M.E. – COMMUNICATION SYSTEMS
CURRICULUM & SYLLABI

Regulation 2020

(Applicable to candidates admitted in the academic year 2020 - 2021 onwards)

K.S.R. College of Engineering

(Autonomous)

K.S.R. Kalvi Nagar, Tiruchengode – 637 215

Namakkal (Dt), Tamilnadu, India

Email : info@ksrce.ac.in **Website : www.ksrce.ac.in**

K.S.R. COLLEGE OF ENGINEERING: TIRUCHENGODE - 637 215 (Autonomous)
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
(REGULATIONS 2020)

M.E-COMMUNICATION SYSTEMS

Vision of the Institution

IV	We envision to achieve status as an excellent educational institution in the global knowledge hub, making self-learners, experts, ethical and responsible engineers, technologists, scientists, managers, administrators and entrepreneurs who will significantly contribute to research and environment friendly sustainable growth of the nation and the world.

Mission of the Institution

IM 1	To inculcate in the students self-learning abilities that enable them to become competitive and considerate engineers, technologists, scientists, managers, administrators and entrepreneurs by diligently imparting the best of education, nurturing environmental and social needs.
IM 2	To foster and maintain a mutually beneficial partnership with global industries and institutions through knowledge sharing, collaborative research and innovation.

Vision of the Department

DV	We envision as a center of excellence in the field of Electronics and Communications Engineering to produce technically competent graduates with diverse teaching and research environments

Mission of the Department

DM 1	To educate the students with the state of art technologies to meet the growing challenges of the industries.
DM 2	To develop an innovate, competent and ethical Electronics and Communication Engineer with strong foundations lo enable them for continuing education.

Programme Educational Objectives (PEOs) :(ME - COMMUNICATION SYSTEMS)

The graduates of the programme will be able to	
PEO 1	**Professional Skill Development :** Apply concepts of Statistics, Linear Algebra and Residue Calculus in Communication, Signal processing and Electromagnetics domain
PEO 2	**Core Competence:** Solve issues in real world communication sectors, and develop feasible and viable communication systems.
PEO 3	**Interpersonal Skill and teamwork:** Inculcate effective communication skills, produce effective teamwork, professional ethics and pursue research.

Programme Outcomes (POs) of ME - COMMUNICATION SYSTEMS

Program Outcomes (POs)	
PO1	**M.E. Communication Systems graduates will be able to:** **Conduct Investigations of complex Problems:** An ability to independently carry out research /investigation and development work to solve practical problems.
PO2	**Presentation Skill:** An ability to write and present a substantial technical report/document.
PO3	**Scholarship of Knowledge:** Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.
Program Specific Outcomes (PSOs)	
PSO1	**Research Culture:** Use the knowledge of signal processing, communications, networks and Electromagnetics to simulate algorithms in virtual environments and to perform research to implement embedded and VLSI platforms.
PSO2	**Core Values:** Contribute core Universal values and social good m the community**.**

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Department	Department of Electronics and Communication Engineering
Programme	M.E - Communication Systems

SEMESTER – I

Sl.No.	Course Code	Course Name	Hours/ Week			Credit	Maximum Marks		
			L	T	P	C	CA	ES	Total
THEORY									
1.	CU20111	Advanced Radiation Systems	3	0	0	3	30	70	100
2.	CU20112	Wireless and Mobile Communication	3	0	0	3	30	70	100
3.	CU20113	Advanced Communication Network	3	0	0	3	30	70	100
4.		Elective –I	3	0	0	3	30	70	100
5.	CU20114	Research Methodology and IPR	2	0	0	2	30	70	100
6.		Audit Course 1	2	0	0	0	50	50	100
PRACTICAL									
7.	CU20121	Antennas and Radiating Systems Laboratory	0	0	3	2	50	50	100
8.	CU20122	Advanced Communication Networks Laboratory	0	0	3	2	50	50	100
		Total	16	0	6	18	700		

SEMESTER – II

Sl.No.	Course Code	Course Name	Hours/ Week			Credit	Maximum Marks		
			L	T	P	C	CA	ES	Total
THEORY									
1.	MA20241	Applied Mathematics	3	0	0	3	30	70	100
2.	CU20212	Modern Digital Communication Techniques	3	0	0	3	30	70	100
3.	CU20213	Advanced Digital Signal Processing	3	0	0	3	30	70	100
4.		Elective – 2	3	0	0	3	30	70	100
5.		Elective – 3	3	0	0	3	30	70	100
6.		Audit Course 2	2	0	0	0	50	50	100
PRACTICAL									
7.	CU20221	Advanced Digital Signal Processing Lab	0	0	3	2	50	50	100
8.	CU20222	Mini Project	0	0	3	2	50	50	100
		Total	18	0	6	20	700		

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Department	Department of Electronics and Communication Engineering	
Programme	M.E - Communication Systems	

SEMESTER – III

Sl.No.	Course Code	Course Name	Hours/ Week			Credit	Maximum Marks		
			L	T	P	C	CA	ES	Total
THEORY									
1.		Elective -4	3	0	0	3	30	70	100
2.		Elective –5	3	0	0	3	30	70	100
3.		Open Elective	3	0	0	3	30	70	100
PRACTICAL									
4.	CU20321	Project Phase – I	0	0	12	8	50	50	100
		Total	9	0	12	14	400		

SEMESTER – IV

Sl.No.	Course Code	Course Name	Hours/ Week			Credit	Maximum Marks		
			L	T	P	C	CA	ES	Total
PRACTICAL									
1.	CU20421	Project Phase –II	0	0	24	16	50	50	100
		Total	0	0	24	16	100		

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Department	Department of Electronics and Communication Engineering	
Programme	M.E - Communication Systems	
List of Electives		

ELECTIVES 1(SEMESTER – I)									
Sl.No.	**Course Code**	**Course Name**	**Hours/ Week**			**Credit**	**Maximum Marks**		
			L	**T**	**P**	**C**	**CA**	**ES**	**Total**
1.	CU20161	DSP Processor Architecture and Programming	3	0	0	3	30	70	100
2.	CU20162	Cognitive Radio	3	0	0	3	30	70	100
3.	CU20163	Optical Communication Networks	3	0	0	3	30	70	100
4.	CU20164	Wireless Sensor Networks	3	0	0	3	30	70	100
5.	CU20165	RF and Microwave Circuit Design	3	0	0	3	30	70	100
6.	CU20166	Microstrip Patch Antenna Design	3	0	0	3	30	70	100
7.	CU20167	Digital Communication Receivers	3	0	0	3	30	70	100

ELECTIVES2&3(SEMESTER – II)									
Sl.No.	**Course Code**	**Course Name**	**Hours/ Week**			**Credit**	**Maximum Marks**		
			L	**T**	**P**	**C**	**CA**	**ES**	**Total**
1.	CU20261	Communication Protocol Engineering	3	0	0	3	30	70	100
2.	CU20262	Internet of Things	3	0	0	3	30	70	100
3.	CU20263	Voice and Data Networks	3	0	0	3	30	70	100
4.	CU20264	MIMO Systems	3	0	0	3	30	70	100
5.	CU20265	Satellite Communication	3	0	0	3	30	70	100
6.	CU20266	EM Modeling and Analysis for Planar Antenna	3	0	0	3	30	70	100
7.	CU20267	Communication Network Security	3	0	0	3	30	70	100
8.	CU20268	RF MEMS for Wireless Communication	3	0	0	3	30	70	100
9.	CU20269	Multimedia Compression Techniques	3	0	0	3	30	70	100
10.	PE20201	Soft Computing Techniques (Common to PE & CS)	3	0	0	3	30	70	100

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Department	Department of Electronics and Communication Engineering	
Programme	M.E - Communication Systems	
List of Electives		

ELECTIVES 4&5(SEMESTER – III)									
Sl.No.	**Course Code**	**Course Name**	**Hours/ Week**			**Credit**	**Maximum Marks**		
			L	**T**	**P**	**C**	**CA**	**ES**	**Total**
1.	CU20361	High Performance Computer Networks	3	0	0	3	30	70	100
2.	CU20362	Pattern Recognition and Machine Learning	3	0	0	3	30	70	100
3.	CU20363	Remote sensing	3	0	0	3	30	70	100
4.	CU20364	High Speed Switching Architecture	3	0	0	3	30	70	100
5.	CU20365	Spread Spectrum Communication	3	0	0	3	30	70	100
6.	CU20366	Speech and Audio Processing	3	0	0	3	30	70	100
7.	CU20367	Signal Detection and Estimation	3	0	0	3	30	70	100
8.	CU20368	Internetworking Multimedia	3	0	0	3	30	70	100
9.	CU20369	Wavelet transforms and its applications	3	0	0	3	30	70	100
10.	CU20371	Microwave Integrated Circuits	3	0	0	3	30	70	100

AUDIT COURSES (SEMESTER – I)									
S.No.	**Course Code**	**Course Name**	**Hours/ Week**			**Credit**	**Maximum Marks**		
			L	**T**	**P**	**C**	**CA**	**ES**	**Total**
1.	CUAC01	English for Research Paper Writing	2	0	0	0	-	-	-
2.	CUAC02	Disaster Management	2	0	0	0	-	-	-
3.	CUAC03	Sanskrit for Technical Knowledge	2	0	0	0	-	-	-
4.	CUAC04	Value Education	2	0	0	0	-	-	-
AUDIT COURSES (SEMESTER –II)									
5.	CUAC05	Constitution of India	2	0	0	0	-	-	-
6.	CUAC06	Pedagogy Studies	2	0	0	0	-	-	-
7.	CUAC07	Stress Management by Yoga	2	0	0	0	-	-	-
8.	CUAC08	Personality Development through life Enlightenment skills	2	0	0	0	-	-	-

Chairman BoS/ECE

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SEMESTER - I

		L	T	P	C
CU20111	**ADVANCED RADIATION SYSTEMS**	3	0	0	3

Course Outcomes : On Completion of this course, the student will be able to		***Cognitive Level***
CO1:	*Describe the basic parameters of Antenna fundamentals.*	*Understand*
CO2:	*Analyze the different characteristics of arrays.*	*Analyze*
CO3:	*Illustrate the working principles of aperture antennas.*	*Understand*
CO4:	*Design of micro strip Patch antenna.*	*Apply*
CO5:	*Perform different antenna measurement techniques.*	*Understand*

UNIT - I ANTENNA FUNDAMENTALS [09]

Antenna fundamental parameters, Radiation integrals, Radiation from surface and line current distributions –dipole, monopole, loop antenna; Mobile phone antenna – base station, handset antenna: Image; Induction, reciprocity theorem, Broadband antennas and Matching techniques, Balance to unbalance transformer, Introduction to numerical techniques.

UNIT - II ARRAY ANTENNA [09]

Linear array – uniform array, end fire and broad side array, gain, beam width, side lobe level, Two dimensional uniform array, Phased array, beam scanning, grating lobe, feed network. Three dimensional characteristics, binomial array and Dolph - Tchebycheff arrays, Circular array**.**

UNIT - III RADIATION FROM APERTURES [09]

Field equivalence principle, Radiation from Rectangular and Circular apertures, Uniform aperture distribution on an infinite ground plane, Slot antenna, Horn antenna, Reflector antenna, aperture blockage and design consideration**.**

UNIT - IV ANALYSIS AND DESIGN OF MICROSTRIP PATCH ANTENNAS [09]

Configurations – Excitations and radiation mechanism of microstrip patch antennas – radiation resistance – Power and input impedance. Modeling of Rectangular and Circular microstrip patch antennas–Transmission line model and cavity model method. Circular polarization and bandwidth of micro strip patch antennas. Simulation of microstrip antennas using HFSS.

UNIT - V EMC ANTENNA AND ANTENNA MEASUREMENTS [09]

Concept of EMC measuring antenna; Tx and Rx antenna factors, Log periodic dipole, Bi-conical, Ridge guide, Multiturn loop, Antenna measurement and instrumentation - Gain, Impedance and antenna factor measurement, Antenna test range Design.

Total (L= 45, T = 0) = 45 Periods

Reference Books :

1 C.L.Wadhwa, Electrical Power Systems, New Age International Pvt. Ltd, New Delhi, Seventh Edition, 2016.

2 S.N.Singh, Electric Power Generation Transmission and Distribution, Prentice Hall of India Pvt. Ltd., Delhi, Second Edition, 2011.

3 K.Balanis.A, Antenna Theory Analysis and Design, John Wiley and Sons, New York, Third Edition,2011.

4 Krauss.J.D,Antennas, Second Edition, John Wiley and sons, New York,2011.

5 I.J. Bahl and P. Bhartia, Microstrip Antennas, Artech House, Boston, First Edition, 1996.

6 W.L.Stutzman and G.A.Thiele, Antenna Theory and Design, John Wiley & Sons Inc, Third Edition,2012.

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SEMESTER - I

		L	T	P	C
CU20112	**WIRELESS AND MOBILE COMMUNICATION**	3	0	0	3

Course Outcomes : On Completion of this course, the student will be able to		***Cognitive Level***
CO1:	*Describe mobile communication systems and its fundamentals.*	*Understand*
CO2:	*Analyze the spectral efficiency on different multiple access techniques*	*Analyze*
CO3:	*Describe the process of propagation models*	*Understand*
CO4:	*Illustrate different diversity techniques and CDMA.*	*Analyze*
CO5:	*Describe the upcoming technologies like 4G and 5G.*	*Understand*

UNIT - I CELLULAR FUNDAMENTALS [09]

Cellular Communication Fundamentals: 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 Logical Channels, Data Encryption in GSM, Mobility Management, Call Flows in GSM.2.5G Standards: General Packet Radio Service (GPRS), 2.75 G Standards: EDGE.

UNIT - II MULTIPLE ACCESS TECHNIQUES [09]

Spectral efficiency analysis based on calculations for Multiple access technologies: TDMA, FDMA and CDMA, Comparisons, advantages, disadvantages and application areas. Wireless network planning: Link budget and power spectrum calculations.

UNIT - III PROPAGATION MODELS [09]

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

UNIT - IV DIVERSITY TECHNIQUES AND CDMA [09]

Equalization, Diversity: Equalizers in a communications receiver, Algorithms for adaptive equalization, Diversity techniques: space, polarization, frequency diversity. Interleaving, 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, Evolution of IS 95 (CDMA One) to CDMA 2000, CDMA 2000 layering structure and channels.

UNIT - V SYSTEMS AND STANDARDS [09]

Higher Generation Cellular Standards: 3G Standards: EDGE, enhancements in 4G standard, Architecture and representative protocols, call flow for LTE, VoLTE, UMTS, Introduction to 5G.

Total (L= 45, T = 0) = 45 Periods

Reference Books :

1 C.L.Wadhwa, Electrical Power Systems, New Age International Pvt. Ltd, New Delhi, Seventh Edition, 2016.

2 V.K.Garg, J.E.Wilkes, Principle and Application of GSM, Pearson Education, New Delhi, Fifth Edition, 2008.

3 V.K.Garg, IS-95 CDMA & CDMA 2000, Pearson Education, USA, Fourth Edition, 2009.

4 T.S.Rappaport, Wireless Communications Principles and Practice, Prentice Hall, USA, Second Edition,2001.

5 William C.Y.Lee, Mobile Cellular Telecommunications Analog and Digital Systems, Second Edition, Tata Mcgraw Hill, New Delhi, 2017.

6 Asha Mehrotra, A GSM system Engineering, Artech House Publishers, Bosten, Fifth Edition, 1997.

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SEMESTER - I

		L	T	P	C
CU20113	**ADVANCED COMMUNICATION NETWORK**	3	0	0	3

Course Outcomes : On Completion of this course, the student will be able to		***Cognitive Level***
CO1:	*Describe internet challenges and TCP congestion control.*	*Understand*
CO2:	*Describe advanced concepts in Communication Networking.*	*Understand*
CO3:	*Design and develop protocols for Communication Networks*	*Apply*
CO4:	*Illustrate the mechanisms in Quality of Service in networking.*	*Understand*
CO5:	*Demonstrate the process involved in IP switching and Traffic Engineering*	*Understand*

UNIT - I TCP AND RSVP [09]

Overview of Internet – Concepts and challenges. Overview of ATM, TCP/IP Congestion and Flow Control. Throughput analysis of TCP - TCP for high bandwidth delay networks- Fairness issues in TCP. Real Time Communications over Internet - Latency and throughput issues - Resource reservation in Internet. RSVP - Leaky bucket algorithm and its properties.

UNIT - II TRAFFIC SCHEDULING AND QUEUE MANAGEMENT [09]

Packet Scheduling Algorithms-requirement - Scheduling guaranteed service connections - GPS, WFQ and Rate proportional algorithms - High speed scheduler design - Characterization of Traffic by Linearly Bounded Arrival Processes (LBAP) - Theory of Latency Rate servers and delay bounds in packet switched networks for LBAP traffic- Active Queue Management - RED, WRED and Virtual clock - Control theoretic analysis of active queue management.

UNIT - III PACKET CLASSIFICATION ALGORITHM [09]

IP address lookup-challenges. Packet classification algorithms and Flow Identification- Grid of Tries, Cross producing and controlled prefix expansion algorithms.

UNIT - IV DIFFERENTIATED SERVICES [09]

Admission control in Internet - Concept of Effective bandwidth. Measurement based admission control - Differentiated Services in Internet (DiffServ) - DiffServ architecture and framework.

UNIT - V IP SWITCHING AND TRAFFIC ENGINEERING [09]

IPV4, IPV6, IP tunneling – IP switching and MPLS - Overview of IP over ATM and its evolution to IP switching - MPLS architecture and framework. MPLS Protocols – Traffic engineering issues in MPLS.

Total (L= 45, T = 0) = 45 Periods

Reference Books :

1 C.L.Wadhwa, Electrical Power Systems, New Age International Pvt. Ltd, New Delhi, Seventh Edition, 2016.

2 Jean Wairand and Pravin Varaiya, High Performance Communications Networks, Second Edition, 2000.

3 Jean Le Boudec and Patrick Thiran, Network Calculus A Theory of Deterministic Queuing Systems for the Internet, Springer Veriag, 2001.

4 Zhang Wang, Internet QoS, Morgan Kaufman, 2001.

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

6 George Kesidis, ATM Network Performance, Kluwer Academic, Research Papers, 2005.

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SEMESTER - I

CU20114	RESEARCH METHODOLOGY AND IPR	L	T	P	C
		2	0	0	2

Course Outcomes: On Completion of this course, the student will be able to		***Cognitive Level***
CO1:	*Describe research problem formulation.*	*Understand*
CO2:	*Interpret research related information and follow research ethics*	*Understand*
CO3:	*Describe the nature of IPR rights*	*Understand*
CO4:	*Demonstrate the importance of Pattern Rights*	*Understand*
CO5:	*Illustrate the recent advancements in IPR*	*Understand*

UNIT - I INTRODUCTION [09]

Meaning of research problem, Sources of research problem, Criteria 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 problem, data collection, analysis, interpretation, Necessary instrumentations.

UNIT - II RESEARCH PAPER WRITING [09]

Effective literature studies approaches, analysis Plagiarism , Research ethics, Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.

UNIT - III INTELLECTUAL PROPERTY RIGHTS [09]

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

UNIT - IV PATENT RIGHTS [09]

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

UNIT - V RECENT ADVANCEMENTS IN IPR [09]

New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

Total (L= 45, T = 0) = 45 Periods

Reference Books :

1. Stuart Melville and Wayne Goddard, Research methodology: an introduction for science & engineering students, Juta & Company, South Africa, Reprint 2007.
2. Wayne Goddard and Stuart Melville, Research Methodology: An Introduction, Juta Academic, South Africa, 2014
3. Ranjit Kumar, Research Methodology: A Step by Step Guide for beginners, Pearson Education, USA, Second Edition, 2005.
4. Halbert, Resisting Intellectual Property, Taylor & Francis Ltd, 2007.
5. Mayall , Industrial Design, McGraw Hill, London, 1992.
6. Niebel , Product Design, McGraw Hill, London, 1974.
7. Asimov, Introduction to Design, Prentice Hall, USA, 1962.

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SEMESTER - I

CU20121	**ANTENNAS AND RADIATING SYSTEMS LABORATORY**	L	T	P	C
		0	0	3	2

Course Outcomes: On Completion of this course, the student will be able to		***Cognitive Level***
CO1:	*Design and simulate the dipole antennas*	*Understand*
CO2:	*Measure the quarter wave and monopole antenna performances*	*Apply*
CO3:	*Show the effect on height of the antenna and its characteristics*	*Understand*
CO4:	*Analyze the antenna array parameters and radiation pattern*	*Analyze*
CO5:	*Describe the phase difference estimation in antenna arrays*	*Understand*

List of Experiments:

1. Simulation of half wave dipole antenna.
2. Simulation of change of the radius and length of dipole wire on frequency of resonance of antenna.
3. Simulation of quarter wave, full wave antenna and comparison of their parameters.
4. Simulation of monopole antenna with and without ground plane.
5. Study the effect of the height of the monopole antenna on the radiation characteristics of the antenna.
6. Simulation of a half wave dipole antenna array.
7. Study the effect of change in distance between elements of array on radiation pattern of dipole array.
8. Study the effect of the variation of phase difference 'beta' between the elements of the array on the radiation pattern of the dipole array.
9. Case study.

Total (P = 45) = 45 Periods

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - I

CU20122	**ADVANCED COMMUNICATION NETWORKS LABORATORY**	L	T	P	C
		0	0	3	2

Course Outcomes: On Completion of this course, the student will be able to		***Cognitive Level***
CO1:	*Describe the different types of network devices and their functions within a network.*	*Understand*
CO2:	*Build the skills of sub-netting and routing mechanisms.*	*Apply*
CO3:	*Demonstrate basic protocols of computer networks.*	*Understand*
CO4:	*Apply the protocols to design and implementation of network.*	*Apply*
CO5:	*Apply the QoS and Shortest path algorithms to estimate network parameters*	*Apply*

List of Experiments:

1. Study of Networking Commands (Ping, Tracert, TELNET, nslookup, netstat, ARP, RARP) and Network Configuration Files.
2. Linux Network Configuration.
    a. Configuring NIC's IP Address.
    b. Determining IP Address and MAC Address using if-config command.
    c. Changing IP Address using if-config.
    d. Static IP Address and Configuration by Editing.
    e. Determining IP Address using DHCP.
    f. Configuring Hostname in /etc/hosts file.
3. Design TCP iterative Client and Server application to reverse the given input sentence.
4. Design a TCP concurrent Server to convert a given text into upper case using multiplexing system call "select".
5. Design UDP Client Server to transfer a file.
6. Configure a mail server for IMAP/POP protocols and write a simple SMTP client in C/C++/Java Client to send and receive mails.

7.Configure FTP Server on a Linux/Windows machine using a FTP client/SFTP client characterize file transfer rate for a cluster of small files 100k each and a video file of700mb.Use a TFTP client and repeat the experiment.

8. Signaling and QoS of labeled paths using RSVP in MPLS.
9. Find shortest paths through provider network for RSVP and BGP.

Total (P = 45) = 45 Periods

K.S.R. COLLEGE OF ENGINEERING (Autonomous) **R 2020**

SEMESTER - I

CU20161	**DSP PROCESSOR ARCHITECTURE AND PROGRAMMING (ELECTIVE)**	L	T	P	C
		3	0	0	3

Course Outcomes: On Completion of this course, the student will be able to		***Cognitive Level***
CO1:	*Analyze the concept about fundamentals of Programmable DSP*	*Analyze*
CO2:	*Describe the architecture and programming using fixed processor*	*Apply*
CO3:	*Describe the architecture and programming using floating processor*	*Apply*
CO4:	*Describe various parameters considered in ADSP processor*	*Apply*
CO5:	*Demonstrate the concepts of advanced processors*	*Understand*

UNIT - I **FUNDAMENTALS OF PROGRAMMABLE DSPs** **[09]**

Multiplier and multiplier accumulator – Modified bus structures and memory access in PDSPs– Multiple access memory – Multi-port memory – VLIW architecture- Pipelining –Special addressing modes in P-DSPs – On chip peripherals.

UNIT - II **TMS320C5X PROCESSOR -Fixed** **[09]**

Architecture – Assembly language syntax - Addressing modes – Assembly language Instructions - Pipeline structure, Operation – Block diagram of DSP starter kit – Application programs for processing real time signals.

UNIT - III **TMS320C3X PROCESSOR -Floating** **[09]**

Architecture – Data formats - Addressing modes – Groups of addressing modes- Instruction sets - Operation – Block diagram of DSP starter kit – Application programs for processing real time signals – Generating and finding the sum of series, Convolution of two sequences, Filter design.

UNIT - IV **ADSP PROCESSORS** **[09]**

Architecture of ADSP-21XX and ADSP-210XX series of DSP processors- Addressing modes and assembly language instructions – Application programs –Filter design, FFT calculation.

UNIT - V **ADVANCED PROCESSORS** **[09]**

Architecture of TMS320C54X: Pipe line operation, Code composer studio – Architecture of TMS320C6X - Architecture of Motorola DSP563XX – Comparison of the features of DSP family processors.

Total (L= 45, T = 0) = 45 Periods

Reference Books :

1 C.L.Wadhwa, Electrical Power Systems, New Age International Pvt. Ltd, New Delhi, Seventh Edition, 2016.

1 Venkataramani B. and Bhaskar M., Digital Signal Processors – Architecture, Programming and Applications, Tata McGraw – Hill Publishing Company Limited. New Delhi, Second Edition, 2011.

2 User guides Texas Instrumentation, Analog Devices, Motorola.

3 Sen.M.Kuo, Woon–Seng S.Gan, Digital Signal Processors: Architecture, Implementation and Applications, Pearson, New Delhi, First Edition, 2012.

4 www.analogdevices.com

5 www.adi.com

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SEMESTER - I

		L	T	P	C
CU20162	**COGNITIVE RADIO (ELECTIVE)**	3	0	0	3

Course Outcomes: On Completion of this course, the student will be able to		***Cognitive Level***
CO1:	*Describe the fundamental concepts of cognitive radio networks.*	*Understand*
CO2:	*Develop the techniques for spectrum sensing and spectrum holes detection*	*Apply*
CO3:	*Demonstrate the optimization techniques and programming*	*Understand*
CO4:	*Describe the fundamental issues regarding dynamic spectrum access.*	*Understand*
CO5:	*Illustrate spectrum trading and research challenges.*	*Understand*

UNIT - I INTRODUCTION TO COGNITIVE RADIO [09]

Introduction to Cognitive Radios: Digital dividend, cognitive radio (CR) architecture, functions of cognitive radio, dynamic spectrum access (DSA), components of cognitive radio, spectrum sensing, spectrum analysis and decision, potential applications of cognitive radio.

UNIT - II SPECTRUM SENSING [09]

Spectrum Sensing: Spectrum sensing, detection of spectrum holes (TVWS), collaborative sensing, geo-location database and spectrum sharing business models.

UNIT - III OPTIMIZATION TECHNIQUES [09]

Optimization Techniques of Dynamic Spectrum Allocation: Linear programming, convex programming, non-linear programming, integer programming, dynamic programming, stochastic programming.

UNIT - IV DYNAMIC SPECTRUM [09]

Dynamic Spectrum Access and Management: Spectrum broker, cognitive radio architectures, centralized dynamic spectrum access, distributed dynamic spectrum access, learning algorithms and protocols.

UNIT - V SPECTRUM TRADING AND RESEARCH CHALLENGES [09]

Spectrum Trading: Introduction to spectrum trading, classification to spectrum trading, radio resource pricing, brief discussion on economics theories in DSA (utility, auction theory), classification of auctions (single auctions, double auctions, concurrent, sequential). Research Challenges in Cognitive Radio: Network layer and transport layer issues, cross layer design for cognitive radio networks

Total (L= 45, T = 0) = 45 Periods

Reference Books :

1 C.L.Wadhwa, Electrical Power Systems, New Age International Pvt. Ltd, New Delhi, Seventh Edition, 2016.

2 Ekram Hossain, Dusit Niyato, Zhu Han, Dynamic Spectrum Access and Management in Cognitive Radio Networks, Cambridge University Press, 2009.

3 Kwang-Cheng Chen, Ramjee Prasad, Cognitive radio networks, John Wiley & Sons Ltd., New York, 2009.

4 Bruce Fette,, Cognitive radio technology, Elsevier, Second edition, 2009.

5 Huseyin Arslan, Cognitive Radio, Software Defined Radio, and Adaptive Wireless Systems, Springer, 2007.

4 Francisco Rodrigo Porto Cavalcanti, Soren Andersson, Optimizing Wireless Communication Systems, Springer, 2009.

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SEMESTER - I

CU20163	OPTICAL COMMUNICATION NETWORKS (ELECTIVE)	L	T	P	C
		3	0	0	3

Course Outcomes: On Completion of this course, the student will be able to		***Cognitive Level***
CO1:	*Describe optical system components and network design*	*Understand*
CO2:	*Demonstrate different optical networks architectures.*	*Understand*
CO3:	*Illustrate different multiplexing techniques in optical networks*	*Understand*
CO4:	*Describe the different accessing techniques.*	*Understand*
CO5:	*Illustrate about network management techniques.*	*Understand*

UNIT - I OPTICAL SYSTEM COMPONENTSAND NETWORK DESIGN [09]

Optical system components: Couplers, Isolators and Circulators, Multiplexers and Filters, Optical amplifiers, Switches, Wavelength converters – Transmission system engineering – System model, Power penalty-Transmitter, Receiver, Optical amplifiers, crosstalk, dispersion, wavelength stabilization; Overall design considerations.

UNIT - II OPTICAL NETWORK ARCHITECTURES [09]

Introduction to optical networks; SONET/SDH, Metropolitan Area Networks, Layered architecture; Broad cast and select Networks– Topologies, Media Access Control protocols and test beds.

UNIT - III WAVELENGTH ROUTING NETWORKS [09]

WDM network elements: WDM network design – Cost tradeoffs, Routing and wavelength assignment, Virtual topology design, Wavelength routing test beds, Architectural variations.

UNIT - IV PACKET SWITCHING AND ACCESS NETWORKS [09]

Photonic packet switching: OTDM, Multiplexing and De-multiplexing, Synchronization, Broadcast OTDM networks, Switch based networks – Access Networks – Network architecture overview, Future access networks, Optical access network architectures and OTDM networks.

UNIT - V NETWORK MANAGEMENT AND SURVIVABILITY [09]

Control and Management: Network management functions, Configuration management, Performance management, Fault management, Optical safety, Service interface.

Total (L= 45, T = 0) = 45 Periods

Reference Books :

1 C.L. Wadhwa, Electrical Power Systems, New Age International Pvt. Ltd, New Delhi, Seventh Edition, 2016.

2 Rajiv Ramaswami and Kumar N.Sivarajan, Optical Networks: A Practical Perspective, Harcourt Asia Pvt.Ltd,Second Edition, 2006.

3 C.Siva Ram Moorthy and Mohan Gurusamy, WDM Optical Networks: Concept, Design and Algorithms, Prentice HallofIndia, New Delhi, Second Edition, 2002.

4 P.E. Green, Jr., Fiber Optic Networks, Prentice Hall, New Jersy, First Edition, 1993.

5 Biswanath Mukherjee, Optical WDM Networks, Springer, New York, 2006.

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SEMESTER - I

		L	T	P	C
CU20164	**WIRELESS SENSOR NETWORKS (ELECTIVE)**	3	0	0	3

Course Outcomes: On Completion of this course, the student will be able to		***Cognitive Level***
CO1:	*Describe the concept of basics of wireless sensor networks.*	*Understand*
CO2:	*Illustrate various architectures in Wireless sensor network*	*Understand*
CO3:	*Interpret the process of networking of sensors*	*Understand*
CO4:	*Describe the concept of Infrastructure establishment in WSN*	*Understand*
CO5:	*Illustrate various tools used in sensor network platform*	*Understand*

UNIT - I OVERVIEW OF WIRELESS SENSOR NETWORKS [09]

Challenges for wireless sensor networks – Characteristics requirements –Required mechanisms, Difference between mobile ad-hoc and sensor networks, Applications of sensor networks –Enabling technologies for wireless sensor networks.

UNIT - II ARCHITECTURES [09]

Single – node Architecture – Hardware components, Energy consumption of sensor nodes, Operating systems and execution environments, Network architecture – Sensor network scenarios, Optimization goals and figures of merit, Gate way concepts.

UNIT - III NETWORKING OF SENSORS [09]

Physical layer and transceiver design considerations, MAC protocols for wireless sensor networks, Low duty cycle protocols and wakeup concepts- S-MAC, The mediation device protocol, Wakeup radio concepts, Address and name management, Assignment of MAC addresses, Routing protocols – Energy – efficient routing, Geographic routing.

UNIT - IV INFRASTRUCTURE ESTABLISHMENT [09]

Topology control, Clustering, Time synchronization, Localization and localization services, Sensor tasking and control – Information based joint routing and information aggregation.

UNIT - V SENSOR NETWORK PLATFORMS AND TOOLS [09]

Operating systems for wireless sensor networks, Sensor node hardware – Berkeley motes, Programming challenges, Node- level software platforms, Node – level simulators, State-centric programming.

Total (L= 45, T = 0) = 45 Periods

Reference Books :

1 C.L.Wadhwa, Electrical Power Systems, New Age International Pvt. Ltd, New Delhi, Seventh Edition, 2016.

2 Holger Karl & Andreas Willig, Protocols And Architectures for Wireless Sensor Networks, John Wiley,2011.

3 Feng Zhao & Leonidas J. Guibas, Wireless Sensor Networks – An Information Processing Approach, Elsevier, Reprint 2012

4 KazemSohraby, Daniel Minoli, & Taieb Znati, Wireless Sensor Networks -Technology, Protocols, and Applications, John Wiley, 2007.Reprint2012.

5 AnnaHac, Wireless Sensor Network Designs, John Wiley, 2009.

6 Bhaskar Krishnamachari, Networking Wireless Sensors, Cambridge Press, 2005.

7 Mohammad IlyasandImad Mahgaob, Handbook of Sensor Networks: Compact Wireless And Wired Sensing Systems, CRC Press, 2005.

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SEMESTER - I

		L	T	P	C
CU20165	**RF AND MICROWAVE CIRCUIT DESIGN (ELECTIVE)**	3	0	0	3

Course Outcomes: On Completion of this course, the student will be able to		***Cognitive Level***
CO1:	*Analyze transmission lines using Smith chart and matching networks.*	*Analyze*
CO2:	*Describe the behavior of RF passive components and model active components.*	*Understand*
CO3:	*Demonstrate use of Smith Chart for high frequency circuit design.*	*Understand*
CO4:	*Illustrate the choice/selection of components from the design aspects.*	*Understand*
CO5:	*Design RF circuits like broadband amplifier, oscillators, Mixers design*	*Apply*

UNIT - I **TRANSMISSION LINE THEORY** **[09]**

Transmission Line Theory: Lumped element circuit model for transmission line, field analysis, Smith chart, quarter wave transformer, generator and load mismatch, impedance matching and tuning.

UNIT - II **MICROWAVE COMPONENTS** **[09]**

Microwave Network Analysis: Impedance and equivalent voltage and current, Impedance and admittance matrix, The scattering matrix, transmission matrix, Signal flow graph. Microwave Components: Microwave resonators, Microwave filters, power dividers and directional couplers, Ferromagnetic devices and components

UNIT - III **RANDOM PROCESS** **[09]**

Nonlinearity And Time Variance Inter-symbol interference, random process & noise, definition of sensitivity and dynamic range, conversion gain and distortion.

UNIT - IV **MICROWAVE SEMICONDUCTOR DEVICES** **[09]**

Microwave Semiconductor Devices And Modeling: PIN diode, Tunnel diodes, Varactor diode, Schottky diode, IMPATT and TRAPATT devices, transferred electron devices, Microwave BJTs, GaAs FETs, low noise and power GaAs FETs, MESFET, MOSFET, HEMT.

UNIT - V **RF CIRCUITS DESIGN** **[09]**

Amplifiers Design: Power gain equations, stability, impedance matching, constant gain and noise figure circles, small signal, low noise, high power and broadband amplifier, oscillators, Mixers design.

Total (L= 45, T = 0) = 45 Periods

Reference Books :

1 C.L.Wadhwa, Electrical Power Systems, New Age International Pvt. Ltd, New Delhi, Seventh edition, 2016.

2 K.T.Lee, Design of CMOS RF Integrated Circuits, Cambridge, London, 2004.

3 B.Razavi, RF Microelectronics, Pearson Education, USA,1997.

4 JanCrols, Michiel Steyaert, CMOS Wireless Transceiver Design, Kluwer Academic Publishers, 1997.

5 B.Razavi, Design of Analog CMOS Integrated Circuits, Mc Graw Hill, New Delhi, 2001.

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SEMESTER - I

		L	T	P	C
CU20166	**MICROSTRIP PATCH ANTENNA DESIGN (ELECTIVE)**	3	0	0	3

Course Outcomes: On Completion of this course, the student will be able to		***Cognitive Level***
CO1:	*Describe the fundamentals of microstrip patch antennas*	*Understand*
CO2:	*illustrate various broadband techniques*	*Understand*
CO3:	*Design planar and compact broadband antennas*	*Apply*
CO4:	*Analyze the polarization concepts in antenna radiations*	*Analyze*
CO5:	*Analyze microstrip antenna array theory*	*Analyze*

UNIT - I **BASICS OF MICROSTRIP PATCH ANTENNA** **[09]**

Introduction – Radiation mechanism of micro strip antenna – Feeding techniques – Printed slot antennas - Design considerations of rectangular patch – Substrate selection – Radiation pattern and radiation resistance – Characteristics of patch antennas – Circular disc and ring antennas.

UNIT - II **BROADBAND MICROSTRIP ANTENNAS** **[09]**

Introduction – Effects on substrate parameters on Bandwidth – Selection of feeding techniques – Multimoding techniques – Tunable and dual frequency microstrip antennas – Broadband circularly polarized microstrip antennas.

UNIT - III **PLANAR MULTIRESONATORS AND COMPACT BROADBAND MICROSTRIP ANTENNAS** **[09]**

Introduction – Mechanism of parasitic coupling – Gap coupled MSA – radiating and non-radiating edge coupled MSAs – Compact shorted RMSAs – slot loaded RMSAs – U slot RMSAs.

UNIT - IV **CIRCULARLY POLARIZED MICROSTRIP ANTENNAS AND TECHNIQUES** **[09]**

Introduction – Linear elliptical and circularly polarized antennas – Dual feed circularly polarized antennas - various types of circularly polarized microstrip antennas – Design Procedure for Single-Feed Circularly Polarized MSAs - Bandwidth enhancement techniques.

UNIT - V **DESIGN AND ANALYSIS OF MICROSTRIP ANTENNA ARRAYS** **[09]**

Parallel and series feed systems – Mutual coupling – design of linear arrays – Design of planar arrays – Monolithic integrated phased arrays and its design considerations

Total (L= 45, T = 0) = 45 Periods

Reference Books :

1 C.L.Wadhwa, Electrical Power Systems, New Age International Pvt. Ltd, New Delhi, Seventh Edition, 2016.

2 J.R James & P.S.Hall, Handbook of Microstrip Antennas, IEEE Electromagnetic Waves Series, London 1989.

3 Ramesh Garg and Prakash Bhartia, Microstrip Antenna Design Hand Book, Artech house, London, 2001.

4 G.Kumar and K.P.Ray, Broad band Microstrip Antennas, Artech house, London 2003.

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SEMESTER - I

		L	T	P	C
CU20167	**DIGITAL COMMUNICATION RECEIVERS (ELECTIVE)**	3	0	0	3

Course Outcomes: On Completion of this course, the student will be able to		***Cognitive Level***
CO1:	*Gain the knowledge about overview of digital communication.*	*Understand*
CO2:	*Analyze the concept of optimization process in receivers.*	*Analyze*
CO3:	*Understand the fading channels in receiving side.*	*Understand*
CO4:	*Develop the various techniques used in synchronization process.*	*Understand*
CO5:	*Discuss the various algorithms in adaptive equalization.*	*Understand*

UNIT - I REVIEW OF DIGITAL COMMUNICATION TECHNIQUES [09]

Baseband and band pass communication; Signal space representation, linear and nonlinear modulation techniques, and spectral characteristics of digital modulation.

UNIT - II OPTIMUM RECEIVERS FOR AWGN CHANNEL [09]

Correlation demodulator matched filter, maximum likelihood sequence detector, optimum receiver for CPM signals, M-ary orthogonal signals, envelop detectors for M-ary and correlated binary signals.

UNIT - III RECEIVERS FOR FADING CHANNELS [09]

Characterization of fading multiple channels, statistical models, slow fading, frequency selective fading, diversity technique, RAKE demodulator, coded waveform for fading channel.

UNIT - IV SYNCHRONIZATION TECHNIQUES [09]

Carrier and signal synchronization, carrier phase estimation – PLL, Decision directed loops, symbol timing estimation, maximum likelihood and non-decision directed timing estimation, joint estimation.

UNIT - V ADAPTIVE EQUALIZATION [09]

Zero forcing algorithm, LMS algorithm, adaptive decision – feedback equalizer and Equalization of Trellis –coded signals. Kalman algorithm, blind equalizers and stochastic gradient algorithm.

Total (L= 45, T = 0) = 45 Periods

Reference Books :

1 C.L.Wadhwa, Electrical Power Systems, New Age International Pvt. Ltd, New Delhi, Seventh Edition, 2016.

2 K.Hein rich Meyer, Mare Moeneclacy, Stefan.A.Fechtel, Digital Communication Receivers, VolI & VolII, John Wiley, NewYork,1997.

3 John.G.Proakis, Digital communication, McGraw-Hill, NewYork, Fourth Edition, 2001.

4 E.A.Lee and D.G.Messerschmitt,Digitalcommunication,AlliedPublishers,NewDelhi, Second Edition, 1994.

5 Simon Marvin, Digitalcommunicationoverfadingchannel;Anunifiedapproachtoperformance Analysis, John Wiley, NewYork, 2000.

6 N.Benuveruto & G.Cherubini, Algorithms for Communication Systems and their Applications, Wiley 2002.

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SEMESTER - I

		L	T	P	C
CUAC01	**ENGLISH FOR RESEARCH PAPER WRITING (AC)**	2	0	0	0

Course Outcomes: On Completion of this course, the student will be able to		***Cognitive Level***
CO1:	*Describe how to improve your writing skills and level of readability*	*Understand*
CO2:	*Demonstrate about what to write in each section*	*Analyze*
CO3:	*Illustrate the skills needed for writing a Title*	*Understand*
CO4:	*Ensure the good quality of paper at very first-time submission*	*Understand*
CO5:	*Handling useful phrases for writing paper*	*Understand*

UNIT - I **[06]**

Planning and preparation, Word order, Breaking up long sentences, Structuring, Paragraphs and sentences, Being concise and removing redundancy, Avoiding, Ambiguity and vagueness

UNIT - II **[06]**

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and plagiarism, Sections of a paper, abstracts. Introduction. Review of the literature, methods, results, discussion, Conclusions, The final check.

UNIT - III **[06]**

Key skills are needed when writing a Title, key skills are needed when writing an abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature

UNIT - IV **[06]**

Skills are needed when writing the methods, skills needed when writing the results, skills are needed when writing the Discussion, skills are needed when writing the conclusions

UNIT - V **[06]**

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

Total (L= 30, T = 0) = 30 Periods

Reference Books :

1 C.L.Wadhwa, Electrical Power Systems, New Age International Pvt. Ltd, New Delhi, Seventh Edition, 2016.

2 Goldbort R (2006) Writing for Science, Yale University Press.

3 Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press

4 Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book.

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

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SEMESTER - I

		L	T	P	C
CUAC02	**DISASTER MANAGEMENT (AC)**	2	0	0	0

Course Outcomes: On Completion of this course, the student will be able to		***Cognitive Level***
CO1:	*Describe the terminologies in disaster management.*	*Understand*
CO2:	*Critically evaluate disaster risk reduction and humanitarian response policy*	*Analyze*
CO3:	*Develop the standards of humanitarian response and practical relevance in specific types of disasters and conflict situations*	*Understand*
CO4:	*Demonstrate the strengths and weaknesses of disaster management approaches*	*Understand*
CO5:	*Describe a critical understanding of key concepts in disaster risk reduction and humanitarian response*	*Understand*

UNIT - I INTRODUCTION [04]

Disaster: Definition, Factors and Significance; Difference Between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types And Magnitude.

UNIT - II REPERCUSSIONS OF DISASTERS AND HAZARDS [04]

Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks Of Disease and Epidemics, War and Conflicts.

UNIT - III DISASTER PRONE AREAS IN INDIA [04]

Study of Seismic Zones; Areas Prone To Floods and Droughts, Landslides and Avalanches; Areas Prone To Cyclonic and Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases and Epidemics

UNIT - IV DISASTER PREPAREDNESS AND MANAGEMENT [04]

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.

UNIT - V RISK ASSESSMENT [04]

Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-operation In Risk Assessment and Warning, People's Participation In Risk Assessment. Strategies for Survival.

UNIT - VI DISASTER MITIGATION

Meaning, Concept and Strategies of Disaster Mitigation, merging Trends In Mitigation. Structural Mitigation And Non-Structural Mitigation, Programs Of Disaster Mitigation In India.

Total (L= 24, T = 0) = 24 Periods

Reference Books :

1 C.L.Wadhwa, Electrical Power Systems, New Age International Pvt. Ltd, New Delhi, Seventh Edition, 2016.

1 K.Hein rich Meyer, Mare Moeneclacy, Stefan.A.Fechtel, Digital communication receivers, VolI & VolII, John Wiley, NewYork1997.

2 John.G.Proakis, Digital communication, Fourth Edition, McGraw-Hill, NewYork2001.

3 E.A.LeeandD. G.Messerschmitt, Digital communication, Second Edition, Allied Publishers, New Delhi 1994.

4 Simon Marvin, Digital communication over fading Channel; An unified approach to performance Analysis, John Wiley, NewYork2000.

5 N.Benuveruto & G.Cherubini, Algorithms for Communication Systems and their Applications, Wiley 2002.

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SEMESTER - I

		L	T	P	C
CUAC03	**SANSKRIT FOR TECHNICAL KNOWLEDGE (AC)**	2	0	0	0

Course Outcomes: On Completion of this course, the student will be able to		***Cognitive Level***
CO1:	*Describe basic Sanskrit language*	*Understand*
CO2:	*Ancient Sanskrit literature about science & technology can be understood*	*Understand*
CO3:	*Being a logical language will help to develop logic in students*	*Understand*

UNIT - I ALPHABETS [08]

Alphabets in Sanskrit, Past/Present/Future Tense, Simple Sentences.

UNIT - II TECHNICAL INFORMATION [08]

Order, Introduction of roots, Technical information about Sanskrit Literature.

UNIT - III TECHNICAL CONCEPTS [08]

Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics.

Total (L= 24, T = 0) = 24 Periods

Reference Books :

1 C.L.Wadhwa, Electrical Power Systems, New Age International Pvt. Ltd, New Delhi, Seventh Edition, 2016.

2 Abhyaspustaka – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi

3 Teach Yourself Sanskrit, Prathama Deeksha-Vempati Kutumb shastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication

4 India's Glorious Scientific Tradition Suresh Soni, Ocean books (P) Ltd., New Delhi.

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SEMESTER - I

		L	T	P	C
CUAC04	**VALUE EDUCATION (AC)**	2	0	0	0

Course Outcomes: On Completion of this course, the student will be able to		***Cognitive Level***
CO1:	*Knowledge of self-development*	*Understand*
CO2:	*Learn the importance of Human values*	*Understand*
CO3:	*Developing the overall personality*	*Understand*

UNIT - I VALUES AND SELF – DEVELOPMENT [04]

- Social values and individual attitudes.
- Work ethics, Indian vision of humanism.
- Moral and non- moral valuation. Standards and principles.
- Value judgements

UNIT - II IMPORTANCE OF CULTIVATION OF VALUES [06]

- Sense of duty. Devotion, Self-reliance. Confidence, Concentration.
- Truthfulness, Cleanliness.
- Honesty, Humanity. Power of faith, National Unity.
- Patriotism. Love for nature ,Discipline

UNIT - III PERSONALITY AND BEHAVIOR DEVELOPMENT [06]

- Soul and Scientific attitude.
- Positive Thinking. Integrity and discipline.
- Punctuality, Love and Kindness.
- Avoid fault Thinking.
- Free from anger, Dignity of labour.
- Universal brotherhood and religious tolerance.
- True friendship.
- Happiness Vs suffering, love for truth.
- Aware of self-destructive habits.
- Association and Cooperation.
- Doing best for saving nature

UNIT - IV CHARACTER AND COMPETENCE [06]

- Holy books vs Blind faith.
- Self-management and Good health.
- Science of reincarnation.
- Equality, Nonviolence, Humility, Role of Women.
- All religions and same message.
- Mind your Mind, Self-control.
- Honesty, Studying effectively

Total (L= 22, T = 0) = 22 Periods

Reference Books :

1 C.L.Wadhwa, Electrical Power Systems, New Age International Pvt. Ltd, New Delhi, Seventh Edition, 2016.

2 Chakroborty, S.K.Values and Ethics for organizations Theory and practice, Oxford University Press, New Delhi

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SEMESTER - II

MA20241 **APPLIED MATHEMATICS**

L	T	P	C
3	0	0	3

Course Outcomes: On Completion of this course, the student will be able to ***Cognitive Level***

CO1:	*Interpret the basics of Eigen values and vectors of symmetric matrices, by factorization and decomposition of matrices*	*Apply*
CO2:	*Solving one dimensional random variables.*	*Apply*
CO3:	*Analyze the two-dimensional random variables.*	*Apply*
CO4:	*Identifying the waiting times by using queuing models.*	*Apply*
CO5:	*Develop and evaluate Bessel function using orthogonal property*	*Apply*

UNIT - I **MATRIX THEORY** **[09]**

Matrix factorizations – The Cholesky decomposition – QR factorization – Least squares method – Singular value decomposition - Toeplitz matrices and some applications.

UNIT - II **ONE DIMENSIONAL RANDOM VARIABLES** **[09]**

Random variables - Probability function – Moments – Moment generating functions and their properties – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions – Function of a Random Variable.

UNIT - III **DISASTER PRONE AREAS IN INDIA** **[09]**

Joint distributions – Marginal and Conditional distributions – Functions of two-dimensional random variables – Regression Curve – Correlation.

UNIT - IV **QUEUEING MODELS** **[09]**

Poisson Process – Markovian queues – Applications of Queuing Models – characteristics of Queuing Models – Kendall's notation - Model I– (M/M/1) : ($\infty /FIFO$) Single Server with infinite capacity, – Little's formula - Model II – (M/M/C) : ($\infty /FIFO$) Multi Server with infinite capacity, - Model III – (M/M/1) : ($N /FIFO$) Single Server with finite capacity, - Model IV – (M/M/C) : ($N /FIFO$) Multi server with finite capacity - Machine Interference Model – Steady State analysis.

UNIT - V **SPECIAL FUNCTIONS**

Bessel's equation – Bessel function – Recurrence relations - Generating function and orthogonal property for Bessel functions of first kind – Fourier - Bessel expansion.

Total (L= 45, T = 0) = 45 Periods

Reference Books :

1 Grewal, B.S., Numerical methods in Engineering and Science, Khanna Publishers, Chennai, Forty second edition, 2013.

2 Moon, T.K., Sterling, W.C., Mathematical methods and algorithms for signal processing, Pearson Education, 2014.

3 Richard Johnson, Miller & Freund, Probability and Statistics for Engineers, Prentice – Hall of India, Private Ltd., New Delhi, Seventh Edition, 2013.

4 Donald Gross and Carl M. Harris, Fundamentals of Queuing theory, John Wiley and Sons, New York, Tenth edition, 2013

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SEMESTER - II

		L	T	P	C
CU20212	**MODERN DIGITAL COMMUNICATION TECHNIQUES**	3	0	0	3

Course Outcomes: On Completion of this course, the student will be able to		***Cognitive Level***
CO1:	*Demonstrate on fundamental digital modulation mechanisms.*	*Understand*
CO2:	*Describe OFDM concepts and applications*	*Understand*
CO3:	*Analyze and apply different block codes*	*Analyze*
CO4:	*Design convolutional codes with error probability*	*Understand*
CO5:	*Apply equalization techniques in communication systems*	*Apply*

UNIT - I DIGITAL MODULATION TECHNIQUES [09]

Generation of sub-carriers using the IFFT; Guard time and cyclic extension; Windowing; OFDM signal processing; Peak power problem: PAP reduction schemes - Clipping, filtering, coding and scrambling.

UNIT - II OFDM [09]

Generation of sub-carriers using the IFFT; Guard time and cyclic extension; Windowing; OFDM signal processing; Peak power problem: PAP reduction schemes - Clipping, filtering, coding and scrambling.

UNIT - III BLOCK CODED DIGITAL COMMUNICATION IN INDIA [09]

Architecture and performance – Binary block codes; Orthogonal; Bi orthogonal; Trans orthogonal – Shannon's channel coding theorem; Channel capacity; Matched filter; Concepts of spread spectrum communication –Coded BPSK and DPSK demodulators – Linear block codes; Hamming; Golay; Cyclic; BCH; Reed – Solomon codes.

UNIT - IV CONVOLUTIONAL CODED DIGITAL COMMUNICATION [09]

Representation of codes using polynomial, state diagram, tree diagram, and trellis diagram –Decoding techniques using maximum Likelihood, Viterbi algorithm, Sequential and threshold methods–Error probability performance for BPSK and Viterbi algorithm, Turbo coding.

UNIT - V EQUALIZATION TECHNIQUES [09]

Band limited channels – ISI – Nyquist criterion – Controlled ISI – Partial response signals– Equalization algorithms–Viterbi algorithm – Linear equalizer–Decision feedback equalization – Adaptive equalization algorithms

Total (L= 45, T = 0) = 45 Periods

Reference Books :

1 C.L.Wadhwa, Electrical Power Systems, New Age International Pvt. Ltd, New Delhi, Seventh Edition, 2016.

2 M.K.Simon,S.M.Hinedi and W.C.Lindsey, Digital Communication techniques; Signaling and detection, Prentice Hall India, New Delhi.1995.Reprint Edition2003.

3 Simon Haykin, Digital communications, John Wiley and sons, 1998.

4 John G. Proakis., Digital Communication, Second Edition, McGraw Hill Publication, 2001.

5 Theodore S.Rappaport., Wireless Communications, Second Edition, Pearson Education, 2002.

6 Stephen G.Wilson., Digital Modulation and Coding, First Indian Reprint, Pearson Education, 2003.

7 Richard VanNee & Ramje ePrasad, OFDM for Multimedia Communications, Artech House Publication 2001.

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SEMESTER - II

		L	T	P	C
CU20213	**ADVANCED DIGITAL SIGNAL PROCESSING**	3	0	0	3

Course Outcomes: On Completion of this course, the student will be able to		***Cognitive Level***
CO1:	*Describe the knowledge about discrete random signal processing.*	*Understand*
CO2:	*Demonstrate different spectral estimation technique*	*Understand*
CO3:	*Analyze the concept about linear prediction.*	*Analyze*
CO4:	*Design LMS and RLS adaptive filters for signal enhancement, channel equalization.*	*Understand*
CO5:	*Describe how a multi rate system works.*	*Understand*

UNIT - I DISCRETE RANDOM SIGNAL PROCESSING [09]

Discrete random processes – Ensemble averages – Stationary processes: Bias and Estimation, Auto covariance, Autocorrelation - Parseval's theorem - Wiener-Khintchine relation – White noise - Power spectral density, Spectral factorization – Filtering random processes – Low pass filtering of white noise.

UNIT - II SPECTRUM ESTIMATION [09]

Estimation of spectra from finite duration signals -Non-Parametric methods – Correlation method – Periodogram estimator – Performance analysis of estimators - Unbiased, Consistent estimators – Modified periodogram –Bartlett and Welch methods – Blackman – Tukey method - Parametric methods: AR, MA, ARMA model based spectral estimation, Yule-Walker equations-Solutions using Durbin's algorithm.

UNIT - III LINEAR ESTIMATION AND PREDICTION [09]

Linear prediction – Forward and backward predictions, Solutions of the normal equations - Levinson recursion algorithms – Least mean squared error criterion – Wiener filter for filtering and prediction – FIR Wiener filter and IIR Wiener filters – Discrete kalman filter.

UNIT - IV ADAPTIVE FILTERS [09]

FIR adaptive filters – Adaptive filter based on steepest descent method – Widrow – Hoff LMS adaptive algorithm – Normalized LMS – Adaptive channel equalization – Adaptive echo cancellation–Adaptive noise cancellation –Adaptive recursive filters – RLS adaptive filters – Exponentially weighted RLS sliding window RLS.

UNIT - V MULTIRATE DIGITAL SIGNAL PROCESSING [09]

Mathematical description of change of sampling rate – Interpolation and decimation – Decimation by an integer factor – Interpolation by an integer factor – Sampling rate conversion by a rational factor–Filter implementation for sampling rate conversion – Direct form FIR structures – Polyphase filter structures-Time-variant structures –Multistage implementation of multirate system – Application to sub band coding -Wavelet transform and filter bank implementation of wavelet expansion of signals.

Total (L= 45, T = 0) = 45 Periods

Reference Books :

1 C.L.Wadhwa, Electrical Power Systems, New Age International Pvt. Ltd, New Delhi, Seventh Edition, 2016.

2 Monson H. Hayes, Statistical Digital Signal Processing and Modeling, John Wiley and Sons,Inc., Singapore, 2008

3 JohnJ. Proakis, Dimitris G.Manolakis, Digital Signal Processing', Pearson Education, 2007.

4 Dimitris G Manolakis, Statistical and Adaptive Signal Processing, McGraw Hill, New York, 2005.

5 Rafael Gonzalez.C. Richard Woods E.Digital Image Processing", Second Edition, Pearson Education, Inc. 2004.

6 John Proakis.G. Algorithms for Statistical Signal Processing, Pearson Education, 2002

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SEMESTER - II

		L	T	P	C
CU20221	**ADVANCED DIGITAL SIGNAL PROCESSING LAB**	0	0	3	2

Course Outcomes: On Completion of this course, the student will be able to		***Cognitive Level***
CO1:	*Design and implement the various signal representation*	*Apply*
CO2:	*Analyze Routh - Hurwitz and FFT techniques.*	*Analyze*
CO3:	*Simulate various filters using MATLAB.*	*Apply*
CO4:	*Simulate different codes in communication.*	*Apply*
CO5:	*Simulate and analyze PSD and Z transform.*	*Apply*

LIST OF EXPERIMENTS:

1. Basic Signal Representation
2. Correlation Auto and Cross
3. Stability Using Hurwitz Routh Criteria
4. Sampling FFT of Input Sequence
5. Butterworth Lowpass and High pass Filter Design
6. Chebychev Type I, II Filter
7. State Space Matrix from Differential Equation
8. Normal Equation Using Levinson Durbin
9. Decimation and Interpolation Using Rationale Factors
10. Maximally Decimated Analysis DFT Filter
11. Cascade Digital IIR Filter Realization
12. Convolution and M Fold Decimation &PSD Estimator
13. Estimation of PSD
14. Inverse Z Transform

Total (P = 45) = 45 Periods

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SEMESTER - II

		L	T	P	C
CU20222	**MINI PROJECT**	0	0	3	2

Course Outcomes: On Completion of this course, the student will be able to

CO1	Identify, analyze, interpret and formulate the problem and conceptualize the methodology of the project in research areas of the department interests or of Industrial importance.
CO2	*Solve a specific problem right from its identification and literature review till the successful solution of the same.*
CO3	*Apply the theoretical concepts to solve real time problems with teamwork and multi-disciplinary approach.*
CO4	*Design /develop/conduct experiment and document the results by using modern tools/methods.*
CO5	*Prepare a good mini project report and be able to present the ideas with clarity.*

The students should adhere the following Guidelines:

1. To start with literature review about the proposed idea of the mini project and executing the same in consultation with the guide/project coordinator/Industry experts.

2. A detailed analysis/modeling/simulation/design/problem solving/experiment is must.
3. The progress of the mini Project is evaluated based on a minimum of three reviews and the Head of the Department may constitute the review committee.

4. A mini project report is required to be submitted at the end of the semester in the prescribed format.

5. The mini project is evaluated based on oral presentation and the report jointly by external and internal examiners constituted by the Head of the Department.

Total (P: 45) = 45 Periods

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SEMESTER - II

		L	T	P	C
CU20261	**COMMUNICATION PROTOCOL ENGINEERING (ELECTIVE)**	3	0	0	3

Course Outcomes: On Completion of this course, the student will be able to		***Cognitive Level***
CO1:	*Describe the concept of network reference models.*	*Understand*
CO2:	*Analyze the different types of specification in communication protocol.*	*Analyze*
CO3:	*Demonstrate protocol verification and validation.*	*Understand*
CO4:	*Develop the testing methodology used for protocol conformance.*	*Apply*
CO5:	*Apply the various protocol synthesis techniques for communication networks.*	*Apply*

UNIT - I NETWORK REFERENCE MODEL [09]

Communication model-software, subsystems, protocol, protocol development methods, Protocol engineering process, Layered architecture, Network services and Interfaces, Protocol functions, OSI model, TCP/IP protocol suite.

UNIT - II PROTOCOL SPECIFICATIONS [09]

Components of protocol, Specifications of communication service, Protocol entity, Interface, Interactions, Multimedia protocol, Internet protocol, SDL, SDL based protocol other protocol specification languages.

UNIT - III PROTOCOL VERIFICATION / VALIDATION [09]

Protocol verification, Verification of a protocol using finite state machines, Protocol validation, protocol design errors, Protocol validation approaches, SDL based protocol verification and validation.

UNIT - IV PROTOCOL CONFORMANCE / PERFORMANCE TESTING [09]

Conformance testing methodology and framework, Conformance test architectures, Test sequence generation methods, Distributed architecture by local methods, Conformance testing with TTCN, systems with semi controllable interfaces-RIP, SDL based tools for conformance testing, SDL based conformance testing of MPLS Performance testing, SDL based performance testing of TCP and OSPF, Interoperability testing, SDL based interoperability testing of CSMA/CD and CSMA/CA protocol using Bridge, Scalability testing

UNIT - V PROTOCOL SYNTHESIS AND IMPLEMENTATION [09]

Protocol synthesis, Interactive synthesis algorithm, Automatic synthesis algorithm, Automatic synthesis of SDL from MSC, Protocol re-synthesis; Requirements of protocol implementation, Object based approach to protocol implementation, Protocol compilers, Tool for protocol engineering.

Total (L= 45, T = 0) = 45 Periods

Reference Books :

1 C.L.Wadhwa, Electrical Power Systems, New Age International Pvt. Ltd, New Delhi, Seventh Edition, 2016.

1 Pallapa Venkataram and Sunil kumar S.Manvi, Communication protocol Engineering, Eastern Economy edition, 200).

2 RichardLai and Jirachief pattana, Communication Protocol Specification and Verification, Kluwer Publishers, Boston 1998.

3 Tarnay, K., Protocol Specification and Testing, Plenum, New York1991.

4 Mohamed G.Gouda, Elements of Network Protocol Design, John Wiley & Sons, Inc. New York, USA 1998.

5 G.J.Holtzmann, Design and validation of Computer protocols, Prentice Hall, New York 1991.

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SEMESTER - II

CU20262	INTERNET OF THINGS (ELECTIVE)	L	T	P	C
		3	0	0	3

Course Outcomes: On Completion of this course, the student will be able to		***Cognitive Level***
CO1:	*Describe IoT technologies are used for today, and what is required in certain scenarios.*	*Understand*
CO2:	*Demonstrate the types of technologies that are available and in use today and can be utilized to implement IoT solutions.*	*Understand*
CO3:	*Apply technologies to tackle scenarios in teams of using an experimental platform for implementing prototypes and testing them as running applications.*	*Apply*
CO4:	*Demonstrate the building blocks for IoT*	*Understand*
CO5:	*Describe operating systems and applications.*	*Understand*

UNIT - I INTRODUCTION TO IOT [09]

Smart cities and IoT revolution, Fractal cities, From IT to IoT, M2M and peer networking concepts, Ipv4 and IPV6.

UNIT - II CLOUD AND NETWORKING [09]

Software Defined Networks SDN, From Cloud to Fog and MIST networking for IoT communications, Principles of Edge/P2P networking, Protocols to support IoT communications, modular design and abstraction, security and privacy in fog – Scaling.

UNIT - III IOT NETWORKS [09]

Wireless sensor networks: introduction, IOT networks (PAN, LAN and WAN), Edge resource pooling and caching, client side control and configuration.

UNIT - IV HARDWARE PROGRAMMING [09]

Smart objects as building blocks for IoT, Open source hardware and Embedded systems platforms for IoT, Edge/gateway, IO drivers, Battery Operated Devices, C Programming, multithreading concepts - Accelerometer sensor.

UNIT - V OPERATING SYSTEMS AND APPLICATIONS [09]

Operating systems requirement of IoT environment, study of Embed, RIoT, and Contiki operating systems, Introductory concepts of big data for IoT applications. Applications of IoT, Connected cars IoT Transportation, Smart Grid and Healthcare sectors using IoT, Security and legal considerations, IT Act 2000 and scope for IoT legislation.

Total (L= 45, T = 0) = 45 Periods

Reference Books :

1 C.L.Wadhwa, Electrical Power Systems, New Age International Pvt. Ltd, New Delhi, Seventh Edition, 2016.

2 A Bahaga, V. Madisetti, Internet of Things- Hands on approach, VPT publisher, 2014.

3 A. McEwen, H. Cassimally, Designing the Internet of Things, Wiley, 2013.

4 CunoPfister, Getting started with Internet of Things, Maker Media, 1st edition, 2011.

5 Samuel Green guard, Internet of things, MIT Press, 2015.

6 http://www.datamation.com/open-source/35-open-source-tools-for-the-internet-of-things-1.html

7 https://developer.mbed.org/handbook/AnalogIn

8 http://www.libelium.com/50_sensor_applications

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SEMESTER - II

CU20263	VOICE AND DATA NETWORKS (ELECTIVE)	L	T	P	C
		3	0	0	3

Course Outcomes: On Completion of this course, the student will be able to		***Cognitive Level***
CO1:	*Describe the basics of voice networks*	*Understand*
CO2:	*Analyze about the data link layer*	*Analyze*
CO3:	*Demonstrate configure queuing models and multiple access*	*Understand*
CO4:	*Develop concepts of the network layer*	*Apply*
CO5:	*Describe the quality of service in networks*	*Understand*

UNIT - I NETWORK BASICS AND SWITCHING [09]

Network Design Issues, Network Performance Issues, Network Terminology, centralized and distributed approaches for networks design, Issues in design of voice and data networks. Layered and Layer less Communication, Cross layer design of Networks, Voice Networks (wired and wireless) and Switching, Circuit Switching and Packet Switching, Statistical Multiplexing.

UNIT - II DATA LINK LAYER [09]

Data Networks and their Design, Link layer design- Link adaptation, Link Layer Protocols, Retransmission. Mechanisms (ARQ), Hybrid ARQ (HARQ), Go Back N, Selective Repeat protocols and their analysis.

UNIT - III QUEUING AND MULTIPLE ACCESS TECHNIQUES [09]

Queuing Models of Networks, Traffic Models, Little's Theorem, Markov chains, M/M/1and other Markov systems, Multiple Access Protocols, Aloha System, Carrier Sensing, Examples of Local area networks.

UNIT - IV NETWORK LAYER [09]

Inter-networking, Bridging, Global Internet, IP protocol and addressing, Sub netting, Classless Inter domain Routing (CIDR), IP address lookup, Routing in Internet. End to End Protocols, TCP and UDP. Congestion Control, Additive Increase/Multiplicative Decrease, Slow Start, Fast Retransmit/ Fast Recovery.

UNIT - V QoS IN NETWOKS [09]

Congestion avoidance, RED TCP Throughput Analysis, Quality of Service in Packet Networks. Network Calculus, Packet Scheduling Algorithms – DPI Packet inspection.

Total (L= 45, T = 0) = 45 Periods

Reference Books :

1 C.L.Wadhwa, Electrical Power Systems, New Age International Pvt. Ltd, New Delhi, Seventh Edition, 2016.

2 D. Bertsekas and R. Gallager, Data Networks, Second Edition, Prentice Hall, 1992.

3 L. Peterson and B. S. Davie, Computer Networks: A Systems Approach, Fifth Edition, Morgan Kaufman, 2011.

4 Kumar, D. Manjunath and J. Kuri,, Communication Networking: An analytical approach, First Edition, Morgan Kaufman, 2004.

5 Walrand, Communications Network: A First Course, Second Edition, McGraw Hill, 2002.

6 Leonard Kleinrock, Queuing Systems, Volume I: Theory, First Edition, John Wiley and Sons, 1975.

7 Aaron Kershenbaum, Telecommunication Network Design Algorithms, McGraw Hill,1993.

8 Vijay Ahuja, Design and Analysis of Computer Communication Networks, McGraw Hill, 1987

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SEMESTER - II

CU20264	MIMO SYSTEMS (ELECTIVE)	L	T	P	C
		3	0	0	3

Course Outcomes: On Completion of this course, the student will be able to ***Cognitive Level***

CO1:	*Describe the basics of voice networks*	*Understand*
CO2:	*Analyze about the data link layer*	*Analyze*
CO3:	*Configure queuing models and multiple access*	*Understand*
CO4:	*Develop concepts of the network layer*	*Apply*
CO5:	*Describe the quality of service in networks*	*Understand*

UNIT - I OVERVIEW OF MIMO [09]

Introduction to Multi-antenna Systems, Motivation, Types of multi-antenna systems, MIMO vs. multi-antenna systems. Diversity, Exploiting multipath diversity, Transmit diversity, Space-time codes, The Alamouti scheme, Delay diversity, Cyclic delay diversity, Space-frequency codes, Receive diversity, The rake receiver, Combining techniques, Spatial Multiplexing, Spectral efficiency and capacity, Transmitting independent streams in parallel, Mathematical notation.

UNIT - II MIMO FUNCTIONS AND EQUALIZATION TECHNIQUES [09]

The generic MIMO problem, Singular Value Decomposition, Eigenvalues and Eigen vectors, Equalising MIMO systems, Disadvantages of equalizing MIMO systems, Pre distortion in MIMO systems, Disadvantages of pre-distortion in MIMO systems, Pre-coding and combining in MIMO systems, Advantages of pre-coding and combining, Disadvantages of pre coding and combining, Channel state information.

UNIT - III BEAMFORMING TECHNIQUES IN MIMO [09]

Codebooks for MIMO, Beam forming, Beam forming principles, Increased spectrum efficiency, Interference cancellation, Switched beam former, Adaptive beam former, Narrow band beam former, Wideband beam former.

UNIT - IV MIMO CHANNEL MODEL AND CODE WORDS [09]

Case study: MIMO in LTE, Code words to layers mapping, Pre-coding for spatial multiplexing, Pre-coding for transmit diversity, Beam forming in LTE, Cyclic delay diversity based pre-coding, Pre-coding codebooks, Propagation Channels, Time & frequency channel dispersion, AWGN and multipath propagation channels, Delay spread values and time variations, Fast and slow fading environments, Complex baseband multipath channels, Narrowband and wideband channels, MIMO channel models.

UNIT - V MIMO ESTIMATION TECHNIQUES [09]

Channel Estimation, Channel estimation techniques, Estimation and tracking, Training based channel estimation, Blind channel estimation, Channel estimation architectures, Iterative channel estimation, MMSE channel estimation, Correlative channel sounding, Channel estimation in single carrier systems, Channel estimation for CDMA, Channel estimation for OFDM.

Total (L= 45, T = 0) = 45 Periods

Reference Books :

1 C.L.Wadhwa, Electrical Power Systems, New Age International Pvt. Ltd,New Delhi, Seventh Edition, 2016.

2 Claude Oestges, Bruno Clerckx, MIMO Wireless Communications: From Real-world Propagation to Space-time Code Design, Academic Press, First edition, 2010.

3 Mohinder Janakiraman, Space - Time Codes and MIMO Systems, Artech House Publishers, Boston, 2004.

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SEMESTER - II

CU20265	SATELLITE COMMUNICATION (ELECTIVE)	L	T	P	C
		3	0	0	3

Course Outcomes: On Completion of this course, the student will be able to ***Cognitive Level***

CO1:	*Describe the elements of satellite communication*	*Understand*
CO2:	*Perform the different multiple accessing techniques*	*Understand*
CO3:	*Design satellite link systems*	*Apply*
CO4:	*Demonstrate the basics of navigation using satellite systems*	*Understand*
CO5:	*Illustrate the various applications of satellite systems*	*Understand*

UNIT - I ELEMENTS OF SATELLITE COMMUNICATION [09]

Satellite systems, Orbital description and Orbital mechanics of LEO, MEO and GSO – Placement of a satellite in a GSO - Satellite-description of different communication subsystems - Bandwidth allocation.

UNIT - II TRANSMISSION, MULTIPLEXING, MODULATION, MULTIPLE ACCESS AND CODING [09]

Different Modulation and Multiplexing Schemes – Multiple access techniques: FDMA, TDMA, CDMA and DAMA – Coding schemes.

UNIT - III SATELLITE LINKDESIGN [09]

Basic link analysis – Interference analysis – Rain induced attenuation and interference, Ionospheric characteristics – Link design with and without frequency reuse**.**

UNIT - IV SATELLITE NAVIGATIONAND GLOBAL POSITIONING SYSTEM [09]

Radio and Satellite navigation – GPS: Position location, principles, GPS receivers and codes - Satellite signal acquisition - GPS receiver operation and differential GPS**.**

UNIT - V APPLICATIONS [09]

Satellite packet communications, INTELSAT series – INSAT series–VSAT, Mobile satellite services – INMARSAT - Satellite and Cable Television - DBS (DTH), Satellite phones.

Total (L= 45, T = 0) = 45 Periods

Reference Books :

1 C.L.Wadhwa, Electrical Power Systems, New Age International Pvt. Ltd, New Delhi, Seventh Edition, 2016.

2 Wilbur.L.Pritchard, H.G. Suyderhoud, Robert A.Nelson, Satellite Communication Systems Engineering, Prentice Hall, New Jersey, 2006.

3 Timothy Pratt and Charles W.Bostain, Satellite Communications, John Wiley and Sons, 2003.

4 D.Roddy, Satellite Communication, McGraw Hill, 2006.

5 Tri T Ha, Digital Satellite Communication, McGraw Hill, 1990.

6 B.N.Agarwal, Design of Geo synchronous Spacecraft, Prentice Hall,1993.

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SEMESTER - II

CU20266	EM MODELLING AND ANALYSIS FOR PLANAR ANTENNAS(ELECTIVE)	L	T	P	C
		3	0	0	3

Course Outcomes: On Completion of this course, the student will be able to		***Cognitive Level***
CO1:	*Apply numerical analysis method of planar structure*	*Apply*
CO2:	*Describe transmission line model approach*	*Understand*
CO3:	*Analyze multiport network approach*	*Analyze*
CO4:	*Apply full wave analysis method*	*Apply*
CO5:	*Perform cavity* model and computer aided design	*Apply*

UNIT - I NUMERICAL ANALYSIS METHOD [09]

Introduction – Model based on the electric surface current – Horizontal electric dipole in microstrip – Numerical techniques for sommerfield integrals – Method of moments – Excitation and loading – Single rectangular patch antenna – Microstrip arrays.

UNIT - II NUMERICAL ANALYSIS METHOD [09]

Simple transmission line model – Improved transmission line model – Application of the improved transmission line model – Transmission line model for mutual coupling.

UNIT - III MULTIPORT NETWORK APPROACH [09]

Models for microstrip antennas – Z- matrix characterization of planar segments – Edge- Admittance and mutual coupling networks – Analysis of multiport network model – Examples

UNIT - IV FULLWAVE ANALYSIS OF MICROSTRIP ANTENNAS [09]

Spectral domain Fullwave analysis – Input impedance and Radiation analysis – Radiation patters – Numerical Evaluation – Basis functions – Mathematical model of excitation – Applications of spectral domain techniques – Integral equations – Potential in green function – FDTD method – Numerical dispersion – Excitation and source modeling

UNIT - V CAVITY MODEL AND COMPUTER AIDED DESIGN [09]

Cavity Models for analyzing Microstrip patch antennas – Generalized cavity model – Cavity model analysis for rectangular and circular MSAs – Computer aided design of microstrip antennas.

Total (L= 45, T = 0) = 45 Periods

Reference Books :

1 C.L.Wadhwa, Electrical Power Systems, New Age International Pvt. Ltd, New Delhi, Seventh Edition, 2016.

2 J.R James & P.S.Hall, Handbook of Microstrip Antennas, IEE Electromagnetic Waves Series, London 1989.

3 Ramesh Garg and Prakash Bhartia, Microstrip Antenna Design Hand Book, Artech house, London, 2001.

4 G.Kumar and K.P.Ray, Broad band Microstrip Antennas, Artech house, London 2003.

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SEMESTER - II

CU20267	COMMUNICATION NETWORK SECURITY(ELECTIVE)	L	T	P	C
		3	0	0	3

Course Outcomes: On Completion of this course, the student will be able to		***Cognitive Level***
CO1:	*Describe the concepts of various types of attacks and security techniques*	*Understand*
CO2:	*Describe the knowledge about algorithms in security*	*Understand*
CO3:	*Discuss the various techniques used in data securing*	*Understand*
CO4:	*Interpret the concept about firewalls and network security*	*Understand*
CO5:	*Illustrate the knowledge about wireless network security*	*Understand*

UNIT - I INTRODUCTION ON SECURITY [09]

Security goals, Types of attacks: Passive attack, Active attack, Attacks on confidentiality, Attacks on Integrity and Availability. Security services and mechanisms, Techniques: Cryptography, Steganography, Revision on Mathematics for cryptography.

UNIT - II SYMMETRIC & ASYMMETRIC KEY ALGORITHMS [09]

Substitution Ciphers, Transposition ciphers, Stream and block ciphers, Data Encryption Standards (DES), Advanced Encryption Standard (AES), RC4, Principle of asymmetric key algorithms, RSA cryptosystem.

UNIT - III INTEGRITY, AUTHENTICATION AND KEY MANAGEMENT [09]

Message integrity, Hash functions: SHA, Digital signatures: Digital signature standards. Authentication: Entity authentication, Biometrics, Key management techniques.

UNIT - IV NETWORK SECURITY , FIREWALLS AND WEB SECURITY [09]

Introduction on firewalls, Types of firewalls, Firewall configuration and Limitation of firewall. IP security overview, IP security architecture, Authentication header, Security pay load, Security associations, Key management. Web security requirement, Secure sockets layer, Transport layer security, Secure electronic transaction, Dual signature.

UNIT - V WIRELESS NETWORK SECURITY [09]

Security attack issues specific to wireless systems: Wormhole, Tunneling, DoS, WEP for Wi-Fi network, Security for 4G networks: Secure adhoc network, Secure sensor network.

Total (L= 45, T = 0) = 45 Periods

Reference Books :

1 C.L.Wadhwa, Electrical Power Systems, New Age International Pvt. Ltd, New Delhi, Seventh Edition, 2016.

2 K. Behrouz A.Fourcuzan, Cryptography and Network security, Tata McGraw Hill, 2008.

3 William Stallings, Cryptography and Network security: principles and practice, Second Edition, Prentice Hall of India, New Delhi (2002)

4 AtulKahate, Cryptography and Network security, Second Edition, Tata Mc-GrawHill,2008.

5 H.Yangetal. Security in Mobile AdHoc Networks: Challenges and Solution, IEEE Wireless Communications, Feb, (2004).

6 Securing Ad Hoc Networks, IEEE Network Magazine, vol.13, no. 6, pp24-30, December1999.

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SEMESTER - II

CU20268	RF MEMS FOR WIRELESS COMMUNICATION (ELECTIVE)	L	T	P	C
		3	0	0	3

Course Outcomes: On Completion of this course, the student will be able to		***Cognitive Level***
CO1:	*Describe the different wireless transceiver architectures*	*Understand*
CO2:	*Demonstrate the Working principle of different MEM switches and its applications*	*Understand*
CO3:	*Demonstrate RF MEMS applications in various areas of communication*	*Understand*
CO4:	*Explain about the RF Phase shifters and filters*	*Understand*
CO5:	*Illustrate the RF MEMS antennas.*	*Understand*

UNIT - I WIRELESS TRANSCEIVER ARCHITECTURES [09]

Introduction Spheres of wireless activities - The home and office -The ground fixed/mobile platform - The space platform - Wireless standards - Systems and architectures, wireless standards, conceptual wireless systems, wireless transceiver architectures, power and bandwidth-efficient wireless systems & challenges, MEMS based wireless appliances enable ubiquitous connectivity. Physical aspects of RF circuit design, skin effect, transmission lines on thin substrates, self-resonance frequency, quality factor packaging, practical aspects of RF circuit design, dc biasing, and impedance mismatch effect in RF MEMS.

UNIT - II MEM SWITCHES AND ITS APPLICATIONS [09]

Enabled circuit elements and models - RF/Microwave substrate properties - Micro machined enhanced elements - Capacitors, inductors, varactors - MEM switches - Shunt MEM switch - Low voltage hinged MEM switch approaches - Push-pull series switch - Folded beam springs suspension series switch - Resonators - Transmission line planar resonators, cavity resonators - Micromechanical resonators - Film bulk acoustic wave resonators - MEMS modeling - Mechanical modeling, electromagnetic modeling.

UNIT - III RF APPLICATIONS OF MEMS [09]

Enabled circuits - Reconfigurable circuits - The resonant MEMS switch – Capacitors – Inductors - Tunable CPW resonator - MEMS microswitch arrays - Reconfigurable circuits - Double - Stub tuner, Nth – stub tuner, filters, resonator tuning system -Massively parallel switchable RF front ends -True time-delay digital phase shifters.

UNIT - IV PHASE SHIFTERS & FILTERS [09]

Phase shifters –Fundamentals - X-Band RF MEMS phase shifter for phased array applications - Ka- Band RF MEMS Phase shifter for radar systems applications - Film bulk acoustic wave filters – FBAR filter fundamentals, FBAR filter for PCS applications.

UNIT - V RF MEMS ANTENNA [09]

Micro machined antenna - Micro electro mechanical system antennas - Reconfigurable Antennas - Tunable dipole antennas - Tunable microstrip patch - Array antenna. Integrates antenna selection - Photonic band gap antennas.

Total (L= 45, T = 0) = 45 Periods

Reference Books :

1 C.L.Wadhwa, Electrical Power Systems, New Age International Pvt. Ltd, New Delhi, Seventh Edition, 2016.

2 Hector J. De Los Santos, RF MEMS Circuit Design for Wireless Communications, Artech House, 2002

3 Vijay K.Varadan, K.J. Vinoy, K.A. Jose., RF MEMS and their Applications, John Wiley and sons, LTD, 2002.

4 Gabriel M. Rebeiz, RF MEMS Theory, Design & Technology, Wiley Inter science, 2002.

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SEMESTER - II

		L	T	P	C
CU20269	**MULTIMEDIA COMPRESSION TECHNIQUES (ELECTIVE)**	3	0	0	3

Course Outcomes: On Completion of this course, the student will be able to		***Cognitive Level***
CO1:	*Demonstrate the special features and representations of different data types of multimedia.*	*Understand*
CO2:	*Illustrate different multimedia communication standards for text compression*	*Understand*
CO3:	*Describe the knowledge about compression techniques in audio signal*	*Understand*
CO4:	*Describe the concept about image compression*	*Understand*
CO5:	*Illustrate the various standards in video compression*	*Understand*

UNIT - I INTRODUCTION [09]

Special features of multimedia, Graphics and image data representations – Fundamental concepts in text, images, graphics, video and digital audio – Storage requirements for multimedia applications – Need for compression – Lossy& Lossless compression techniques – Overview of source coding, information theory & source models– Kraft McMillan in equality–Scalar quantization-Uniform and non-uniform quantization - Vector quantization.

UNIT - II TEXT COMPRESSION [09]

Compaction techniques – Run length coding – Huffmann coding–Adaptive Huffmann coding – Arithmetic coding – Shanonfano coding- Dictionary techniques – LZW family algorithms

UNIT - III AUDIO COMPRESSION [09]

Audio compression techniques – µLaw and A-Law companding frequency domain and filtering– Basic sub–band coding – Application to speech coding – G.722 – Application to audio coding – MPEG audio, Progressive encoding for audio – Silence compression, speech compression techniques – Formant and CELP vocoders.

UNIT - IV IMAGE COMPRESSION [09]

Predictive techniques – DM, PCM, DPCM: Optimal predictors and Optimal quantization – Contour based compression – Transform coding – JPEG standard – Sub-band coding algorithms: Design of filter banks–Wavelet based compression: Implementation using filters – EZW, SPIHT coders – JPEG 2000 standards, JBIG, JBIG2 standards.

UNIT - V VIDEO COMPRESSION [09]

Video compression techniques and standards – MPEG Video coding: MPEG–1 and 2 – MPEG Video coding II : MPEG–4and7– Motion estimation and compensation techniques – H.261standard – DVI technology – DVI real-time compression – Packet video.

Total (L= 45, T = 0) = 45 Periods

Reference Books :

1 C.L.Wadhwa, Electrical Power Systems, New Age International Pvt. Ltd, New Delhi, Seventh Edition, 2016.

2 Khalid Sayood, Introduction to Data Compression, Morgan Kauffman Harcourt India, Second Edition, Reprint 2011.

3 David Salomon, Data Compression–The Complete Reference, Springer Verlag, New York, Second, 2001.

4 YunQ.Shi, Huifang Sun: Image and Video Compression for Multimedia Engineering– Fundamentals Algorithms & Standards", CRC press 2003.

5 Peter Symes, Digital Video Compression, McGraw Hill Publications, 2004.

6 MarkS.Drew, Ze-NianLi: Fundamentals of Multimedia, PHI, First Edition, 2003.

7 J.Watkinson, Compression in Video and Audio, Focal press, London, 1995.

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SEMESTER – II

		L	T	P	C
PE20201	**SOFT COMPUTING TECHNIQUES** (Common to CS & PE)	3	0	0	3

Course Outcomes : On successful completion of the course, the student will be able to ***Cognitive Level***

CO1:	*Infer the concepts of artificial neural network.*	*Understand*
CO2:	*Apply the knowledge of neural network to develop architecture and algorithms of BPN, hop field.*	*Apply*
CO3:	*Analyze the concept competitive neural networks.*	*Understand*
CO4:	*Discuss the concepts of fuzzy logic system with classical system; apply the knowledge of fuzzy logic controller for classical applications.*	*Apply*
CO5:	*Illustrate the fundamentals of genetic algorithm and its various functionalities.*	*Remember*

UNIT - I ARTIFICIAL NEURAL NETWORK [09]

Motivation for the development of neural networks – Biological neural networks – Artificial neural networks – Fundamental Concepts – Weights – Biases and thresholds – Common activation functions. McCulloch-pitts neuron: Architecture – Algorithm – Applications – Hebb Net – Architecture – Algorithm – Application – Perceptron – Architecture – Algorithm – Applications – Linear separability – Perceptron learning rule convergence theorem – Delta rule.

UNIT - II NEURAL NETWORK ARCHITECTURE AND ALGORITHMS [09]

Back propogation Neural Net: Standard and counter back propogation – Architecture – Algorithm – Number of hidden layers – Applications – Hopfield neural net – Discrete and Continuous – Architecture – Algorithm – Applications – Associative Memory Neural Networks – Boltzman Machine.

UNIT - III COMPETITIVE NEURAL NETWORKS [09]

Fixed-weight competitive nets – Maxnet- Mexican Hat Net –Kohonenself-organizing Maps – Applications – Adaptive Resonance Theory – Basic architecture and operation – Neuro controllers – Functional diagram – Inverse dynamics – coping control action – Case studies.

UNIT - IV FUZZY LOGIC [09]

Fuzzy sets – Properties of Classical and Fuzzy sets – Operations on Fuzzy sets – Fuzzy relations – Linguistic variables – Linguistic Hedges – Fuzzy statements – Assignment statements – Conditional statements – Unconditional statements – Fuzzy rule base – Canonical rule formation – Decomposition of compound rules.- Fuzzy logic controller: Functional diagram – Fuzzification – Membership value assignments using intuition – Membership functions –Defuzzification: Max – Membership principle – Centroid method – Weighted average method – Inference Engine – Knowledge Base – Rule base – Case studies

UNIT - V EVOLUTIONARY PROGRAMMING [09]

Optimization – Traditional optimization methods – Concept of Evolutionary Algorithm – Simulated Annealing – Genetic Algorithm – Encoding and decoding of variables – GA operators – Reproductions – Cross over – Mutation – Fitness function – Fitness scaling – Real coded GA – Advanced operators – Particle swarm optimization.

Total = 45 Periods

Reference Books :

1 Jacek.M.Zurada, Introduction to Artificial Neural Systems, Jaico Publishing House, Third Edition, 2006.
2 Lawrence Faussett, Fundamental of neural networks, Prentice Hall, First Edition, 2004.
3 Ross,T.J., Fuzzy Logic with Engineering Applications, McGraw-Hill, Newyork, First Edition, 2005.
4 Zimmerman, H.J., Fuzzy set theory-and its Applications-Kluwer Academic Publishers, Fourth Edition, 1994.
5 Driankov, Hellendroon, Introduction to Fuzzy Control, Narosa Publishers, Second Revised Edition, 1996.
6 David.E. Gold berg, Genetic algorithms in search optimization and machine learning, Addison Wesley, Pearson Education, Asia, Fourth Edition, 2001.

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SEMESTER - III

		L	T	P	C
CU20361	**HIGH PERFORMANCE COMPUTER NETWORKS (ELECTIVE)**	3	0	0	3

Course Outcomes: On Completion of this course, the student will be able to		***Cognitive Level***
CO1:	*Describe the basics of communication and OSI layers.*	*Understand*
CO2:	*Demonstrate the various services and mechanism for multimedia networking.*	*Understand*
CO3:	*Analyze the concept of advanced network concepts.*	*Analyze*
CO4:	*Describe the various types of modeling in traffic management.*	*Understand*
CO5:	*Illustrate basic concept of network security and management.*	*Understand*

UNIT - I INTRODUCTION [09]

Review of OSI,TCP/IP: Multiplexing, modes of communication, switching, routing, SONET,DWD, DSL,ISDN,BISDN, ATM

UNIT - II MULTIMEDIA NETWORKING APPLICATIONS [09]

Streaming stored audio and video, Best effort service, Protocols for real time interactive applications, Beyond best effort, Scheduling and policing mechanism, Integrated services, RSVP, Differentiated services.

UNIT - III ADVANCED NETWORKS CONCEPTS [09]

VPN, Remote - Access VPN, site-to-site VPN, Tunneling to PPP, Security in VPN, MPLS Operation, Routing, Tunneling and use of FEC, Traffic Engineering, MPLS based VPN, Overlay Networks - P2P Connections.

UNIT - IV TRAFFIC MODELLING [09]

Little's theorem, Need for modeling, Poisson modeling and its failure, Non- Poisson models, Network performance evaluation.

UNIT - V NETWORK SECURITY AND MANAGEMENT [09]

Principles of cryptography, Authentication, Integrity, Key distribution and certification, Access control and fire walls, Attacks and counter measures, Security in many layers, Infrastructure for network management, The internet standard management framework, SMI, MIB, SNMP, Security and administration, ASN.1.

Total (L= 45, T = 0) = 45 Periods

Reference Books :

1 C.L.Wadhwa, Electrical Power Systems, New Age International Pvt. Ltd, New Delhi, Seventh Edition, 2016.

2 J.F.Kurose & K.W.Ross, Computer Networking– A top down approach featuring the internet, Pearson, Third edition,Ninthimpression2011.

3 Walrand.J.Varatya, Morgan Kauffman, High Performance Communication Network, Harcourt Asia Pvt. Ltd. Second Edition,Reprint2011.

4 Aunuragkumar.D, Anjunath.M, JoyKuri, Communication Networking, Morgan Kaufmann Publishers, First edition, Reprint2012.

5 Hersent Gurle & Petit, IP Telephony, Packet Pored Multimedia Communication Systems, Pearson Education, Reprint2011.

6 Fred Halsall and Lingana Gouda Kulkarni, Computer Networking and the Internet, Fifth Edition, Pearson education,Reprint2012.

7 Nader F. Mir, Computer and Communication Networks, Pearson Education, Third impression, 2009.

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SEMESTER - III

		L	T	P	C
CU20362	**PATTERN RECOGNITION AND MACHINE LEARNING (ELECTIVE)**	3	0	0	3

Course Outcomes: On Completion of this course, the student will be able to		***Cognitive Level***
CO1:	*Describe basics of Pattern Recognition.*	*Understand*
CO2:	*Demonstrate various types of linear models.*	*Understand*
CO3:	*Illustrate the concepts of Neural Networks.*	*Understand*
CO4:	*Describe the various types of modeling in traffic management.*	*Understand*
CO5:	*Interpret basic concept of algorithm Independent machine learning and unsupervised learning and clustering.*	*Understand*

UNIT - I **INTRODUCTION TO PATTERN RECOGNITION** **[09]**

Problems, applications, design cycle, learning and adaptation, examples, Probability distributions, Parametric learning, Maximum likelihood and Bayesian decision theory, Bayes rule, discriminant functions, loss functions and Bayesian error analysis

UNIT - II **LINEAR MODELS** **[09]**

Linear models for regression, linear regression, logistic regression, Linear models for classification.

UNIT - III **NEURAL NETWORK** **[09]**

Perceptron, multi-layer perceptron, back propagation algorithm, error surfaces, practical techniques for improving back propagation, additional networks and training methods, Adaboost, Deep learning.

UNIT - IV **LINEAR DISCRIMINANT FUNCTIONS** **[09]**

Decision surfaces, two-category, multi-category, minimum squared error procedures, the Ho-Kashyap procedures, linear programming algorithms, Support vector machine.

UNIT - V **ALGORITHM INDEPENDENT MACHINE LEARNING AND UNSUPERVISED LEARNING AND CLUSTERING** **[09]**

Lack of inherent superiority of any classifier, bias and variance, re-sampling for classifier design, combining classifiers, k-means clustering, fuzzy k-means clustering, hierarchical clustering.

Total (L= 45, T = 0) = 45 Periods

Reference Books :

1 C.L.Wadhwa, Electrical Power Systems, New Age International Pvt. Ltd, New Delhi, Seventh Edition, 2016.

1 Richard O. Duda, Peter E. Hart, David G. Stork, Pattern Classification, Second Edition, John Wiley & Sons, 2001.

2 Trevor Hastie, Robert Tibshirani, Jerome H. Friedman, The Elements of Statistical Learning, Second Edition, Springer, 2009.

3 C. Bishop, Pattern Recognition and Machine Learning, Springer, 2006.

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SEMESTER - III

CU20363	REMOTE SENSING (ELECTIVE)	L	T	P	C
		3	0	0	3

Course Outcomes: On Completion of this course, the student will be able to ***Cognitive Level***

CO1:	*Describe the basics of remote sensing*	*Understand*
CO2:	*Explain the various data acquisition systems*	*Understand*
CO3:	*Illustrate the concept of advanced photographic Products*	*Understand*
CO4:	*Describe the various types of scattering system*	*Understand*
CO5:	*Describe basic concept of thermal and hyper spectral remote sensing*	*Understand*

UNIT - I PHYSICS OF REMOTE SENSING [09]

Electromagnetic spectrum, Physics of remote sensing, Effects of atmosphere-Scattering, Different types, Absorption, Atmospheric window, Energy interaction with surface features, Spectral reflectance of vegetation, soil and water atmospheric influence on spectral response patterns-Multi concept in remote sensing.

UNIT - II DATA ACQUISITION [09]

Types of platforms – Different types of aircrafts - Manned and unmanned space crafts – Sun synchronous and geo synchronous satellites – Types and characteristics of different platforms – LANDSAT, SPOT, IRS, INSAT, IKONOS, QUICKBIRD, etc.,

UNIT - III PHOTOGRAPHIC PRODUCTS [09]

B/W, color, color IR film and their characteristics, Resolving power of lens and film, OPTO mechanical electro optical sensors, Across track and along track scanners, Multispectral scanners and thermal scanners, Geometric characteristics of scanner imagery - Calibration of thermal scanners.

UNIT - IV SCATTERING SYSTEM [09]

Microwave scattermetry, types of RADAR, SLAR, Resolution, Range and azimuth, Real aperture and synthetic aperture RADAR, Characteristics of Microwave images topographic effect , different types of Remote Sensing platforms, Airborne and space borne sensors, ERS, JERS, RADARSAT, RISAT, Scattero meter, Altimeter, LiDAR remote sensing, Principles, Applications.

UNIT - V THERMAL AND HYPER SPECTRAL REMOTE SENSING [09]

Sensors characteristics ,Principle of spectroscopy, Imaging spectroscopy, Field conditions, Compound spectral curve, Spectral library, Radiative models, Processing Procedures, Derivative spectrometry, Thermal remote sensing, Thermal sensors, Principles, Thermal data processing, Applications.

Total (L= 45, T = 0) = 45 Periods

Reference Books :

1 C.L.Wadhwa, Electrical Power Systems, New Age International Pvt. Ltd, New Delhi, Seventh Edition, 2016.

2 Lillesand T.M., and Kiefer,R.W. Remote Sensing and Image interpretation, John Wiley & Sons-2000, 6thEdition

3 John R. Jensen, Introductory Digital Image Processing: A Remote Sensing Perspective, Second Edition, 1995

4 John A.Richards, Springer –Verlag, Remote Sensing Digital Image Analysis,1999

5 Paul Curran P.J. Principles of Remote Sensing, ELBS; 1995.

6 Charles Elachi and Jakob J. van Zyl, Introduction To The Physics and Techniques of Remote Sensing, Wiley Series in Remote Sensing and Image Processing, 2006.

7 Sabins, F.F.Jr, Remote Sensing Principles and Image interpretation, W.H.Freeman & Co, 1978

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SEMESTER - III

CU20364	HIGH SPEED SWITCHINGARCHITECTURE (ELECTIVE)	L	T	P	C
		3	0	0	3

Course Outcomes: On Completion of this course, the student will be able to ***Cognitive Level***

CO1:	*Describe the basics concept of LAN switching technology*	*Understand*
CO2:	*Illustrate the concept about ATM switching architecture*	*Understand*
CO3:	*Demonstrate the knowledge of queuing performance in ATM switches*	*Understand*
CO4:	*Describe various architectures in Packet switching*	*Understand*
CO5:	*Illustrate the concept about IP switching*	*Understand*

UNIT - I LAN SWITCHING TECHNOLOGY [09]

Switching concepts, Switch forwarding techniques, Switch path control, LAN switching, Cut through forwarding, Store and forward, Virtual LANs.

UNIT - II ATM SWITCHING ARCHITECTURE [09]

Blocking networks, Basic and enhanced banyan networks, Sorting networks, Merge sorting, Re-arrangable networks, Full and partial connection networks, Non-blocking networks- Recursive network construction, Comparison of non-blocking network, Switching with deflection routing, Shuffle switch, Tandem banyan switch.

UNIT - III QUEUES IN ATM SWITCHES [09]

Internal queuing - Input, output and shared queuing, Multiple queuing networks, Combined input, output and shared queuing - Performance analysis of queued switches.

UNIT - IV PACKET SWITCHING ARCHITECTURES [09]

Architectures of internet switches and routers, Bufferless and buffered crossbar switches, Multi-stage switching, Optical packet switching, Switching fabric on a chip, Internally buffered crossbars.

UNIT - V IP SWITCHING [09]

Addressing model, IP Switching types, Flow driven and topology driven solutions, IP over ATM address and next hop resolution, Multicasting, IPV6 over ATM.

Total (L= 45, T = 0) = 45 Periods

Reference Books :

1 C.L.Wadhwa, Electrical Power Systems, New Age International Pvt. Ltd, New Delhi, Seventh Edition, 2016.

2 Achille Pattavina, Switching Theory: Architectures and Performance in Broadband ATM Networks, John Wiley & Sons Ltd, New York. Reprint, 2012.

3 Elhanany M.Hamdi, High Performance Packet Switching Architectures, Springer Publications, 2010

4 Christopher Y Metz, Switching protocols & Architectures, McGraw–Hill Professional Publishing, New York. Reprint 2012.

5 Rainer Handel, Manfred NHuber, Stefan Schroder, ATM Networks – Concepts Protocols, Applications, Third Edition, Addison Wesley, New York, 2009.

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SEMESTER - II

CU20266	EM MODELLING AND ANALYSIS FOR PLANAR ANTENNAS (ELECTIVE)	L	T	P	C
		3	0	0	3

Course Outcomes: On Completion of this course, the student will be able to		***Cognitive Level***
CO1:	*Apply numerical analysis method of planar structure*	*Apply*
CO2:	*Describe transmission line model approach*	*Understand*
CO3:	*Analyze multiport network approach*	*Analyze*
CO4:	*Apply full wave analysis method*	*Apply*
CO5:	*Perform cavity* model and computer aided design	*Apply*

UNIT - I NUMERICAL ANALYSIS METHOD [09]

Introduction – Model based on the electric surface current – Horizontal electric dipole in microstrip – Numerical techniques for sommer field integrals – Method of moments – Excitation and loading – Single rectangular patch antenna – Microstrip arrays.

UNIT - II NUMERICAL ANALYSIS METHOD [09]

Simple transmission line model – Improved transmission line model – Application of the improved transmission line model – Transmission line model for mutual coupling.

UNIT - III MULTIPORT NETWORK APPROACH [09]

Models for microstrip antennas – Z- matrix characterization of planar segments – Edge- Admittance and mutual coupling networks – Analysis of multiport network model – Examples

UNIT - IV FULLWAVE ANALYSIS OF MICROSTRIP ANTENNAS [09]

Spectral domain Fullwave analysis – Input impedance and Radiation analysis – Radiation patters – Numerical Evaluation – Basis functions – Mathematical model of excitation – Applications of spectral domain techniques – Integral equations – Potential in green function – FDTD method – Numerical dispersion – Excitation and source modeling

UNIT - V CAVITY MODEL AND COMPUTER AIDED DESIGN [09]

Cavity Models for analyzing Microstrip patch antennas – Generalized cavity model – Cavity model analysis for rectangular and circular MSAs – Computer aided design of microstrip antennas.

Total (L= 45, T = 0) = 45 Periods

Reference Books :

1 C.L.Wadhwa, Electrical Power Systems, New Age International Pvt. Ltd, New Delhi, Seventh Edition, 2016.

2 J.R James & P.S.Hall , Handbook of Microstrip Antennas, IEE Electromagnetic Waves Series, London 1989.

3 Ramesh Garg and Prakash Bhartia, Microstrip Antenna Design Hand Book, Artech house, London, 2001.

4 G.Kumar and K.P.Ray, Broad band Microstrip Antennas, Artech house, London 2003.

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SEMESTER - II

CU20267	COMMUNICATION NETWORK SECURITY (ELECTIVE)	L	T	P	C
		3	0	0	3

Course Outcomes: On Completion of this course, the student will be able to		***Cognitive Level***
CO1:	*Describe the concepts of various types of attacks and security techniques*	*Understand*
CO2:	*Describe the knowledge about algorithms in security*	*Understand*
CO3:	*Discuss the various techniques used in data securing*	*Understand*
CO4:	*Interpret the concept about firewalls and network security*	*Understand*
CO5:	*Illustrate the knowledge about wireless network security*	*Understand*

UNIT - I INTRODUCTION ON SECURITY [09]

Security goals, Types of attacks: Passive attack, Active attack, Attacks on confidentiality, Attacks on Integrity and Availability. Security services and mechanisms, Techniques: Cryptography, Steganography, Revision on Mathematics for cryptography.

UNIT - II SYMMETRIC & ASYMMETRIC KEY ALGORITHMS [09]

Substitution Ciphers, Transposition ciphers, Stream and block ciphers, Data Encryption Standards (DES), Advanced Encryption Standard (AES), RC4, Principle of asymmetric key algorithms, RSA cryptosystem.

UNIT - III INTEGRITY, AUTHENTICATION AND KEY MANAGEMENT [09]

Message integrity, Hash functions: SHA, Digital signatures: Digital signature standards. Authentication: Entity authentication, Biometrics, Key management techniques.

UNIT - IV NETWORK SECURITY , FIREWALLS AND WEB SECURITY [09]

Introduction on firewalls, Types of firewalls, Firewall configuration and Limitation of firewall. IP security overview, IP security architecture, Authentication header, Security pay load, Security associations, Key management. Web security requirement, Secure sockets layer, Transport layer security, Secure electronic transaction, Dual signature.

UNIT - V WIRELESS NETWORK SECURITY [09]

Security attack issues specific to wireless systems: Wormhole, Tunneling, DoS, WEP for Wi-Fi network, Security for 4G networks: Secure adhoc network, Secure sensor network.

Total (L= 45, T = 0) = 45 Periods

Reference Books :

1 C.L.Wadhwa, Electrical Power Systems, New Age International Pvt. Ltd, New Delhi, Seventh Edition, 2016.

2 K. Behrouz A.Fourcuzan, Cryptography and Network security, Tata McGraw Hill, 2008.

3 William Stallings, Cryptography and Network security: principles and practice, Second Edition, Prentice Hall of India, New Delhi (2002)

4 Atul Kahate, Cryptography and Network security, Second Edition, Tata Mc-Graw Hill, 2008.

5 H.Yangetal. Security in Mobile AdHoc Networks: Challenges and Solution, IEEE Wireless Communications, Feb, (2004).

6 Securing Ad Hoc Networks, IEEE Network Magazine, vol.13, no. 6, pp24-30, December 1999.

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SEMESTER - II

		L	T	P	C
CU20268	**RF MEMS FOR WIRELESS COMMUNICATION (ELECTIVE)**	3	0	0	3

Course Outcomes: On Completion of this course, the student will be able to		***Cognitive Level***
CO1:	*Describe the different wireless transceiver architectures*	*Understand*
CO2:	*Demonstrate the Working principle of different MEM switches and its applications*	*Understand*
CO3:	*Demonstrate RF MEMS applications in various areas of communication*	*Understand*
CO4:	*Explain about the RF Phase shifters and filters*	*Understand*
CO5:	*Illustrate the RF MEMS antennas.*	*Understand*

UNIT - I WIRELESS TRANSCEIVER ARCHITECTURES [09]

Introduction Spheres of wireless activities - The home and office -The ground fixed/mobile platform - The space platform - Wireless standards - Systems and architectures, wireless standards, conceptual wireless systems, wireless transceiver architectures, power and bandwidth-efficient wireless systems & challenges, MEMS based wireless appliances enable ubiquitous connectivity. Physical aspects of RF circuit design, skin effect, transmission lines on thin substrates, self-resonance frequency, quality factor packaging, practical aspects of RF circuit design, dc biasing, and impedance mismatch effect in RF MEMS.

UNIT - II MEM SWITCHES AND ITS APPLICATIONS [09]

Enabled circuit elements and models - RF/Microwave substrate properties - Micro machined enhanced elements - Capacitors, inductors, varactors - MEM switches - Shunt MEM switch - Low voltage hinged MEM switch approaches - Push-pull series switch - Folded beam springs suspension series switch - Resonators - Transmission line planar resonators, cavity resonators - Micromechanical resonators - Film bulk acoustic wave resonators - MEMS modeling - Mechanical modeling, electromagnetic modeling.

UNIT - III RF APPLICATIONS OF MEMS [09]

Enabled circuits - Reconfigurable circuits - The resonant MEMS switch – Capacitors – Inductors - Tunable CPW resonator - MEMS microswitch arrays - Reconfigurable circuits - Double - Stub tuner, Nth – stub tuner, filters, resonator tuning system -Massively parallel switchable RF front ends -True time-delay digital phase shifters.

UNIT - IV PHASE SHIFTERS & FILTERS [09]

Phase shifters –Fundamentals - X-Band RF MEMS phase shifter for phased array applications - Ka- Band RF MEMS Phase shifter for radar systems applications - Film bulk acoustic wave filters – FBAR filter fundamentals, FBAR filter for PCS applications.

UNIT - V RF MEMS ANTENNA [09]

Micro machined antenna - Micro electro mechanical system antennas - Reconfigurable Antennas - Tunable dipole antennas - Tunable microstrip patch - Array antenna. Integrates antenna selection - Photonic band gap antennas.

Total (L= 45, T = 0) = 45 Periods

Reference Books :

1 C.L.Wadhwa, Electrical Power Systems, New Age International Pvt. Ltd, New Delhi, Seventh Edition, 2016.

2 Hector J. De Los Santos, RF MEMS Circuit Design for Wireless Communications, Artech House, 2002

3 Vijay K.Varadan, K.J. Vinoy, K.A. Jose., RF MEMS and their Applications, John Wiley and sons, LTD, 2002.

4 Gabriel M. Rebeiz, RF MEMS Theory, Design & Technology, Wiley Inter science, 2002.

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SEMESTER - II

CU20269	MULTIMEDIA COMPRESSION TECHNIQUES (ELECTIVE)	L	T	P	C
		3	0	0	3

Course Outcomes: On Completion of this course, the student will be able to ***Cognitive Level***

CO1:	*Demonstrate the special features and representations of different data types of multimedia.*	*Understand*
CO2:	*Illustrate different multimedia communication standards for text compression*	*Understand*
CO3:	*Describe the knowledge about compression techniques in audio signal*	*Understand*
CO4:	*Describe the concept about image compression*	*Understand*
CO5:	*Illustrate the various standards in video compression*	*Understand*

UNIT - I INTRODUCTION [09]

Special features of multimedia, Graphics and image data representations – Fundamental concepts in text, images, graphics, video and digital audio – Storage requirements for multimedia applications – Need for compression – Lossy & Lossless compression techniques – Overview of source coding, information theory & source models– Kraft McMillan in equality–Scalar quantization-Uniform and non-uniform quantization - Vector quantization.

UNIT - II TEXT COMPRESSION [09]

Compaction techniques – Run length coding – Huffmann coding–Adaptive Huffmann coding – Arithmetic coding – Shanonfano coding- Dictionary techniques – LZW family algorithms

UNIT - III AUDIO COMPRESSION [09]

Audio compression techniques – µLaw and A-Law companding frequency domain and filtering– Basic sub–band coding – Application to speech coding – G.722 – Application to audio coding – MPEG audio, Progressive encoding for audio – Silence compression, speech compression techniques – Formant and CELP vocoders.

UNIT - IV IMAGE COMPRESSION [09]

Predictive techniques – DM, PCM, DPCM: Optimal predictors and Optimal quantization – Contour based compression – Transform coding – JPEG standard – Sub-band coding algorithms: Design of filter banks–Wavelet based compression: Implementation using filters – EZW, SPIHT coders – JPEG 2000 standards, JBIG, JBIG2 standards.

UNIT - V VIDEO COMPRESSION [09]

Video compression techniques and standards – MPEG Video coding: MPEG–1 and 2 – MPEG Video coding II : MPEG–4and7– Motion estimation and compensation techniques – H.261standard – DVI technology – DVI real time compression – Packet video.

Total (L= 45, T = 0) = 45 Periods

Reference Books :

1 C.L.Wadhwa, Electrical Power Systems, New Age International Pvt. Ltd, New Delhi, Seventh Edition, 2016.

2 KhalidSayood, Introduction to Data Compression, Morgan Kauffman Harcourt India, Second Edition, Reprint 2011.

3 David Salomon, Data Compression – The Complete Reference, Springer Verlag, New York, Second, 2001.

4 YunQ.Shi, Huifang Sun: Image and Video Compression for Multimedia Engineering – Fundamentals Algorithms & Standards", CRC press 2003.

5 Peter Symes, Digital Video Compression, McGraw Hill Publications, 2004.

6 MarkS.Drew, Ze-NianLi: Fundamentals of Multimedia, PHI, First Edition, 2003.

7 J.Watkinson, Compression in Video and Audio, Focal press, London, 1995.

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SEMESTER - II

		L	T	P	C
PE20201	**SOFT COMPUTING TECHNIQUES (ELECTIVE)**	3	0	0	3

Course Outcomes: On Completion of this course, the student will be able to		***Cognitive Level***
CO1:	*Describe the concepts of artificial neural network*	*Understand*
CO2:	*Apply the knowledge of neural network to develop architecture and algorithms of BPN, Hopfield*	*Apply*
CO3:	*Describe the concept competitive neural networks*	*Understand*
CO4:	*Explain the concepts of fuzzy logic system with Classical system, Apply the knowledge of fuzzy logic controller for classical applications*	*Understand*
CO5:	*Illustrate the fundamentals of genetic algorithm and its various functionalities*	*Understand*

UNIT - I ARTIFICIAL NEURAL NETWORK [09]

Motivation for the development of neural networks – biological neural networks – artificial neural networks – Fundamental Concepts – weights – biases and thresholds – common activation functions. McCulloch-pitts neuron: Architecture – Algorithm – Applications – Hebb Net – Architecture – Algorithm – Application – Perceptron – Architecture – Algorithm – Applications – Linear separability – Perceptron learning rule convergence theorem – Delta rule.

UNIT - II NEURAL NETWORK ARCHITECTURE AND ALGORITHMS [09]

Back propagation Neural Net: Standard and counter back propagation – architecture – algorithm – number of hidden layers – applications – Hopfield neural net – Discrete and Continuous – architecture – algorithm – applications – Associative Memory Neural Networks – Boltzman Machine.

UNIT - III COMPETITIVE NEURAL NETWORKS [09]

Fixed-weight competitive nets – Maxnet- Mexican Hat Net- Kohonen self-organizing Maps – applications – Adaptive Resonance Theory – Basic architecture and operation – Neuro controllers – Functional diagram – Inverse dynamics – coping control action – Case studies.

UNIT - IV FUZZY LOGIC [09]

Fuzzy sets – Properties of Classical and Fuzzy sets – Operations on Fuzzy sets – Fuzzy relations – Linguistic variables – Linguistic Hedges – Fuzzy statements – Assignment statements – Conditional statements – unconditional statements – Fuzzy rule base – Canonical rule formation – Decomposition of compound rules.- Fuzzy logic controller: Functional diagram – Fuzzification – Membership value assignments using intuition – Membership functions- Defuzzification: Max – Membership principle - centroid method - weighted average method – Inference Engine – Knowledge Base – Rule base – Case studies.

UNIT - V EVOLUTIONARY PROGRAMMING [09]

Optimization – Traditional optimization methods – Concept of Evolutionary Algorithm – Simulated Annealing – Genetic Algorithm – encoding and decoding of variables – GA operators – reproductions – Cross over – mutation – fitness function – fitness scaling – Real coded GA – Advanced operators – Particle swarm optimization.

Total (L= 45, T = 0) = 45 Periods

Reference Books :

1 C.L.Wadhwa, Electrical Power Systems, New Age International Pvt. Ltd, New Delhi, Seventh Edition, 2016.

1 Jacek.M.Zurada, Introduction to Artificial Neural Systems, Jaico Publishing House, 2006.

2 Lawrence Faussett, Fundamental of neural networks, Prentice Hall, 2004.

3 T.J.Ross, Fuzzy Logic with Engineering Applications, McGraw-Hill, New York, 2005.

4 H.J. Zimmerman, Fuzzy set theory-and its Applications-Kluwer Academic Publishers, 1994.

5 Driankov, Hellendroon, Introduction to Fuzzy Control, Narosa Publishers, 2001.

6 David .E. Gold berg, Genetic algorithms in search optimization and machine learning, Addison Wesley, Pearson Education, Asia, 2001.

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SEMESTER - III

		L	T	P	C
CU20361	**HIGH PERFORMANCE COMPUTER NETWORKS (ELECTIVE)**	3	0	0	3

Prerequisite: Electromagnetic Theory

Course Outcomes: On Completion of this course, the student will be able to		***Cognitive Level***
CO1:	*Describe the basics of communication and OSI layers.*	*Understand*
CO2:	*Demonstrate the various services and mechanism for multimedia networking.*	*Understand*
CO3:	*Analyze the concept of advanced network concepts.*	*Analyze*
CO4:	*Describe the various types of modeling in traffic management.*	*Understand*
CO5:	*Illustrate basic concept of network security and management.*	*Understand*

UNIT - I INTRODUCTION [09]

Review of OSI,TCP/IP: Multiplexing, modes of communication, switching, routing, SONET,DWD, DSL,ISDN,BISDN, ATM

UNIT - II MULTIMEDIA NETWORKING APPLICATIONS [09]

Streaming stored audio and video, Best effort service, Protocols for real time interactive applications, Beyond best effort, Scheduling and policing mechanism, Integrated services, RSVP, Differentiated services.

UNIT - III ADVANCED NETWORKS CONCEPTS [09]

VPN, Remote - Access VPN, site-to-site VPN, Tunneling to PPP, Security in VPN, MPLS Operation, Routing, Tunneling and use of FEC, Traffic Engineering, MPLS based VPN, Overlay Networks - P2P Connections.

UNIT - IV TRAFFIC MODELLING [09]

Little's theorem, Need for modeling, Poisson modeling and its failure, Non- Poisson models, Network performance evaluation.

UNIT - V NETWORK SECURITY AND MANAGEMENT [09]

Principles of cryptography, Authentication, Integrity, Key distribution and certification, Access control and fire walls, Attacks and counter measures, Security in many layers, Infrastructure for network management, The internet standard management framework, SMI, MIB, SNMP, Security and administration, ASN.1.

Total (L= 45, T = 0) = 45 Periods

Reference Books :

1 C.L.Wadhwa, Electrical Power Systems, New Age International Pvt. Ltd, New Delhi, Seventh Edition, 2016.

2 J.F.Kurose & K.W.Ross, Computer Networking – A top down approach featuring the internet, Pearson, Third edition, Ninth impression 2011.

3 Walrand. J.Varatya, Morgan Kauffman, High Performance Communication Network, Harcourt Asia Pvt. Ltd. Second Edition, Reprint 2011.

4 Aunurag kumar.D, Anjunath. M,JoyKuri, Communication Networking, Morgan Kaufmann Publishers, First edition, Reprint 2012.

5 Hersent Gurle & Petit, IP Telephony, Packet Pored Multimedia Communication Systems, Pearson Education, Reprint 2011.

6 Fred Halsall and Lingana Gouda Kulkarni, Computer Networking and the Internet, Fifth Edition, Pearson education, Reprint 2012.

7 NaderF.Mir, Computer and Communication Networks, Pearson Education, Third impression 2009.

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SEMESTER - III

CU20362	**PATTERN RECOGNITION AND MACHINE LEARNING (ELECTIVE)**	L	T	P	C
		3	0	0	3

Course Outcomes: On Completion of this course, the student will be able to		***Cognitive Level***
CO1:	*Describe basics of Pattern Recognition.*	*Understand*
CO2:	*Demonstrate various types of linear models.*	*Understand*
CO3:	*Illustrate the concepts of Neural Networks.*	*Understand*
CO4:	*Describe the various types of modeling in traffic management.*	*Understand*
CO5:	*Interpret basic concept of algorithm Independent machine learning and unsupervised learning and clustering.*	*Understand*

UNIT - I **INTRODUCTION TO PATTERN RECOGNITION** **[09]**

Problems, applications, design cycle, learning and adaptation, examples, Probability distributions, Parametric learning, Maximum likelihood and Bayesian decision theory, Bayes rule, discriminant functions, loss functions and Bayesian error analysis

UNIT - II **LINEAR MODELS** **[09]**

Linear models for regression, linear regression, logistic regression, Linear models for classification.

UNIT - III **NEURAL NETWORK** **[09]**

Perceptron, multi-layer perceptron, back propagation algorithm, error surfaces, practical techniques for improving back propagation, additional networks and training methods, Adaboost, Deep learning.

UNIT - IV **LINEAR DISCRIMINANT FUNCTIONS** **[09]**

Decision surfaces, two-category, multi-category, minimum squared error procedures, the Ho-Kashyap procedures, linear programming algorithms, Support vector machine.

UNIT - V **ALGORITHM INDEPENDENT MACHINE LEARNING AND UNSUPERVISED LEARNING AND CLUSTERING** **[09]**

Lack of inherent superiority of any classifier, bias and variance, re-sampling for classifier design, combining classifiers, k-means clustering, fuzzy k-means clustering, hierarchical clustering.

Total (L= 45, T = 0) = 45 Periods

Reference Books :

1 C.L.Wadhwa, Electrical Power Systems, New Age International Pvt. Ltd, New Delhi, Seventh Edition, 2016.

1 Richard O. Duda, Peter E. Hart, David G. Stork, Pattern Classification, Second Edition, John Wiley & Sons, 2001.

2 Trevor Hastie, Robert Tibshirani, Jerome H. Friedman, The Elements of Statistical Learning, Second Edition, Springer, 2009.

3 C. Bishop, Pattern Recognition and Machine Learning, Springer, 2006.

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SEMESTER - III

CU20363	REMOTE SENSING(ELECTIVE)	L	T	P	C
		3	0	0	3

Course Outcomes: On Completion of this course, the student will be able to		***Cognitive Level***
CO1:	*Describe the basics of remote sensing*	*Understand*
CO2:	*Explain the various data acquisition systems*	*Understand*
CO3:	*Illustrate the concept of advanced photographic Products*	*Understand*
CO4:	*Describe the various types of scattering system*	*Understand*
CO5:	*Describe basic concept of thermal and hyper spectral remote sensing*	*Understand*

UNIT - I PHYSICS OF REMOTE SENSING [09]

Electromagnetic spectrum, Physics of remote sensing, Effects of atmosphere-Scattering, Different types, Absorption, Atmospheric window, Energy interaction with surface features, Spectral reflectance of vegetation, soil and water atmospheric influence on spectral response patterns-Multi concept in remote sensing.

UNIT - II DATA ACQUISITION [09]

Types of platforms – Different types of aircrafts - Manned and unmanned space crafts – Sun synchronous and geo synchronous satellites – Types and characteristics of different platforms – LANDSAT, SPOT, IRS, INSAT, IKONOS, QUICKBIRD, etc.,

UNIT - III PHOTOGRAPHIC PRODUCTS [09]

B/W, color, color IR film and their characteristics, Resolving power of lens and film, OPTO mechanical electro optical sensors, Across track and along track scanners, Multispectral scanners and thermal scanners, Geometric characteristics of scanner imagery - Calibration of thermal scanners.

UNIT - IV SCATTERING SYSTEM [09]

Microwave scatterometry, types of RADAR, SLAR, Resolution, Range and azimuth, Real aperture and synthetic aperture RADAR, Characteristics of Microwave images topographic effect , different types of Remote Sensing platforms, Airborne and space borne sensors, ERS, JERS, RADARSAT, RISAT, Scatterometer, Altimeter, LiDAR remote sensing, Principles, Applications.

UNIT - V THERMAL AND HYPER SPECTRAL REMOTE SENSING [09]

Sensors characteristics ,Principle of spectroscopy, Imaging spectroscopy, Field conditions, Compound spectral curve, Spectral library, Radiative models, Processing Procedures, Derivative spectrometry, Thermal remote sensing, Thermal sensors, Principles, Thermal data processing, Applications.

Total (L= 45, T = 0) = 45 Periods

Reference Books :

1 C.L.Wadhwa, Electrical Power Systems, New Age International Pvt. Ltd, New Delhi, Seventh Edition, 2016.

2 Lilles and T.M., and Kiefer,R.W. Remote Sensing and Image interpretation, John Wiley & Sons-2000, 6thEdition

3 John R. Jensen, Introductory Digital Image Processing: A Remote Sensing Perspective, Second Edition, 1995

4 John A.Richards, Springer –Verlag, Remote Sensing Digital Image Analysis,1999

5 Paul Curran P.J. Principles of Remote Sensing, ELBS; 1995.

6 Charles Elachi and Jakob J. van Zyl, Introduction To The Physics and Techniques of Remote Sensing, Wiley Series in Remote Sensing and Image Processing, 2006.

7 Sabins, F.F.Jr, Remote Sensing Principles and Image interpretation, W.H.Freeman & Co, 1978

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SEMESTER - III

CU20364	HIGHSPEED SWITCHING ARCHITECTURE (ELECTIVE)	L	T	P	C
		3	0	0	3

Course Outcomes: On Completion of this course, the student will be able to		***Cognitive Level***
CO1:	*Describe the basics concept of LAN switching technology*	*Understand*
CO2:	*Illustrate the concept about ATM switching architecture*	*Understand*
CO3:	*Demonstrate the knowledge of queuing performance in ATM switches*	*Understand*
CO4:	*Describe various architectures in Packet switching*	*Understand*
CO5:	*Illustrate the concept about IP switching*	*Understand*

UNIT - I LAN SWITCHING TECHNOLOGY [09]

Switching concepts, Switch forwarding techniques, Switch path control, LAN switching, Cut through forwarding, Store and forward, Virtual LANs.

UNIT - II ATM SWITCHING ARCHITECTURE [09]

Blocking networks, Basic and enhanced banyan networks, Sorting networks, Merge sorting, Re-arrangable networks, Full and partial connection networks, Non-blocking networks- Recursive network construction, Comparison of non-blocking network, Switching with deflection routing, Shuffle switch, Tandem banyan switch.

UNIT - III QUEUESIN ATM SWITCHES [09]

Internal queuing - Input, output and shared queuing, Multiple queuing networks, Combined input, output and shared queuing - Performance analysis of queued switches.

UNIT - IV PACKET SWITCHING ARCHITECTURES [09]

Architectures of internet switches and routers, Buffer less and buffered crossbar switches, Multi-stage switching, Optical packet switching, Switching fabric on a chip, Internally buffered crossbars.

UNIT - V IP SWITCHING [09]

Addressing model, IP Switching types, Flow driven and topology driven solutions, IP over ATM address and next hop resolution, Multicasting, IPV6 over ATM.

Total (L= 45, T = 0) = 45 Periods

Reference Books :

1 C.L.Wadhwa, Electrical Power Systems, New Age International Pvt. Ltd, New Delhi, Seventh Edition, 2016.

2 Achille Pattavina, Switching Theory: Architectures and Performance in Broadband ATM Networks, John Wiley & Sons Ltd, NewYork. Reprint, 2012.

3 Elhanany M.Hamdi, High Performance Packet Switching Architectures, Springer Publications, 2010

4 Christopher Y Metz, Switching protocols & Architectures, McGraw–Hill Professional Publishing, NewYork.Reprint2012.

5 Rainer Handel, Man fred N Huber , Stefan Schroder, ATM Networks – Concepts Protocols, Applications, Third Edition, Addison Wesley, NewYork.2009.

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SEMESTER - III

CU20365	SPREAD SPECTRUM COMMUNICATION (ELECTIVE)	L	T	P	C
		3	0	0	3

Course Outcomes: On Completion of this course, the student will be able to ***Cognitive Level***

CO1:	*Describe the concept about introduction to spread spectrum systems.*	*Understand*
CO2:	*Illustrate various types of techniques used in spectrum systems.*	*Understand*
CO3:	*Demonstrate the knowledge about Generation of spreading code methods.*	*Understand*
CO4:	*Describe basics of synchronization of spread spectrum systems.*	*Understand*
CO5:	*Analyze the concept about performance in spread spectrum systems.*	*Analyze*

UNIT - I INTRODUCTION TO SPREAD SPECTRUM SYSTEMS [09]

Detection of binary signals in AWGN, Quadrature multiplexed signaling schemes, Signaling through band limited channels, Equalization of digital data transmission system, Realization imperfections, Degradations in performance.

UNIT - II SPREAD SPECTRUM SYSTEMS TECHNIQUES [09]

Communication in the presence of pulse noise jamming, Low probability detection scheme, Direct Sequence Spread Spectrum (DSSS) and frequency hop spread spectrum systems and examples of spread spectrum systems. Direct sequence spread spectrum methods employing BPSK, QPSK and MSK, Frequency hop spread spectrum methods, Coherent slow frequency hop technique, Non coherent slow and fast frequency hop spread spectrum techniques, Hybrid DS/FH spread spectrum, Complex envelope representation of spread spectrum systems.

UNIT - III SPREADING CODE GENERATION [09]

Binary Shift Register Sequences For Spread Spectrum Systems: Definition, PN sequence generator fundamentals, Maximal length sequences, Properties, Power spectrum and polynomial tables for maximal length sequences, Gold codes, Rapid acquisition systems, Non-linear code generators.

UNIT - IV SYNCHRONIZATION OF SPREAD SPECTRUM SYSTEMS [09]

Optimal tracking of wide band signals, Early-late tracking loops, Code tracking loops for FHSS, Optimum synchronization techniques, Multipled well and sequential detectors, Synchronization using matched filter, Synchronization by estimating the received spreading code.

UNIT - V PERFORMANCE OF SPREAD SPECTRUM SYSTEM [09]

SS Systems communications models, Performance without coding under AWGN and different jamming environments, spread spectrum systems performances with forward error correction, Block coding, Convolutional coding and specific error correcting codes, Inter leaving, Random coding bounds.

Total (L= 45, T = 0) = 45 Periods

Reference Books :

1 C.L.Wadhwa, Electrical Power Systems, New Age International Pvt. Ltd, New Delhi, Seventh Edition, 2016.

1 Ziemer RE and Peterson RL, Digital Communication and Spread Spectrum Systems, Macmillan Publishing Co., 1985.

2 Dixon R C, Spread Spectrum Systems, Wiley Inter science, 1976.

3 Holms JK, Coherent Spread Spectrum Systems, Wiley Inder science, 1982.

4 Ziemer RE and Peterson RL, Introduction to Spread Spectrum Communications, Prentice Hall of India, 1995.

5 Don.J.Yorrieri, Principles of Spread Spectrum Communication Systems, Springer 2005.

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SEMESTER - III

		L	T	P	C
CU20366	**SPEECH AND AUDIO PROCESSING (ELECTIVE)**	3	0	0	3

Course Outcomes: On Completion of this course, the student will be able to		***Cognitive Level***
CO1:	*Describe about various mechanics of speech signals.*	*Understand*
CO2:	*Illustrate the concept for time domain methods for speech processing.*	*Understand*
CO3:	*Describe knowledge about various methods in frequency domain for speech processing.*	*Understand*
CO4:	*Analyze concept for linear predictive analysis of speech.*	*Analyze*
CO5:	*Illustrate about various applications of speech and audio signal processing.*	*Understand*

UNIT - I MECHANICS OF SPEECH [09]

Speech production mechanism, Nature of speech signal, Discrete time modeling of speech production, Representation of speech signals, Classification of speech sounds, Phones, Phonemes, Phonetic and phonemic alphabets, Articulatory features, Music production, Auditory perception, Anatomical pathways from the ear to the perception of sound, Peripheral auditory system psychoacoustics.

UNIT - II TIME DOMAIN METHODS FOR SPEECH PROCESSING [09]

Time domain parameters of speech signal, Methods for extracting the parameters energy, Average magnitude, Zero crossing rate, Silence discrimination using ZCR and energy, Short time auto correlation function, Pitch period estimation using auto correlation function.

UNIT - III FREQUENCY DOMAIN METHOD FOR SPEECH PROCESSING [09]

Short time fourier analysis, Filter bank analysis, Formant extraction, Pitch extraction, Analysis by synthesis, Analysis synthesis systems, Phase vocoder, Channel vocoder, Homomorphic speech analysis: Cepstral analysis of speech, Formant and pitch estimation, Homomorphic vocoders.

UNIT - IV LINEAR PREDICTIVE ANALYSIS OF SPEECH [09]

Formulation of linear prediction problem in time domain, Basic principle, Auto correlation method, covariance method, Solution of LPC equations, Cholesky method, Durbin's recursive algorithm, Lattice formation and solutions, Comparison of different methods, Application of LPC parameters, Pitch detection using LPC parameters– Formant analysis – VELP – CELP

UNIT - V APPLICATIONS [09]

Algorithms: Spectral estimation, Dynamic time warping, Hidden Markov model, Music analysis, Pitch detection, Feature analysis for recognition, Music synthesis, Automatic speech recognition, Feature extraction for ASR, Deterministic sequence recognition, Statistical sequence recognition, ASR Systems, Speaker identification and verification, Voice response system, Speech synthesis: Text to speech, Voice over IP.

Total (L= 45, T = 0) = 45 Periods

Reference Books :

1 C.L.Wadhwa, Electrical Power Systems, New Age International Pvt. Ltd, New Delhi, Seventh Edition, 2016.

1 LR Rabiner and RW Schaffer, Digital Processing of Speech signals, Prentice Hall, First edition, 2003.

2 Ben Gold and Nelson Morgan, Speech and Audio Signal Processing, John Wiley and Sons, Inc, Singapore, 2004.

3 Quatieri, Discrete time Speech Signal Processing, Prentice Hall, 2001.

4 JL Flanagan, Speech analysis Synthesis and Perception, Second edition, Berlin, 1972.

5 IHWitten, Principles of Computer Speech, Academic Press,1982.

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SEMESTER - III

CU20367	SIGNAL DETECTION AND ESTIMATION (ELECTIVE)	L	T	P	C
		3	0	0	3

Course Outcomes: On Completion of this course, the student will be able to		***Cognitive Level***
CO1:	*Understand the basic concepts of random signals.*	*Understand*
CO2:	*Learn about various types of detection and estimation of signals.*	*Understand*
CO3:	*Gain knowledge about minimum probability error criterion.*	*Understand*
CO4:	*Analyze the concept of estimation of continuous waveforms.*	*Analyze*
CO5:	*Learn about estimation of time varying signals.*	*Understand*

UNIT - I INTRODUCTION [09]

Simple binary hypothesis tests, M-Hypothesis, Estimation theory, Composite hypothesis, General Gaussian problem, Performance bounds and approximations, Sampling of band limited random signals, Periodic random processes, Spectral decomposition, Vector random processes.

UNIT - II DETECTION & ESTIMATION OF SIGNALS [09]

Detection & estimation of signals in White Gaussian noise and Non-White Gaussian noise, Signals with unwanted parameters, Multiple channels and multiple parameter, Linear & Non-linear estimates, MLP & ML estimates, Maximum likelihood estimate of parameters of linear systems.

UNIT - III MINIMUM PROBABILITY ERROR CRITERION [09]

Minimum probability error criterion, Neyman – Pearson criterion for radar detection of constant and variable amplitude signals, Matched filters, Optimum formulation, Detection of random signals, Simple problems thereon with multi sample cases.

UNIT - IV ESTIMATION OF CONTINUOUS WAVE FORMS [09]

Estimation of continuous wave forms**:** Derivation of estimator equations, Alower bound on the mean square estimation error, Multi-dimensional wave form estimation, Non-random waveform estimation.

UNIT - V ESTIMATION OF TIME VARYING SIGNALS [09]

Estimation of time varying signals – Kalman filtering, Filtering signals in noise treatment, Restricted to two variable cases only –Simple problems, Realizable linear filters, Kalman Bucy filters, Fundamental role of optimum linear filters.

Total (L= 45, T = 0) = 45 Periods

Reference Books :

1 C.L.Wadhwa, Electrical Power Systems, New Age International Pvt. Ltd, New Delhi, Seventh Edition, 2016.

2 HarryL. Van Trees, Detection, Estimation and Modulation Theory: Part–I, John Wiley & Sons, USA, Reprint 2004.

3 Mischa Schwartz, Leonard Shaw, Signal Processing: Discrete Spectral Analysis – Detection & Estimation, McGrawHill, Reprint, 2007.

4 Steven.M.Kay, Fundamentals of Statistical Signal Processing: Volume Estimation Theory, Prentice Hall, USA, Reprint, 2011.

5 Srinath, Rajasekaran, Viswanathan, Introduction to Statistical Signal Processing with Applications, PHI, 2003.

6 LouisL.Scharf, Statistical Signal Processing: Detection, Estimation and Time Series Analysis, Addison Wesley, Reprint 2007.

7 K.SamS hanmugam, Arthur M Breiphol, Random Signals: Detection, Estimation and Data Analysis, John Wiley & Sons, 1998.

8 Simon Haykins, Detection of Signals, John Wiley & Sons, 2000.

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SEMESTER - III

		L	T	P	C
CU20368	**INTERNET WORKING MULTIMEDIA (ELECTIVE)**	3	0	0	3

Course Outcomes: On Completion of this course, the student will be able to		***Cognitive Level***
CO1:	*Analyze the requirements that a distributed multimedia application may enforce on the communication network.*	*Analyze*
CO2:	*Describe the knowledge about sub network technology.*	*Understand*
CO3:	*Develop the concept about multicast and transport protocol.*	*Understand*
CO4:	*Analyze the various techniques used for voice and video control.*	*Analyze*
CO5:	*Describe the different applications used for multimedia.*	*Understand*

UNIT - I INTRODUCTION [09]

Digital sound, Video and graphics – Basic multimedia networking, Multimedia characteristics, Evolution of internet services model, Network requirements for audio / video transform, Multimedia coding and compression for text, image, audio and video, Multimedia communication in wireless network.

UNIT - II SUB NETWORK TECHNOLOGY [09]

Broadband services, ATM and IP, IPV6, High-speed switching, Resource reservation, Buffer management, Traffic shaping, Caching, Scheduling and policing, Throughput, delay and jitter performance.

UNIT - III MULTICAST AND TRANSPORT PROTOCOL [09]

Multicast over shared media network, Multicast routing, Addressing and scraping, Multicast and NBMA networks, Reliable transport protocols, TCP Adaptation Algorithm, RTP, RTCP.

UNIT - IV MEDIA-ON–DEMAND [09]

Storage and media servers, Voice and video over IP – MPEG – 2 over ATM/IP, Indexing synchronization of requests-Recording and remote control.

UNIT - V APPLICATIONS [09]

MIME, Peer-to-peer computing, Shared application, Video conferencing, Centralized and distributed conference control, Distributed virtual reality, Light weight session philosophy.

Total (L= 45, T = 0) = 45 Periods

Reference Books :

1 C.L.Wadhwa, Electrical Power Systems, New Age International Pvt. Ltd, New Delhi, Seventh Edition, 2016.

2 Jon Crowcroft, Mark Handley, Ian Wakeman. Internetworking Multimedia, Harcourt Asia Pvt. Ltd. Singapore, Reprint 2012.

3 B.O.Szuprowicz, Multimedia Networking, Third edition, McGraw Hill, New York. 2009.

4 Tay Vaughan, Multimedia making it to work, Fourth edition, Tata McGraw Hill, New Delhi, Reprint 2010.

5 Ellen kayatawesel, Ellen Khayata, Wireless Multimedia Communication: Networking Video, Voice and Data, Addison Wesley Longman Publication, USA, 1998.

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SEMESTER - III

		L	T	P	C
CU20369	**WAVELET TRANSFORMS AND ITS APPLICATIONS (ELECTIVE)**	3	0	0	3

Course Outcomes: On Completion of this course, the student will be able to		***Cognitive Level***
CO1:	*Describe Fourier tools to analyze signals.*	*Analyze*
CO2:	*Illustrate knowledge about MRA and representation using wavelet bases.*	*Understand*
CO3:	*Acquire knowledge about various wavelet transforms and design wavelet transform.*	*Understand*
CO4:	*Analyze the concept about discrete wavelet transform.*	*Analyze*
CO5:	*Apply wavelet transform for various signal & image processing applications*	*Apply*

UNIT - I INTRODUCTION [09]

Vector Spaces, Properties, Dot product, Basis, Dimension, Orthogonally and orthonormality, Relationship between vectors and signals, Signal spaces, Concept of Convergence, Hilbert spaces for energy signals, Generalized Fourier expansion.

UNIT - II MULTIRESOLUTION ANALYSIS [09]

Definition of Multi Resolution Analysis (MRA), HAAR basis, Construction of general orthonormal MRA Wavelet basis for MRA, Continuous time MRA interpretation for the DTWT, Discrete time MRA, Basis functions for the DTWT, PRQMF filter banks.

UNIT - III CONTINUOUS WAVELET TRANSFORMS [09]

Wavelet transform, Definition and properties, Concept of scale and its relation with frequency, Continuous Wavelet Transform (CWT), Scaling function and wave let functions (Daubechies, Coiflet, Mexican Hat, Sinc, Gaussian, Bi-Orthogonal), Tiling of time-scale plane for CWT.

UNIT - IV DISCRETE WAVELET TRANSFORMS [09]

Filter Bank and subband coding principles, Wavelet filters, Inverse DWT computation by filter banks-Basic properties of filter coefficients, Choice of wavelet function coefficients, Derivations of Daubechies wavelets, Mallat's algorithm for DWT, Multi-band wavelet transforms. Lifting Scheme: Wavelet Transform using Poly phase Matrix Factorization, Geometrical foundations of lifting scheme – Lifting scheme in Z– domain.

UNIT - V APPLICATIONS [09]

Signal Compression, Image compression techniques: EZW-SPHIT coding, Image denoising techniques: Noise estimation, Shrink age rules, Shrink age functions, Edge detection and object Isolation, Image fusion, Fusion and object detection. Curve and surface editing, Variational modeling and finite element method using wavelets.

Total (L= 45, T = 0) = 45 Periods

Reference Books :

1 C.L.Wadhwa, Electrical Power Systems, New Age International Pvt. Ltd, New Delhi, Seventh Edition, 2016.

2 M.Vetterli and J.Kovacevic, Wavelets and sub band coding, Prentice Hall, 1995.

3 S.Mallat, A Wavelet Tour of Signal Processing, Academic Press 2008

4 Soman.K.P and Ramachandran. K.I, Insight in to Wavelets – From Theory to practice, Prentice-Hall, 2004.

5 Rao.R.Mand Bopardikar.A.S, "Wavelet Transforms–Introduction to Theory and Applications, Pearson Education Asia Pvt. Ltd., 2000.

6 C.Sidney Burrus,Ramesh A.Gopinath & Haito Guo, Introduction to Wavelets and Wavelet Transform: A Primer, Prentice Hall,1998.

7 G.Strang and T.Nguyen, Wavelet and Filter Banks, Wellesley Cambridge Press – 1997.

8 P.P.Vaidyanathan, Multirate Systems and Filter Banks, Prentice Hall1993.

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SEMESTER - III

		L	T	P	C
CU20371	**MICROWAVE INTEGRATED CIRCUITS (ELECTIVE)**	3	0	0	3

Course Outcomes: On Completion of this course, the student will be able to		***Cognitive Level***
CO1:	*Describe the fabrication of MIC technology*	*Analyze*
CO2:	*Analyze the MIC passive components*	*Understand*
CO3:	*Design MIC Circuits like couplers and filters*	*Apply*
CO4:	*Design MIC Amplifiers*	*Apply*
CO5:	*Design MIC Oscillators*	*Apply*

UNIT - I INTRODUCTION TO MICROWAVE INTEGRATED CIRCUITS [09]

MMIC – technology, Substrate preparation, Advantages and applications, Introduction and design parameters of strip line, Microstrip slot line, CPW.

UNIT - II PASSIVE COMPONENTS [09]

Inductors, Capacitors, Resistors, Design and layout of microstrip power dividers, Branch line coupler – Backward wave coupler, Rat Racehy brid coupler.

UNIT - III FILTER [09]

L- - C Realization, Low Impedance High Impedance Method, Stub method, K Inverter, J Inverter, Kuroda identities, Low pass to High pass, Band Pass & Band Reject transformation. Design and layout of stepped impedance filter, Band pass filter.

UNIT - IV AMPLIFIERS [09]

Stability & gain analysis, Matching techniques, Reactively matched amplifier design, Distributed and power amplifiers and LNA design.

UNIT - V OSCILLATORS [09]

Design principles, Active device CAD techniques for large signal oscillators design, Phase noise, MMIC_VCO, Mixers.

Total (L= 45, T = 0) = 45 Periods

Reference Books :

1 C.L.Wadhwa, Electrical Power Systems, New Age International Pvt. Ltd, New Delhi, Seventh Edition, 2016.

2 D.Robertson & S.Lucyszyn, RFIC and MMIC design and technology, The IEEE Press, 2001.

3 S.Y. Liao, Microwave Amplifier and Oscillator Design, Pearson Education, 2003.

4 Gupta K.C. and Amarjit Singh, Microwave Integrated Circuits, John Wiley, New York, 1975.

5 Ulrich L.Rohde and David P.N., RF / Microwave Circuit Design for Wireless Applications, John Wiley, 2000.

6 C.Gentili, Microwave Amplifiers and Oscillators, North Oxford Academic, 1986.

7 Mathai, Young, Jones, Microwave Filter, Impedance, Matching Networks and Coupling Structures, McGraw Hill Publishers, 1985.

8 Houl & Bharati Bhatt, Strip lines like Transmission Lines, New Age Publisher, 1980.

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SEMESTER – I

		L	T	P	C
CUAC01	**ENGLISH FOR RESEARCH PAPER WRITING (AC)**	2	0	0	-

Course Outcomes: On Completion of the course, the students will be able to: ***Cognitive Level***

CO1:	*Describe how to improve your writing skills and level of readability*	*Understanding*
CO2:	*Acquire knowledge about what to write in each section*	*Understanding*
CO3:	*Interpret ho to Improved skills needed when writing a Title*	*Understanding*
CO4:	*Ensure the good quality of paper at very first-time submission*	*Understanding*
CO5:	*Describe to improve the performance in time management*	*Understanding*

UNIT - I **[6 Periods]**

Planning and preparation, Word order, Breaking up long sentences, Structuring, Paragraphs and sentences, Being concise and removing redundancy, Avoiding, Ambiguity and vagueness

UNIT - II **[6 Periods]**

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and plagiarism, Sections of a paper, abstracts. Introduction. Review of the literature, methods, results, discussion, Conclusions, The final check.

UNIT - III **[6 Periods]**

Key skills are needed when writing a Title, key skills are needed when writing an abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature

UNIT - IV **[6 Periods]**

Skills are needed when writing the methods, skills needed when writing the results, skills are needed when writing the Discussion, skills are needed when writing the conclusions

UNIT - V **[6 Periods]**

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

Total = 30 Periods

Reference Books :

1. Goldbort R Writing for Science, Yale University Press (available on Google Books), 2006.
2. Day R How to Write and Publish a Scientific Paper, Cambridge University Press, 2006.
3. Highman N , Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book, 1998.
4. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

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SEMESTER – I

		L	T	P	C
CUAC02	**DISASTER MANAGEMENT (AC)**	2	0	0	-

Course Outcomes: On Completion of the course, the students will be able to: ***Cognitive Level***

CO1:	*Demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.*	*Understanding*
CO2:	*Describe to evaluate disaster risk reduction and humanitarian response policy*	*Understanding*
CO3:	*Develop the standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.*	*Understanding*
CO4:	*Interpret the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in.*	*Understanding*
CO5:	*Describe to develop the functions of risk assessment.*	*Understanding*

UNIT - I Introduction [4 Periods]

Disaster: Definition, Factors and Significance; Difference Between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types And Magnitude.

UNIT - II Repercussions of Disasters And Hazards [4 Periods]

Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks Of Disease and Epidemics, War and Conflicts.

UNIT - III Disaster Prone Areas In India [4 Periods]

Study of Seismic Zones; Areas Prone To Floods and Droughts, Landslides and Avalanches; Areas Prone To Cyclonic and Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases and Epidemics

UNIT - IV Disaster Preparedness and Management [4 Periods]

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.

UNIT - V Risk Assessment [4 Periods]

Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-operation In Risk Assessment and Warning, People's Participation In Risk Assessment. Strategies for Survival.

UNIT - VI Disaster Mitigation [4 Periods]

Meaning, Concept and Strategies of Disaster Mitigation, merging Trends In Mitigation. Structural Mitigation And Non-Structural Mitigation, Programs Of Disaster Mitigation In India.

Total = 24 Periods

Reference Books :

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.

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SEMESTER – I

		L	T	P	C
CUAC03	**SANSKRIT FOR TECHNICAL KNOWLEDGE (AC)**	2	0	0	-

Course Outcomes: On Completion of the course, the students will be able to: ***Cognitive Level***

CO1:	*Describe the basic Sanskrit language*	*Understanding*
CO2:	*Acquire knowledge about the Ancient Sanskrit literature about science & technology can be understood*	*Understanding*
CO3:	*Interpret the logical language will help to develop logic in students*	*Understanding*

UNIT - I **Alphabets** **[8 Periods]**

Alphabets in Sanskrit, Past/Present/Future Tense, Simple Sentences.

UNIT - II **Technical Information** **[8 Periods]**

Order, Introduction of roots, Technical information about Sanskrit Literature.

UNIT - III **Technical Concepts** **[8 Periods]**

Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics.

Total = 24 Periods

Reference Books :

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

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SEMESTER – I

		L	T	P	C
CUAC04	**VALUE EDUCATION (AC)**	2	0	0	-

Course Outcomes: On Completion of the course, the students will be able to: ***Cognitive Level***

CO1:	*Describe the Knowledge of self-development*	*Understanding*
CO2:	*Discuss the importance of Human values*	*Understanding*
CO3:	*Developing the overall personality and Behavior Development*	*Understanding*
CO4:	*Interpret the various factor to improve the Character and Competence*	*Understanding*

UNIT - I **Values and self - development** **[4 Periods]**

- Social values and individual attitudes.
- Work ethics, Indian vision of humanism.
- Moral and non- moral valuation. Standards and principles.
- Value judgements

UNIT - II **Importance of cultivation of values.** **[6 Periods]**

- Sense of duty. Devotion, Self-reliance. Confidence, Concentration.
- Truthfulness, Cleanliness.
- Honesty, Humanity. Power of faith, National Unity.
- Patriotism. Love for nature ,Discipline

UNIT - III **Personality and Behavior Development** **[6 Periods]**

- Soul and Scientific attitude.
- Positive Thinking. Integrity and discipline.
- Punctuality, Love and Kindness.
- Avoid fault Thinking.
- Free from anger, Dignity of labour.
- Universal brotherhood and religious tolerance.
- True friendship.
- Happiness Vs suffering, love for truth.
- Aware of self-destructive habits.
- Association and Cooperation.
- Doing best for saving nature

UNIT - IV **Character and Competence** **[6 Periods]**

- Holy books vs Blind faith.
- Self-management and Good health.
- Science of reincarnation.
- Equality, Nonviolence, Humility, Role of Women.
- All religions and same message.
- Mind your Mind, Self-control.
- Honesty, Studying effectively

Total = 22 Periods

Reference Books :

1. Chakroborty, S.K. Values and Ethics for organizations Theory and practice, Oxford University Press, New Delhi

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SEMESTER – II

		L	T	P	C
CUAC05	**CONSTITUTION OF INDIA (AC)**	2	0	0	-

Course Outcomes: On Completion of the course, the students will be able to: ***Cognitive Level***

CO1:	*Describe the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.*	*Understanding*
CO2:	*Outline the intellectual origins of the framework of argument that informed the Conceptualization of social reforms leading to revolution in India.*	*Understanding*
CO3:	*Summarize the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.*	*Understanding*
CO4:	*Describe the passage of the Hindu Code Bill of 1956.*	*Understanding*

UNIT - I **History of Making of the Indian Constitution** **[4 Periods]**

History, Drafting Committee, (Composition& Working)

UNIT - II **Philosophy of the Indian Constitution** **[4 Periods]**

Preamble, Salient Features

UNIT - III **Contours of Constitutional Rights & Duties** **[4 Periods]**

- Fundamental Rights
- Right to Equality
- Right to Freedom
- Right against Exploitation
- Right to Freedom of Religion
- Cultural and Educational Rights
- Right to Constitutional Remedies
- Directive Principles of State Policy
- Fundamental Duties

UNIT - IV **Organs of Governance** **[4 Periods]**

- Parliament
- Composition
- Qualifications and Disqualifications
- Powers and Functions
- Executive
- President
- Governor
- Council of Ministers
- Judiciary, Appointment and Transfer of Judges, Qualifications
- Powers and Functions

UNIT - V **Local Administration** **[4 Periods]**

- 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

UNIT - VI Election Commission [4 Periods]

- 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.

Total = 24 Periods

Reference Books :

1 The Constitution of India, 1950 (Bare Act), Government Publication.

2 Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, First Edition, 2015.

3 M. P. Jain, Indian Constitution Law, Seventh Edition, Lexis Nexis, 2014.

4 D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

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SEMESTER – II

		L	T	P	C
CUAC06	**PEDAGOGY STUDIES (AC)**	2	0	0	-

Course Outcomes: On Completion of the course, the students will be able to: ***Cognitive Level***

CO1:	*Describe pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?*	*Understanding*
CO2:	*Summarize the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?*	*Understanding*
CO3:	*Discuss the teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?*	*Understanding*

UNIT - I Introduction and methodology [4 Periods]

- Aims and rationale, Policy background, Conceptual framework and terminology
- Theories of learning, Curriculum, Teacher education.
- Conceptual framework, Research questions.
- Overview of methodology and Searching.

UNIT - II Thematic overview [2 Periods]

- Thematic overview: teachers in formal and informal classrooms in developing countries are using pedagogical practices.
- Curriculum, Teacher education.

UNIT - III Evidence on the effectiveness of Pedagogical Practices [4 Periods]

- Methodology for the in depth stage: quality assessment of included studies.
- How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?
- Theory of change.
- Strength and nature of the body of evidence for effective pedagogical practices.
- Pedagogic theory and pedagogical approaches.
- Teachers' attitudes and beliefs and Pedagogic strategies.

UNIT - IV Professional Development [4 Periods]

- 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

UNIT - V Research gaps and future directions [2 Periods]

- Research design
- Contexts
- Pedagogy
- Teacher education
- Curriculum and assessment
- Dissemination and research impact.

Total = 16 Periods

Reference Books :

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.
5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.

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SEMESTER – II

CUAC07	STRESS MANAGEMENT BY YOGA (AC)	L	T	P	C
		2	0	0	-

Course Outcomes: On Completion of the course, the students will be able to: ***Cognitive Level***

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

CO2: *Discuss to Improve efficiency in asan and pranayam* *Understanding*

UNIT - I Ashtanga **[8 Periods]**

Definitions of Eight parts of yog. (Ashtanga)

UNIT - II Yam and Niyam **[8 Periods]**

Do`s and Don't's in life.

i) Ahinsa, satya, astheya, bramhacharya and aparigraha

ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

UNIT - III Asan and Pranayam **[8 Periods]**

i) Various yog poses and their benefits for mind & body

ii)Regularization of breathing techniques and its effects - Types of pranayam

Total = 24 Periods

Reference Books :

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

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SEMESTER – II

		L	T	P	C
CUAC08	**PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS (AC)**	2	0	0	-

Course Outcomes: On Completion of the course, the students will be able to: ***Cognitive Level***

CO1: *Discuss the Shrimad - Bhagwad - Geeta will help the student in developing his personality and achieve the highest goal in life* *Understanding*

CO2: *Describe the person who has studied Geeta will lead the nation and mankind to peace and prosperity* *Understanding*

CO3: *Summarize Neetishatakam* will help in developing versatile personality of students. *Understanding*

UNIT - I **[8 Periods]**

Neetisatakam-Holistic development of personality

- Verses- 19,20,21,22 (wisdom)
- Verses- 29,31,32 (pride & heroism)
- Verses- 26,28,63,65 (virtue)
- Verses- 52,53,59 (dont's)
- Verses- 71,73,75,78 (do's)

UNIT - II **[8 Periods]**

- Approach to day to day work and duties.
- Shrimad Bhagwad Geeta : Chapter 2-Verses 41, 47,48,
- Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17,23, 35,
- Chapter 18-Verses 45, 46, 48.

UNIT - III **[8 Periods]**

- Statements of basic knowledge.
- Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68
- Chapter 12 -Verses 13, 14, 15, 16,17, 18
- Personality of Role model. Shrimad Bhagwad Geeta:
- Chapter2-Verses 17, Chapter 3-Verses 36,37,42,
- Chapter 4-Verses 18, 38,39
- Chapter18 – Verses 37,38,63

Total = 24 Periods

Reference Books :

1. Srimad Bhagavad Gita by Swami Swarupananda Advaita Ashram (Publication Department), Kolkata
2. Bhartrihari's Three Satakam (Niti-sringar-vairagya) by P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.