine. Pipeline Example.

MODULE IV: EDA TOOLS: LOGICAL SYNTHESIS AND PHYSICAL DESIGN [12L]

Unit 1: Combinational Logic Optimization: BDD: Binary Decision Diagram, OBDD,ROBDD, Technology Mapping: Pattern DAG, Subject DAG, Sequential Logic Optimization

Unit 2: Physical Layout Automation EDA Flow, Partitioning: KL Algorithm, Floor-planning cost function, Placement, Detailed Routing: Channel Routing, Horizontal Constraint Graph, Vertical Constraint Graph, Cyclic Constraint, Left-edge Algorithm, Global Routing: Steiner Tree, Maze Routing.

CO-PO Mapping:

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

IOT TECHNOLOGY
Course Code: MCE 301B
Contacts: 3:0:0
Total Contact Hours:36
Credits: 3

Prerequisite: Basic idea of Sensors, Actuators, Microcontroller, Computer Networks

Course Outcomes:

CO1: Understand the architure IoT.
CO2: Comprehend the Communication and Network Protocols in IoT.
CO3: Understand the role of development boards in IoT.
CO4: Comprehend the the role of Cloud Computing in IOT
CO5: Understand various applications of IoT.

Course Content:

Module 1: Introduction: 3L

Brief description of a digital communication system, Cause of errors and need for error control coding, broad classes of error and classes of error correcting codes, general expression of the probability of error in a binary symmetric Gaussian channel, Principle of maximum likelihood decoding.

Module 2: Linear algebra: 3L

Groups- definition, order of a group, modulo-m addition and multiplication tables, modulo-m subtraction and division, Fields- Definition, binary field, Galois field, Polynomials- The concept of polynomial expression, addition/subtraction/multiplication/division of polynomials over GF(2). Irreducible polynomials, primitive polynomials, Vector space, subspace, dual space – their properties and interrelations, Numerical exercises with manual computation and by using MATLAB.

Module 3: Linear block code: 7L

Definition of linear block code, Generator matrix, properties of generator matrix, Parity check matrix and its properties, Encoding circuit- operating principle, Syndrome- definition, most likelihood principle of error detection. Syndrome circuit- operating principle, Hamming distance, minimum distance, minimum weight, error detecting & error correcting capabilities, Standard array- construction, error detection with syndrome., Decoder-operating principle.

Module 4: Cyclic code: 7L

Definition, generator polynomial, properties of cyclic code and generator polynomial, Generator matrix, parity check matrix, their properties and interrelations, Design and operation of encoder, Design and operation of syndrome circuit, Design & operation of Meggitt decoder, Simulation test of above for data transmission through Gaussian binary symmetric channel, Cyclic Hamming code.

Module 5: Convolutional code: 7L

Definition, encoder, generator sequences, generator matrix, principle of constructing code words, numerical examples, code rate, constraint length, fractional rate loss. Finite state machine analysis of coder, state diagramme, code tree, Trellis. Principle of maximum likelihood decoding of convolutional code, Viterbi algorithm, Numerical examples of decoding and error detection/correction using Trellis, numerical examples using Trellis by MATLAB. Simulation test of above for data transmission through Gaussian binary symmetric channel. Distance properties of convolutional codes.

Module 6: Burst Error Correcting code: 4L

Burst –Error-Correcting Codes: Decoding of Single-Burst error Correcting Cyclic codes, Single Burst-Error-Correcting Cyclic codes, Burst-Error-Correcting Convolutional Codes, Bounds on Burst Error-

Correcting Capability, Interleaved Cyclic and Convolutional Codes, Phased-Burst –Error Correcting Cyclic and Convolutional codes.

Module 7: BCH code: 5L

Construction of Galois field GF(2m)- power representation, polynomial representation, n-tupple representation. Properties of GF(2m), conjugate roots, minimal polynomial, determining minimal polynomials. Description of BCH code, encoding, parity check matrix, error trapping and decoding.

Text Books And Reference Books:

1. Error Control Coding Fundamentals and Applications. – Shu Lin, Daniel J. Costello, Jr. - Prentice Hall.
2. Information Theory Coding and Cryptography. – Ranjan Bose, - TMH.
3. Fundamentals of Convolutional Coding. - Roft Johannesson and K. S. Zigangirov. - OUP.
4. Information and Coding Theory. – gareth A. Jones & J. Mary Jones. - Springer.
5. Error Correcting Codes. - Paterson, W. W. and Weldon, Jr. E. J. - Prentice Hall.
6. Applied Coding and Information Theory for Engineers. – Richard B. Wells. – Pearson Education.
7. Introduction to Error Control Codes. – Salvatore Gravano. – Oxford

CO-PO Mapping:

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

Deep Learning in Computer Vision
Course Code : MCE 301C
Contacts: 3:0:0
Total Lectures : 36 L
Credit Points : 3

COURSE OUTCOMES

1. Develop algorithms simulating human brain.
2. Explore the essentials of Deep Learning and Deep Network architectures.
3. Implement Neural Networks in Tensor Flow for solving problems.
4. Define, train and use a Deep Neural Network for solving real world problems that require artificial Intelligence based solutions.
5. Use deep learning methodology in real world application

Course Content:

MODULE 1: INTRODUCTION **(9L)**

Basics of Deep leaning- Deep learning architectures: Convolutional Neural Networks : Neurons in Human Vision-The Shortcomings of Feature Selection-Vanilla Deep Neural Networks Don't Scale- Filters and Feature Maps-Full Description of the Convolutional Layer-Max Pooling-Full Architectural Description of Convolution Networks-Closing the Loop on MNIST with Convolutional Networks- Image Preprocessing Pipelines Enable More Robust Models-Accelerating Training with Batch Normalization-Building a Convolutional Network for CIFAR-10-Visualizing Learning in Convolutional NetworksLeveraging Convolutional Filters to Replicate Artistic Styles-Learning Convolutional Filters for Other Problem Domains-Training algorithms.

MODULE 2:MEMEORY AUGUMENTED NEURAL NETWORKS **(9L)**

Memory Augmented Neural Networks : Neural Turing Machines-Attention-Based Memory Access- NTM Memory Addressing Mechanisms-Differentiable Neural Computers-Interference-Free Writing in DNCs-DNC Memory Reuse-Temporal Linking of DNC Writes-Understanding the DNC Read Head- The DNC Controller Network Visualizing the DNC in Action-Implementing the DNC in Tensor Flow- Teaching a DNC to Read and Comprehend.

MODULE 3 : TENSOR FLOW **(9L)**

Implementing Neural Networks in tensor Flow : What Is tensor Flow?-How Does Tensor Flow Compare to Alternatives?-Installing tensor Flow-Creating and Manipulating tensor Flow Variables- tensor Flow Operations-Placeholder Tensors-Sessions in tensor Flow-Navigating Variable Scopes and Sharing Variables Managing Model solver the CPU and GPU-Specifying the Logistic Regression Model in tensor Flow-Logging and Training the Logistic Regression Model-Leveraging Tensor Board to Visualize 24 Computation Graphs and Learning-Building a Multilayer Model for MNIST in Tensor Flow. Applications: Deep learning for computer vision, Deep Learning

MODULE 4: APPLICATIONS **(9L)**

Applications at the Enterprise Scale, Deep Learning Models for Healthcare Applications.

TEXT BOOKS

1. Simon Haykins, "Neural Network- A Comprehensive Foundation", Pearson Prentice Hall, 2nd Edition, 1999. ISBN-13: 978-0-13-147139-9/ISBN-10: 0-13-147139-2
2. Zurada and Jacek M, "Introduction to Artificial Neural Systems", West Publishing Company, 1992, ISBN: 9780534954604
3. Nikhil Buduma, Nicholas Locascio, "Fundamentals of Deep Learning: Designing NextGeneration Machine Intelligence Algorithms", O'Reilly Media, 2017.

REFERENCE BOOKS

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning (Adaptive Computation and Machine Learning series", MIT Press, 2017.
2. M T Hagan, H B Demoth, M Beale, "Neural Networks Design", Thomson Learning, 2002. ISBN10: 0-9717321-1-6/ ISBN-13: 978-0-9717321-1-7

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO2	**-**	**-**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

CO3	**-**	**-**	**2**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO4	**-**	**-**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO5	**-**	**-**	**-**	**-**	**2**	**3**	**3**	**-**	**-**	**-**	**-**	**-**

Course Name: Data Analytics

Course Code: MCE302A

Contacts: 3L

Total Contact Hours: 36

Credit: 3

Prerequisite: Numerical Knowledge of probability theory, statistics, and programming is desirable.

Course Outcome:

Post graduate students of ECE program will be able to:

CO1: Implement statistical analysis techniques for solving practical problems.

CO2: Perform statistical analysis on variety of data.

CO3: explore the fundamental concepts of big data analytics

CO4: understand the various search methods and visualization techniques.

CO5: learn to use various techniques for mining data stream

Course Contents

Module I: [6L]

Statistical Methods: Descriptive Statistics, Introduction to the course Descriptive Statistics Probability Distributions. Inferential Statistics: Inferential Statistics through hypothesis tests Permutation &Randomization Test. Regression & ANOVA (Analysis of Variance). Elements, Variables, and Data categorization.

Module II: [12L]

Machine Learning: Introduction and Concepts Differentiating algorithmic and model-based frameworks Regression: Ordinary Least Squares, Ridge Regression, Lasso Regression, K Nearest Neighbours Regression & Classification.

Supervised Learning with Regression and Classification techniques -1: Bias-Variance Dichotomy, Model Validation Approaches, Logistic Regression, Linear DiscriminantAnalysis, Quadratic DiscriminantAnalysis, Regression and Classification Trees, Support Vector Machines

Supervised Learning with Regression and Classification techniques -2: Ensemble Methods, Random Forest, Neural Networks Deep learning.

Unsupervised Learning and Challenges for Big Data Analytics: Clustering, Associative Rule Mining, Challenges for big data analytics

Prescriptive analytics: Creating data for analytics through designed experiments, Creating data for analytics through Active learning, Creating data for analytics through Reinforcement learning.

Module III [5L]

Data Visualisation: Visual Analytics and Business Performance Management Business Reporting Definitions and Concepts. Data and Information Visualization. Different Types of Charts and Graphs. The Emergence of Data Visualization and Visual Analytics

Module IV [5L]

Data Mining: Data Mining Concepts and Applications. Data Mining Applications. Data Mining Process. Data Mining Methods. Data Mining Software Tools. Data Mining Myths and Blunders.

Module V[4L]

Text and Web Analytics: Text Analytics and Text Mining Overview. Natural Language Processing. Text Mining Applications. Text Mining Process. Sentiment Analysis. Web Mining Overview. Search Engines. Web Usage Mining (Web Analytics). Social Analytics

Module VII [4L]

Big Data and Analytics: Definition of Big Data. Fundamentals of Big Data Analytics. Big Data Technologies. Data Scientist. Big Data and Data Warehousing. Big Data Vendors. Big Data and Stream Analytics. Applications of Stream Analytics

Case studies and projects

Understanding business scenarios

Feature engineering and visualization

Text Book:

1. Hastie, Trevor, et al.The elements of statistical learning. Vol. 2. No. 1. New York: springer, 2009.
2. Montgomery, Douglas C., and George C. Runger.Applied statistics and probability for engineers. John Wiley & Sons, 2010 Business Intelligence: A Managerial Approach (2011) Turban, Sharda, Delen, King, Publisher: Prentice Hall, Edition: 2nd, ISBN: 13-978-0-136-
3. Business Intelligence Roadmap: The Complete Project Lifecycle for Decision-Support Applications by Larissa T. Moss

Reference Text

4. The Visual Display of Quantitative Information by Edward R. Tufte
5. Business Intelligence: Making Better Decisions Faster by Elizabeth Vitt , Michael Luckevich, Stacia Misner

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1								3	3	1		2
CO2	3	2						1			3	3	2		1
CO3	3	2	2				1				3	3	3	1	

CO4	3	1	-					2			3	3	2		2
CO5	3	2	2				1				3	3	3	1	

Course Name: Operations Research
Course Code: MCE 302B
Contacts: 3:0:0
Total contact hours: 36
Credit: 3
Course Outcome:
After successful completion of this course, students should be able to:
CO1: Identify and develop operational research models from the verbal description of the real system.
CO2: Understand the mathematical tools that are needed to solve optimization problems.
CO3: Use mathematical software to solve the proposed models.

Prerequisite:
The candidates should have the basic knowledge of Engineering Mathematics and Statistics.

Course Content:
Module I [6L]

Linear programming problems - Mathematical formulation, graphical method of solution, simplex method in details

Module II [6L]

Duality in linear programming problems, dual simplex method, sensitivity analysis, transportation and assignment problems, Traveling salesman Problem.

Module III [8L]

Game theoryIntroduction, two-person zero-sum games, some basic terms, the maxmini- minimax principle, games without saddle points-Mixed Strategies, graphic solution of 2 * n and m*2 games, dominance property.
CPM & PERT- project scheduling, critical path calculations, Crashing.

Module IV [8L]

Queueing theory -basic structure of queuing systems, roles of the Poisson and exponential distributions, classification of queues basic results of M/M/1: FIFO systems, extension to multi-server queues.

Module V [8L]

Simulation: simulation concepts, simulation of a queuing system using event list,pseudo random numbers, multiplication congruential algorithm, inverse transformation method, basic ideas of Monte-Carlo simulation.

Reference Books

1) Taha. H.A, Operation Research: An Introduction, McMilan publishing Co.
2) Ravindran A, Philips D.T & Solbery J.J, Operations Research: Principles and practice, John Wiley & Sons, New York.
3) Frank S. Budnick, Dennis Mcleavey and Richard Mojena, Principles of Operations Research for Management. All India Traveler Book Seller,Delhi.
4) Gillet B.E.,Introduction to OperationsResearch- A Computer oriented algorithmic approach, McGraw Hill.
5) Joseph G.Ecker & Michael Kupper Schimd, Introduction to operations Research, John Wiley & Sons.
6) Hillier F.S & Liberman G.J, operation Research, Second Edition, Holden Day Inc.
7) Kanti Swarup, Gupta P.K. & Man Mohan, operations Research, S. Chand &Sons.

CO-PO Mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
C1	3	1	2	3	2	1	2	3	2	1	1	1
C2	3	2	1	2	3	3	2	1	2	1	2	2
C3	2	3	2	3	2	1	1	2	3	2	1	1

Information Security & Risk Management

Course Code: MCE302C

Contacts: 3:0:0

Total Contact Hours: 36

Credit: 3

Prerequisite:

A basic understanding of information security and information security management topics is helpful for students attending this class. However, a strong background in any of these skills is not a pre-requisite for the class.

Course Outcome:

Post graduate students of ECE Program will be able:

CO1: To analyze IT-security with the requirements of standards;

CO2: To apply actual IT-security standards in the field of IT-security risk management;

CO3: To prepare written and oral presentation materials on professional activities;

CO4: Independently set research tasks, develop experiments plans, provide data collection.

Explain how risk is assessed based on the likelihood of adverse events and the effects on information assets when events occur.

CO5: Recognize the strategy options used to control risk and be prepared to select from them when given background information.

Course Contents:

Module I: Information Security [6L]

Goals of Computer Security. CIA triangle, Identifying the Assets, Threats, Impact, vulnerabilities, User Authentication, System Access Control, Password Management, Privileged User Management, User Account Management, Data Resource Protection, Sensitive System Protection, Cryptography, Intrusion detection, Computer-Security Classifications

Module II: Computer Security [6L]

Hardening (Operating System and Application Code, File System Security, Local Security Policies, Services, Default Accounts), Network Activity, Malicious Code, Firewall , Fault Tolerant System , BACKUP and UPS

Module III: Network Security[6L]

Network security issues, threats & solutions, cryptography, algorithms (encryption, substitution, sequential and random, transposition), crypto-analysis, methods of breaking these algorithms.

Module IV: Disaster Management [6L]

Types of Disaster, Challenge in Global operations, understanding disaster recovery & business continuity, Business Continuity Management, Preparing BCP – a 10 step process, case (eg WTC)

Module V: Risk Management[7L]

Cyber Threats, including motivation, trends, and threat monitoring, General principles of risk analysis ,Mechanics of cybersecurity risk assessment; DDoS risk assessment, IT risk analysis, risk management (Cybersecurity Framework), and security risk metrics , Major steps of risk analysis (probability, impact, prioritization, etc.). Approaches to managing risks (reduction, mitigation transfer, and acceptance). Managing risk with metrics, Security Fatigue

Module VI: Security Policies[5L]

Standards, Guidelines and Approaches for Protection of Organizational Assets; Technical Controls;Social Aspects of Information Security; People vs. Cybersecurity, Economic Aspects of Information Security;

Text:

1. D.P. Sharma, E-retailing Principles and Practice, Himalaya Publications
2. Caroll& Broadhead, Selling Online: How to Become a Successful E-Commerce Merchant, Dearborn publishers
3. Janice Reynolds, The Complete E-Commerce Book: Design, Build, and Maintain a Successful Web-Based Business, CMP Media.
4. Dennis, Fenech &Merrilees, E-retailing, Routledge Press
5. Levy & Weitz, Retailing Management, Tata McGraw Hill

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	-	-	-	-	-	-	-	3	3	1	-	2

CO2	3	2	-	-	-	-	-	1	-	-	3	3	2	-	1
CO3	3	2	2	-	-	-	1	-	-	-	3	3	3	1	-
CO4	3	1	-	-	-	-	-	2	-	-	3	3	2	-	2
CO5	3	2	2	-	-	-	1	-	-	-	3	3	3	1	-

Total Credit = 68