Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor ofEngineering

SoE & Syllabus 2014

7 & 8 Semester

Electronics & Telecommunication Engineering

Updated on June.2020

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(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B.E. SCHEME OF EXAMINATION 2014

(Revised Scheme of Examination w.e.f. 2020-21 onward)

SoE No. ET-101

Electronics and Telecommunication Engineering

S. N.	Sub Code	Subject	Contact Hours				CR	% Weightage			ESE Duration
			L	T	P	Total		MSEs*	TA**	ESE	
SEVENTH SEMESTER											
1	ET1401	RF & Microwave	4	0	0	4	4	30	30	40	3 Hrs
2	ET1402	**Lab.:** RF & Microwave	0	0	2	2	1		60	40	
3	ET1403	Principles of Image Processing	4	0	0	4	4	30	30	40	3 Hrs
4	ET1404	**Lab. :** Principles of Image Processing	0	0	2	2	1		60	40	
5	**Professional Elective-III**		3	0	0	3	3	30	30	40	3 Hrs
	ET1405	PE III : Optical Communication									
	ET1407	PE III : Microwave Integrated circuit									
	ET1409	PE III : Communication Networks									
	ET1431	PE III : Analog VLSI									
6	**Lab.:Professional Elective -III**		0	0	2	2	1		60	40	
	ET1406	**Lab. :PE III :** Optical Communication									
	ET1408	**Lab. :PE III :** Microwave Integrated circuits									
	ET1410	**Lab. :PE III :** Communication Networks									
	ET1432	**Lab. :PE III :** Analog VLSI									
7	ET1413	Industrial Training/ CRT	0	0	0	0	2		100		
8	ET1414	Project phase -I	0	0	4	4	4		60	40	
Total			11	0	10	21	20				

EIGHTH SEMESTER											
1	ET1415	Antenna Theory & Design	4	0	0	4	4	30	30	40	3 Hrs
2	ET1416	**Lab.:** Antenna Theory & Design	0	0	2	2	1		60	40	
3	ET1417	CMOS VLSI Design	4	0	0	4	4	30	30	40	3 Hrs
4	ET1418	**Lab.:** CMOS VLSI Design	0	0	2	2	1		60	40	
5	**Professional Elective IV**		3	0	0	3	3	30	30	40	3 Hrs
	ET1419	PE IV : Power Electronics									
	ET1420	PE IV : Wireless Mobile Communication Systems									
	ET1433	PE IV : Satellite Communication & RADAR Engineering									
	ET1434	PE IV: Biomedical Instrumentation									
	ET1437	PE IV: : Display Technology									
	ET1438	PE IV: : Digital Image Analysis for Remote sensing									
6	**Professional Elective V**		3	0	0	3	3	30	30	40	3 Hrs
	ET1422	PE V : Fuzzy Logic & Neural Networks									
	ET1424	PE V : RF Circuit Design									
	ET1426	PE V : Multimedia Communications									
	ET1435	PE V:Advances in Communication									
7	**Lab.: Professional Elective V**		0	0	2	2	1		60	40	
	ET1423	**Lab.: PE V :** Fuzzy Logic & Neural Networks									
	ET1425	**Lab.: PE V :** RF Circuit Design									
	ET1427	**Lab.: PE V :** Multimedia Communications									
	ET1436	**Lab.: PE V:** Advances in Communication									
8	ET1428	Project Phase-II	0	0	8	8	8		60	40	
9	ET1429	Comprehensive Viva-voce	0	0	0	0	3			100	
10	ET1430	Extra/co curricular Activities	0	0	0	0	2		100		
Total			14	0	14	28	30				

*** MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment**

TA ** = for Theory : 20 marks on lecture quizzes, 8 marks on assignments, 2 marks on class performance

TA = for Practical : MSPA will be 15 marks each**

Chairperson	**Version**	**1.03**	**Applicable for AY 2020-21 Onwards**
Dean (Acad. Matters)	**Date of Release**	**June. 2020**	

7th Semester

ET1401	**RF and Microwave**	L= 4	T = 0	P = 0	Credits = 4

Course Objective	**Course Outcome**
Students should be able to 1. Know various resonant and non resonant microwave power generators. 2. Study the concept of scattering matrix. 3. Understand working of various microwave passive devices 4. Know the various microwave measurement techniques. 5. Learn the working principle of microwave solid state devices.	Students will be able to 1. Analyze behavior of linear beam tubes. 2. Discuss the working of cross field tubes. 3. Apply s-parameters to model output response of microwave transmission lines. 4. Analyze behavior of different passive components using s-matrix. 5. Measure performance parameters of microwave devices 6. Explore various microwave solid state devices.

UNIT I : KLYSTRONS

High frequency limitations of conventional microwave devices,Two cavity Klystron Amplifier – Mechanism and mode of Operation, Power output and Efficiency, Applegate diagram, applications, Reflex Klystron Oscillator – Mechanism and mode of Operation Power output, efficiency, Electronic Admittance.

09 Hrs

UNIT II : MAGNETRONS

Helix, TWT, BWO Slow Wave Structures

Magnetron Oscillator – Hull cut-off voltage, Mechanism of Operation, Mode separation, Phase focusing effect, Power output and Efficiency, Cylindrical magnetron, parallel plate magnetron, Types of strapping, Tuning of magnetron. Applications, Numerical Problems.

08 Hrs

UNIT III : MICROWAVE NETWORK ANALYSIS

Introduction, Symmetrical Z and Y matrices for reciprocal network, Scattering matrix representation of multi port networks, comparison between [S], [Z] and [Y] matrices. Inter relationship between impedance matrix, admittance matrix and Scattering matrix, properties of scattering matrix. Scattering matrix of transmission lines, ABCD parameters with S parameters, Numerical Problems .

08Hrs

UNIT IV : MICROWAVE PASSIVE DEVICES (RECIPROCAL AND NON RECIPROCAL):

Wave guide Tees - E plane Tee, H plane Tee, Magic Tee and their applications, , Directional couplers, Wave guide Corners, Bends and Twists ,Attenuators, Isolators, Gyrators, Circulators, Phase shifter, Scattering matrix derivation for all components.

09Hrs

UNIT V: MICROWAVE MEASUREMENT:

Introduction, Tunable detector, Slotted line Carriage, VSWR meter, Power measurements sensor, Bolo meter sensor, power sensor, Low and High power measurement, Insertion loss and Attenuation measurement, VSWR measurement – Low and High VSWR, Impedance measurement. Frequency measurement, Measurement of cavity Q, Dielectric measurement, Microwave filters-design methods : Image parameter method, Insertion loss method.

07Hrs

UNIT VI: MICROWAVE SOLID STATE DEVICES AND CIRCUITS:

Microwave diodes – Gunn diode – Mode of operation, Crystal diode, PIN diode –, IMPATT diodes, Application as Oscillator and Amplifiers, Varactor diode, parametric amplifier, Microwave transistors, MASER, Strip lines- Micro Strip lines, Parallel Strip lines.

07Hrs

7th Semester

ET1401	RF and Microwave	L= 4	T = 0	P = 0	Credits = 4

Text books:				
1	Microwave device and circuits	Third Edition	Samuel Y.Lio	Pearson Education
2	Foundations of microwave engineering	Second Edition 1992	R.E. Collins	Tata Mc-Graw Hill
3	Microwave engineering	Second Edition 1992	R Chatterjee.	
4	Microwave Engineering	Third Ed. 2007	David Pozar	Wiley Ind. Pub.
Reference books:				
1	Microwave communication	1989	Hund	
2	Microwave theory and measurement		G. Lance	
3	Microwave Engineering	2nd Edition Reprint 2001	Annapurna Das, Sisir. K.Das	Tata McGraw-Hill Co., Ltd.
4	Microwave	1978	Reich J.H.et al	East West Press,

7th Semester

ET1402	Lab. : RF & Microwave	L = 0	T = 0	P = 2	Credits = 1

Course Objective	Course outcomes
Students should be able to : 1. Understand working principle of various antennas & their radiation pattern. 2. Study performance characteristics of active devices. 3. Learn the behavior of various passive devices at microwave frequencies 4. Understand various microwave measurement techniques.	Students will be able to: 1. Analyze performance of various types of antennas. 2. Analyze the behavior of active microwave devices. 3. Verify behavior of various passive components. 4. Perform various microwave measurements.

Sr. No.	Experiments based on
1	Active RF Devices
2	Passive RF Devices
3	Microwave Measurement
4	MIC Components

7th Semester

ET1403	Principles of Image Processing	L= 4	T = 0	P = 0	Credits = 4

Course Objective	Course Outcome
Students should be able to 1. Understand the principles of image formation, sampling and quantization. 2. Learn the algorithms of intensity transformation, filtering and segmentation. 3. Learn restoration and compression of digital images through various algorithms 4. Study the performance of digital images in frequency domain	Students will be able to 1. Analyze the image sampling, quantization and intensity transformation techniques. 2. Apply basic image processing algorithms for image enhancement 3. Implement and evaluate the methodologies for image segmentation. 4. Deal with noise models and degradation process for image restoration. 5. Implement the algorithms for image compression. 6. Interpret the digital images in frequency domain by using various transform techniques

UNIT-1:

Digital Image fundamental

Fundamental steps and components of an image processing system, elements of visual perception, Image formation and acquisition, Image sampling and quantization, some basic relationship between the pixels, mathematical tools used in digital image processing.

Intensity Transformation

Background, Some basic intensity transformation technique, Histogram Processing

08Hrs

UNIT-2:

Filtering in spatial and frequency domain

Spatial Filtering: Fundamentals,Smoothing linear filters, order statistics(nonlinear) filter.

Sharpening Filtering: Foundation, Laplacian, Unsharp masking, High boost filtering and Gradient.

Filtering in Frequency Domain:

Introduction to Fourier transform and frequency domain, Smoothing frequency domain filters, sharpening frequency domain filters, properties of Fourier transform, homomorphic filtering.

08Hrs

UNIT-3

Image Restoration

Image degradation/restoration process, noise model, restoration in presence of noise, periodic noise reduction, linear, position invariant degradation, estimating degradation function, Inverse filtering, Wiener filtering, constrained least squares filtering, geometric mean filter.

08Hrs

UNIT-4:

Image Segmentation

Fundamentals, Detection of discontinuities, Edge linking and boundary detection, Thresholding: Foundation, basic global thresholding, optimal global thresholding, multiple thresholds, variable thresholding, multivariable thresholding. Region based segmentation: Formulation, region growing, split and merge

08Hrs

UNIT-5

Image Transforms

2-D FFT, Properties, Discrete cosine Transform , Discrete sine transform, Hadamard Transform,, Haar transform, Slant transform, Hoteling transform

08Hrs

UNIT-6:

Image compression, Redundancies and their removal methods, Fidelity criteria, Image compression models, Source encoder and decoder, Error free compression, Lossy compression.

08Hrs

7th Semester

ET1403	**Principles of Image Processing**	L= 4	T = 0	P = 0	Credits = 4

Text books:				
1	Digital Image processing	2nd Education, 2002.	R. C. Gonzalez & R. E. Woods	Addison Wesley/ Pearson education
2	Fundamentals of Digital Image processing	1989	A. K. Jain	PHI

Reference books:				
1	Digital Image processing using MAT LAB	Edition, PEA, 2004	Rafael C. Gonzalez, Richard E Woods and Steven L	Pearson
2	Digital Image Processing	3rd Edition, 2004	William K. Pratt, John Wiley	
4	Industrial Instrumentation		D.P. Eckman	Wiley Eastern Ltd.

7th Semester

ET1404	Lab. : Principles of Image Processing	L = 0	T = 0	P = 2	Credits = 1

Course Objective	Course outcomes
Students should be able to 1. Learn the mathematical concepts for manipulation of digital images 2. Study implementation of intensity transformation and histogram processing for image enhancement. 3. Learn and understand spatial domain and frequency domain filtering techniques 4. Understand the process of image restoration, segmentation and compression	Students will be able to 1. Develop a program to perform basic operation on digital images 2. Implement intensity transformation and histogram processing techniques 3. Design filters for spatial and frequency domain analysis of digital images 4. Develop and analyze the algorithms for image segmentation, restoration and compression

Sr. No.	Experiments based on
1	Statistical properties of image and displaying histogram and profile
2	Histogram modification.
3	Image smoothing operations.
4	Edge detection.
5	Segmentation using threshold.
6	Region based segmentation.
7	Image transforms.

7th Semester

ET1405	PE III: Optical Communication	L= 3	T = 0	P = 0	Credits = 3

Course Objective	Course Outcome
Students should be able to 1. Learn the principles of step index and graded index optical fiber. 2. Know the types of losses in optical fiber. 3. Understand Transceiver systems in optical communication. 4. Learn concept of active, passive devices and measurements in optical communication.	Students will be able to 1. Design and analyze an Optical Communication System. 2. Differentiate the types of losses in optical system. 3. Explore different types of sources in fiber optics. 4. Analyze different types of receivers in fiber optics 5. Use different splicing techniques and connectors 6. Explore different methods of loss measurement in fiber optics.

UNIT I : INTRODUCTION TO OPTICAL FIBERS

Evolution of fiber Optic system. Principle of optical communication-Attributes and structures of various fibers such as step index, graded index mode and multi mode fibers. Propagation in fibers-Ray mode, Numerical aperture and multipath dispersion in step index and graded index fibers structure. Electromagnetic wave equation in step index and graded index fibers Modes and Power flow in fibers

06Hrs

UNIT II : SIGNAL DEGRADATION IN OPTICAL FIBERS

Attenuation – Absorption losses, Scattering losses, Bending Losses, Core and Cladding losses, Signal Distortion in Optical Wave guides – Information Capacity determination – Group Delay – Material Dispersion, Wave guide Dispersion, Signal distortion in SM fibers – Polarization Mode dispersion, Intermodal dispersion, Pulse Broadening in GI fibers – Mode Coupling – Design Optimization of SM fibers – RI profile and cut-off wavelength

06Hrs

UNIT III : FIBER OPTICAL SOURCES

Direct and indirect Band gap materials – LED structures – Light source materials – Quantum efficiency and LED power, Modulation of a LED, Laser Diodes – Modes and Threshold condition – Rate equations – External Quantum efficiency – Resonant frequencies – Laser Diodes structures and radiation patterns – Single Mode lasers – Modulation of Laser Diodes, Temperature effects, Source launching and coupling. Fabry Perot cavity Quantum laser

06Hrs

UNIT IV : FIBER OPTICAL RECEIVERS

PIN and APD diodes – Photo detector noise, SNR, Detector Response time, Avalanche Multiplication Noise – Comparison of Photo detectors – Fundamental Receiver Operation – pre-amplifiers - Error Sources – Receiver Configuration – Probability of Error – The Quantum Limit

06Hrs

UNIT V : POWER LAUNCHING AND COUPLING IN DIGITAL TRANMISSION SYSTEM

Source to fiber power launching – Fiber to Fiber Joints – Fiber Splicing and connectors Line Coding - Error correction– Noise Effects on System Performance

06 Hrs

UNIT VI : MEASUREMENT IN OPTICAL FIBERS

Attenuation, Time domain dispersion and Frequency domain dispersion, NA measurement Refractive index profile and optical source characteristic measurements, OTDR, eye pattern

06 Hrs

Text books:				
1	Optical Fiber Communication	2008	Gerd Keiser	McGraw-Hill International, Singapore
2	Optical Communication, Principles and Practice.	1992	J.Senior	
Reference books:				
1	Optical Communication System		J. Gower	Prentice Hall of India
2	Fiber-Optic Communication System	3rd Edition	Govind Agrawal	John Willy & Sons

7th Semester

ET1406	Lab. : PE III: Optical Communication	L = 0	T = 0	P = 2	Credits = 1

Course Objective	**Course outcomes**
Students should be able to 1. Observe and analyze various fiber optic data links when used for both digital and analog transmission. 2. know the measurement of NA of an optical fiber. 3. know data transmission using modulation techniques such as PAM, PWM. 4. understand the use of OTDR in Optical fiber.	Students will be able to 1. explore both analog and digital optical fiber communication. 2. analyze the NA measurements in different optical fibers. 3. use different modulation techniques in optical fiber. 4. explore the OTDR in Optical Fiber.

Sr. No.	Experiments based on
1	Digital and analog link using optical fiber
2	Fiber Attenuation
3	Optical Sources Characteristics
4	Fiber Bandwidth/ Data Rate
5	Digital transmission in optical communication
6	Measurement in optical fiber

7th Semester

ET1407	PE III: Microwave Integrated Circuits	L= 3	T = 0	P = 0	Credits = 3

Course Objective	**Course Outcome**
Students should be able to 1. Understand, design and analyze Planar Transmission Lines. 2. Design Passive MIC components. 3. Study the concepts of microstrip patch antenna. 4. Design & understand active MIC components. 5. Study the Hybrid MIC fabrication processes. 6. Study the Monolithic MIC fabrication processes.	Students will be able to 1. Analyze different types of planar transmission lines. 2. Use the concept of Microstrip lines for designing different passive RF components. 3. Design and analyze Microstrip circuits. 4. Understand the designing of active MIC components. 5. Understand the Hybrid MIC fabrication processes. 6. Understand the Monolithic MIC fabrication processes.

UNIT-1:

Micro strip line:

Analysis using conformal transformation and Hybrid mode method. Characteristic impedance, Guide wavelength and loss, Slot line – Wave-guide analysis, coupling coaxial and micro strip lines Coplanar line: analysis using conformal transformation and Hybrid mode method

06 Hrs

UNIT-2:

Micro strip line devices:

Directional couplers, Micro strip coupler and branch-line couplers, even and odd mode analysis, coupling coefficient and bandwidth. Impedance transformers and filters, Lumped elements for MIC design and fabrication of inductors, resistors and capacitors, Non-reciprocal components, micro strip circulators, isolators, phase shifters

06 Hrs

UNIT-3:

Micro strip Antennas:

Radiation mechanism, radiation fields, patch antennas, traveling wave antennas, slot antennas, excitation techniques, surface waves

06 Hrs

UNIT-4:

Design of micro strip circuits:

High power circuits – Transistor Oscillator, step recovery diode frequency multiplier, avalanche diode oscillator, PIN diode switch, low power circuits Schottky diode, Balanced mixer, parametric amplifier, PIN diode limiter, Diode phase shifter

06 Hrs

UNIT-5:

Hybrid MICs:

Dielectric Substrates, thick film technology, thin film technology, methods of testing, encapsulation of devices, mounting

06 Hrs

UNIT-6:

Monolithic MICs fabrication:

Epitaxial growth, Diffusion, Ion implantation, Electron Beam technology for pattern delineation

06 Hrs

7th Semester

ET1407	PE III: Microwave Integrated Circuits	L= 3	T = 0	P = 0	Credits = 3

Text books:				
1.	Antennas and Radio Wave Propagation	1985	R.E.Collin	McGraw Hill Publishers
2.	Microwave Devices and Circuits	Third Edition	Samuel Liao	Prentice-Hall of India Ltd
3.	**Radio Frequency and Microwave Electronics**		**M.M. Radmanesh**	**2001, Pearson Education Asia,**
4.	Microwave Engineering	Third Edition	David Pozar	Wiley Ind. Pub.
5.	Strip line Transmission Line for MIC		Bharti Bhat, S. K. Koul	New Age International

Reference books:				
1	Microwave Integrated Circuits	1974	K. C. Gupta and Amarjit Singh	Wiley East. Ltd
2	Micro strip Antennas	1980	I.J. Bahl and P. Bhartia	Artech House
3	Strip line Transmission Line for MIC		Bharti Bhat, S. K. Koul	New Age International

7th Semester

ET1408	Lab. : PEIII: Microwave Integrated Circuits	L = 0	T = 0	P = 2	Credits = 1

Course Objective	Course Outcomes
Students should be able to 1. To understand the various microwave Integrated circuits components 2. To Develop the hands-on Trainer Kits of MIC. 3. To analyze the various passive & active MIC components . 4. To get hands on spectrum analyzer. and analyze different microstrip component on it.	Students will be able to 1. Identify the different MIC components. 2. Set up the Test bench of MIC. 3. Analyze the components. 4. Use the spectrum analyzer for the analysis of MIC components.

Sr. No.	Experiments based on
1	Directional coupler
2	Power Divider
3	Measurement of antenna pattern : parabolic antenna, slot antenna, Horn antenna
4	A micro strip antenna
5	Ferrite Devices / Components
6	Micro strip Filters.

7th Semester

ET1409	PE III: Communication Networks	L= 3	T = 0	P = 0	Credits = 3

Course Objective	Course Outcome
Students should be able to 1. Understand Networks, Network topologies and service primitives. 2. Learn basics of LAN, MAN, WAN. 3. Learn the structure and applications of connecting devices. 4. Understand OSI and TCP/IP architecture. 5. Comprehend Network applications and Network Securities.	Students will be able to 1. Compare different LAN Topologies. 2. Apply the knowledge of LAN structure to design autonomous system. 3. Detect Data transmission errors. 4. Compare data transmission protocols. 5. Describe the applications of communication network. **6.** Solve network security issues.

UNIT I :
Introduction, network and services: communication network, approaches to network design, types of network, two stage and three stage network. Uses of computer networks, LAN, MAN, WAN, design issues for layers, connection oriented and connectionless services, service primitives, Application and layered architecture, OSI reference model,

05 Hrs

UNIT II :
LAN network and medium access layer: LAN structure, random access, multiple access protocols, IEEE standard 802 for LAN and MAN, high speed LANS, repeaters, hubs, bridges, fast Ethernet, Wireless LAN

06 Hrs

UNIT III :
Physical layer and data link layer: transmission media, PSTN.
Data link layer design issues, error detection and correction methods, elementary data link protocols, sliding window protocols.

06 Hrs

UNIT IV :
Network layer and transport layer: network layer design issues, routing, congestion, internetworking, transport layer design issues, transport service primitives, internet transport protocol, TCP/IP architecture, TCP/IP protocol, IP packets, IP addressing, TCP/IP utilities ,wireless TCP and UDP, routers and gateways

06 Hrs

UNIT V: Network Applications
Application layer: domain name system, electronic mail system, multimedia, real time transport protocol, electronic mail, world wide web.

06 Hrs

UNIT VI: Network Security:
Network security cryptography, secrete key, public key, digital signature, e-mail security, web security, communication security.

06 Hrs

Text books:				
1	Computer networks	3rd Edition	Tanenbaum	*Amazon*
2	Computer communication	2003	by W. Stanlling	Prentice Hall
3	Data Communication and Networking	4th Edition	Forouzan	McGrawHill

Reference books:				
1	Telecommunication switching systems and networks	Paperback	by vishwanathan	PHI
2	Computer Networks	Third Edition 2003	Larry Peterson, Bruce Davie	MKP

7th Semester

ET1410	Lab. : PE III: Communication Networks	L = 0	T = 0	P = 2	Credits = 1

Course Objective	Course outcomes
Students should be able to 1. Understand the design parameters of LAN topology. 2. Learn design specifications of stop and wait, go back –n, selective repeat ARQ data link and transport layer protocols. 3. Study communication network securities issues. 4. Study methods of error free communication.	Students will be able to 1. Design autonomous system using LAN topologies. 2. Develop algorithms for stop and wait, go back –n, selective repeat ARQ data link layer and transport protocols. 3. Develop algorithms for data encryption and decryption 4. Compare systems with single and burst error.

Sr. No.	Experiments based on
1	Network design LAN, MAN ,WAN
2	PC to PC communication using RS-232 port
3	Sliding window protocol
4	Wireless TCP and UDP protocols
5	Bluetooth
6	Network security cryptography
7	Communication networks like Wi-Fi, Wimax
8	Routing protocols

7th Semester

ET1431	PE III: Analog VLSI Circuits	L= 3	T = 0	P = 0	Credits = 3

Course Objective	Course Outcome
Students should be able to 1. Understand the current trends in Analog VLSI technologies. 2. Study the various design methods of MOS amplifier. 3. Study the single stage amplifier with various loads. 4. Understand the basic concept of Differential amplifier. 5. Study basics of operational amplifier design. 6. Study the basics of switch capacitor and analog layout design.	Students will be able to 1. Apply mathematical methods to analyze Analog VLSI circuits 2. Design MOS amplifier to improve the gain and operating frequency range. 3. Design single stage amplifier with various loads and analyze the various characteristic. 4. Design and analyze the differential amplifier.. 5. Design and analyze Op-AMP with two stage & Cascade stage technique. 6. Make layout for various Analog circuits.

UNIT-1: MOS Device Physics
General Consideration: MOSFET as a switch, MOSFET structure, MOS symbols; MOS Operation and I/V Characteristics: Threshold voltage, Derivation of I/V characteristics; Second order effects; MOS capacitances; MOS Small-Signal Model

06 Hrs

UNIT-2: Analog CMOS Subcircuits
MOS Diode/Active Resistor; Current Sinks and Sources: Simple MOS, Cascade MOS, Bootstrapped MOS, Regulated Cascoded; Current Mirrors: Simple, Cascode, Wilson, Wilder; Voltage and current references; Supply and Temperature independent biasing techniques.

06 Hrs

UNIT-3: Single-Stage Amplifiers
Basic Concepts; Common-Source Stage: Common-Source Stage with Resistive Load, CS Stage with Diode-Connected Load ,CS Stage with current source load, CS Stage with Triode Load , CS Stage with Source Degeneration; Source Follower, Common-Gate Stage; Cascade Stage: Folded Cascade

06 Hrs

UNIT-4: Differential Amplifiers
Single-ended and Differential Operation; Basic Differential Pair: Qualitative and Quantitative Analysis; Common mode response; Differential pair with MOS loads; Gilbert cell.

06 Hrs

UNIT-5 : CMOS Operational Amplifiers
Design of CMOS Op-Amps, Compensation of Op Amps, Design of Two-Stage Op Amps, Cascade Op Amps, Micropower Op Amps.

06 Hrs

UNIT-6:
Special Topics in Analog VLSI
Bandgap References, Switch-Capacitor Circuits and Switch Capacitor Filter, Comparators
Layout And Packaging
General layout Consideration: Design rules, Antenna effect; Analog Layout Techniques; Packaging.

06 Hrs

7th Semester

ET1431	**PE III: Analog VLSI Circuits**	L= 3	T = 0	P = 0	Credits = 3

Text books:				
1	Design of Analog CMOS Integrated Circuits	First Edition	Behzad Razavi	TATA McGRAW HILL
2	CMOS Analog Circuit Design	2nd Edition	Philip Allen and Douglas Holberg	Oxford University Press
Reference books:				
1	CMOS Circuit Design, Layout, and Simulation,	3rd Edition 2010	R. Jacob Baker	Jonh Wiely publication
2	VLSI Design Techniques for Analog and Digital Circuits	Third edition, 2008	Randall Geiger, Phillip Allen, Noel Strader	Tata Mc Graw Hill

7th Semester

ET1432	Lab. : PE III: Analog VLSI Circuits	L = 0	T = 0	P = 2	Credits = 1

Course Objective	Course outcomes
Students should be able to 1. Understand the difference between Analog VLSI and digital VLSI. 2. Study the single stage amplifier with considering various second order affect.. 3. Study the differential amplifier with various loads. 4. Understand the basic concept of OP-AMP.	Students will be able to 1. Design and analyze MOS circuit. 2. Design and analyze MOS amplifier with various loads and estimate gain and bandwidth. 3. Design single stage amplifier with various loads and estimate gain and bandwidth. **4.** Design Differential amplifier and Op-AMP with various loads and estimate gain and bandwidth.

Sr. No.	Experiments based on
1	MOS I/V characteristics
2	Design MOS amplifier and consider various second order effects.
3	Single Stage Common Source Amplifier
4	Cascode Amplifier
5	Current Source and Sink
6	Design Current Mirrors
7	Design Differential Amplifier
8	Design two stage Op Amp
9	Design Comparators
10	Layout of Single Stage amplifier

7th Semester

ET1413	Industrial Training/CRT	L = 0	T = 0	P = 0	Credits = 2

Evaluation Scheme	Continuous Evaluation	TA	Total	ESE Duration
		100	100	

*** Evaluation Based on Seminar / Report.**

8th Semester

ET1415	Antenna Theory and Design	L= 4	T = 0	P = 0	Credits = 4

Course Objective	Course Outcome
Students should be able to 1. Learn the basic principles and of antenna parameters. 2. Design and analyze dipole antennas. 3. Design and analyze loop antennas & Arrays. 4. Design and Analyze Travelling wave & Broadband Antennas. 5. Design & Analyze aperture, Reflector and Patch Antennas. 6. Study different antenna measurements.	Students will be able to 1. Find out various parameters of particular antenna. 2. Describe and analyze various parameters for performance measurement of Dipole antenna. 3. Analyze loop antennas & various arrays. 4. Describe various broadband antennas & travelling wave antennas. 5. Analyze Study different antenna measurements. **6.** Perform antenna measurements.

UNIT I : BASIC ANTENNA CONCEPTS:
Types of antennas, Radiation mechanism, Beam solid angle, radiation intensity, Directivity, effective aperture, beam efficiency, Antenna field zones, Polarization, impedance, bandwidth, impedance, effective length, antenna temperature

08Hrs

UNIT II : DIPOLE ANTENNA RADIATION :
Scalar and vector potentials, retarded potentials, field due to a current elements, power radiated and radiation resistance for field due to a dipole, power radiated and radiation resistance, Earth curvature, Half wave dipole antenna radiated fields of short dipole, small loop and helical Antenna, Radiation resistance, Directivity and Design Feature. Half wave dipole: radiated fields and other feature

08Hrs

UNIT III : LOOP ANTENNAS AND ARRAYS:
circular loop ,polygonal loop and ferrite loop antenna**,** circular loop antenna with constant current, Two element array, linear array, N- element array ,uniform ,broad side, end fire ,Non uniform Amplitude antenna array**,** planar and circular array

08Hrs

UNIT IV :
TRAVELING WAVE AND BROAD BAND DIPOLE
Introduction, traveling wave antenna, long wire, V antenna, rhombic antenna, Broadband antennas, Helical antenna, Electric-Magnetic Dipole, Yagi-Uda array of linear Elements, Yagi array of loops.

08Hrs

UNIT V: SPECIAL ANTENNAS:
Aperture Antennas: Rectangular aperture, Circular aperture, Babinet's principle, Horn antenna: conical horn, corrugated Horn, Multimode horn reflector antenna: plane reflector, corner reflector, corner, parabolic, spherical, Patch Antenna

08Hrs

UNIT VI: ANTENNA MEASUREMENTS:
Antenna Range, Radiation Pattern, Gain Measurement, Directivity Measurement, Radiation Efficiency, Impedance Measurement, Current Measurement, Polarization Measurement

08Hrs

Text books:				
1	Antenna Theory Analysis and Design Technology	1982 Third edition	Balanis E.S.	Wiley India
2	Antennas	II edition 1988	John D.Krauss	McGraw-Hill International edition
Reference books:				
1	Electromagnetic waves and Radiating systems	1993	Edward C.Jordan, Keith G.Balmain	Prentice Hall of India 1Td
2	Antennas and Radio Propagation	1985	R.E. Collins	McGraw-Hill

8th Semester

ET1416	Lab. : Antenna Theory and Design	L = 0	T = 0	P = 2	Credits = 1

Course Objective	Course Outcome
Students should be able to 1. Measure the performance parameters of various antenna through hardware setup module. 2. Study design different wire antennas & measure its parameters through the use of software. 3. Study design of reflector antennas and broadband antennas & measure its parameters through the use of software. 4. Study design of planar antennas antennas & measure its parameters through the use of software.	Students will be able to 1. Assemble & Measure various parameters using hardware module. 2. Use software to design different wire antennas. 3. Design and analyze different parameters of reflector antennas through software. 4. Design application specific antenna.

Sr. No.	Experiments based on
1	Dipole
2	Half Wave Dipole
3	Monopole
4	Yagi Antenna
5	Boardside array
6	Endfire array
7	Loop Antenna
8	Crossed Dipole
9	Lock Periodic Antenna
10	Slot Antenna
11	Helix Antenna
12	Microstrip Antenna

8th Semester

ET 1417	CMOS VLSI Design	L= 4	T = 0	P = 0	Credits = 4

Course Objective	Course Outcome
Students should be able to 1. Understand the current trends in CMOS VLSI technologies. 2. Study analysis of the MOS transistor with first order and second order effects. 3. Study the static and dynamic operating principles of inverter circuit. 4. Understand the different CMOS implementation process. 5. Learn the basic structure and operation of combinational and sequential logic circuits. 6. Study dynamic circuits using domino and dynamic logic.	Students will be able to 1. Apply mathematical methods to analyze CMOS VLSI circuits 2. Design SSI, MSI and LSI CMOS circuits to realize specified digital functions. 3. Apply Lambda design rules to design optimized CMOS layout. 4. Apply various steps for the fabrication of various CMOS circuits 5. Design digital logic circuit using CMOS Technology and verify the functionality, timing, power, area and parasitic effects. 6. Design and analyze BICMOS, dynamic and domino logic circuits.

UNIT-1: Basic MOS Device Physics

General Consideration: MOS as a switch, MOS Structure & Symbols, MOS I/V Characteristics, MOS Enhancement Transistor, Second order effect of MOS: Body Effect, Junction Effect, Gate Leakage Effect, Channel Length Effect, Tunneling Effect, Velocity Modulation, Mobility Variation, Small Signal Modeling of MOSFETs.

08 Hrs

UNIT-2: MOSFET Inverter Characteristics

Resistive Load Inverter, Inverter with n type MOSFET load, Inverter with Active Load, CMOS Inverter, Principle of operation & DC Characteristics, Tri-stated Inverter, Noise Margin Calculation, Logic Design with MOSFETs. Compound Gates in CMOS.

08 Hrs

UNIT-3: Fabrication & Layout of CMOS IC

Integrated circuit fabrication process: oxidation, diffusion, ion implantation, photolithography and twin-tub CMOS process. CMOS Technology: N-well, P-well, Twin Tub Process, Silicon on Insulator (SOI) Process, Layout Design Rules, Physical Design of Logic Gates, Euler's Path, Stick Diagram, Layout, Latch-up Effect.

08 Hrs

UNIT-4: Switching Characteristics & Interconnection Effect

MOS Device Capacitance Estimation, Switching Characteristics: Rise Time, Fall Time, Propagation Delay, Delay Estimation: Propagation Delay, Contamination Delay, Power Dissipation in CMOS: Static & Dynamic Power Calculation, Charge Sharing, Fan-in, Fan-out.

08 Hrs

UNIT-5 : Combinational & Sequential MOS Logic Circuits

Combinational circuit design, static CMOS, Transmission Gate Circuits(TG),Pass Transistor, Multiplexers, Logic Design Using Pass Transistor and TG. Ratio-ed Logic circuits, sequential circuit, Latches and Flip Flops,, Clock Flip- Flop.

08 Hrs

UNIT-6: Advanced Techniques in CMOS Logic Circuits

Complementary Static CMOS, Pseudo NMOS Logic, Dynamic CMOS Logic, CMOS Domino Logic, Zipper Logic, Clocked CMOS Logic, CVSL, Bi-CMOS Logic Family.

08 Hrs

8th Semester

ET 1417	**CMOS VLSI Design**	L= 4	T = 0	P = 0	Credits = 4

Text books:				
1	Introduction to VLSI Circuits and Systems	First Edition	John P. Uyemura	Wiley Publication
2	Principle of CMOS VLSI Design	2nd Edition, 1994	Neil H. E. Weste, K. Eshraghian	Addison Wesley VLSI Series
Reference books:				
1	CMOS VLSI Design	3rd Edition, 2005	Pucknell , K. Eshraghian	Prentice Hall
2	CMOS Digital Integrated circuits Analysis and Design	Third edition, 2008	Sung-Mo Kang, Yusuf leblebici	TataMc Graw Hill
3	Design of Analog CMOS Integrated Circuits	2001	Razavi, Behzod	McGraw Hill

8th Semester

ET1418	Lab. : CMOS VLSI	L = 0	T = 0	P = 2	Credits = 1

Course Objective	Course outcomes
Students should be able to 1. The fundamental principles of VLSI circuit design & layout 2. To provide hands-on design experience using EDA tools. 3. To verify the characteristic of static logic circuit using EDA tools. 4. To verify the behaviour of Dynamic logic circuits using EDA tools.	Students will be able to 1. Apply mathematical methods to design and simulate CMOS VLSI circuits. 2. Design and simulate SSI, MSI and LSI CMOS circuits to realize specified digital functions using EDA tools. 3. Apply Lambda design rules to design optimized CMOS layout using EDA tools. 4. Design and simulate digital logic circuit using EDA tools to verify the functionality and able to calculate timing, power, area and parasitic capacitance practically. 5. Design and simulate BICMOS, dynamic and domino logic circuits and able to understand the actual behaviour of the logic design.

Sr. No.	Experiments based on
1.	Introduction to EDA Tool.
2.	To study and Plot the transfer characteristics of NMOS and PMOS using EDA Tools
3.	To study and Plot the transfer characteristics of CMOS Inverter using EDA Tools.
4.	To perform the analysis of Basic logic Gates like NAND, NOR, AND, OR using gate level design.
5.	To perform the Gate Level Analysis of Pass Transistor and Transmission Gate.
6.	To study the Gate Level Analysis of Half Adder and Half Subtractor.
7.	To study the Gate Level Analysis of Full Adder and Full Subtractor.
8.	To study the Gate Level Analysis of 4:1 Multiplexer using CMOS and Transmission Gate.
9.	To perform the analysis of Resistive Load Inverter and Pseudo NMOS Inverter.
10.	To study and Design a D Flip-flop.
11.	Mini-project. (For Example: Look Ahead Carry Adder, 4 Bit Parallel Adder)

8th Semester

ET1419	PE IV: Power Electronics	L= 3	T = 0	P = 0	Credits = 3

Course Objective	Course Outcome
Students should be able to 1. Understand the characteristics of different power electronics switches and selection of components for different applications, 2. Learn different types of power devices 3. Understand the switching behavior of power electronics circuits such as DC/DC converters. 4. Learn the role of different type of inverters.	Students will be able to 1. Analyze and design an AC/DC rectifier circuit. 2. Analyze characteristics of different devices. 3. Design of AC voltage converters and Cycloconverters 4. Analyze and design DC/DC converter circuits. 5. Analyze and design inverter circuits. 6. Demonstrate the application of power electronics to solve real life problems.

UNIT I :
Power Semiconductor Diodes and Circuits, control Characteristics of power devices, power modules, power diodes, reverse recovery, series, shunt connected diodes, Diode Rectifiers—single phase, three phase rectifiers, bride rectifiers, design of rectifiers

06Hrs

UNIT II :
Power Transistors, Switching characteristics of BJT, Power MOSFETs, IGBTs, limitations, Power Thyristors

06Hrs

UNIT III:
Controlled Rectifiers: phase control converter, single phase, three phase converters, AC Voltage Controllers. Principle of ON-OFF control, Phase control, Single phase controllers, three phase controllers, cyclo-converters

06Hrs

UNIT IV :
Turn on Turn off mechanism SCR, Commutation methods of SCR. DC-DC Converters, Step up, step down, thyrister Choppers, design of choppers

0**6Hrs**

UNIT V :
Resonant Pulse Inverters—Series, parallel, resonant inverters, Class E resonant inverter, Pulse width Modulated Inverters: Principle, single phase, Multiple phase, PWM Forced commuted inverters, current source inverters, design of inverter.

06Hrs

UNIT VI:
Power Supplies, SMPS, SM ac power supplies, Gate Drive Circuits- Protection of Devices and Circuits Snubber, reverse recovery transients, Introduction to AC and DC drives.

06Hrs

Text books:				
1	Power Electronics:Circuits,Devices and Applications	Second Edition 1993	M. Rashid	PHI
Reference books:				
1	Power Electronics and its application	Second Edition, 2004	Alok Jain	Penram International Publishing Pvt Ltd

8th Semester

ET 1420	PE IV : Wireless Mobile Communication Systems	L= 3	T = 0	P = 0	Credits = 3

Course Objective	Course Outcome
Students should be able to 1. Study cellular concepts and techniques to improve capacity in cellular system. 2. Understand mobile radio environment and its different parameters. 3. Study fundamentals of equalization, diversity & its techniques. 4. Understand the operating principles of various wireless systems & standards. 5. Learn the fundamentals of wireless networking.	Students will be able to 1. Explain cellular system standards. 2. Describe capacity improvement in cellular systems. 3. Quantify causes and effects of path loss and signal fading on received signal characteristic 4. Describe concept of equalization, diversity & its techniques. 5. Analyze GSM & CDMA systems. **6.** Understand the fundamentals of wireless networking.

UNIT I : Introduction to Wireless Communication Systems:
Evolution of Mobile Radio Communications, Mobile Radio Systems around the world. Examples of Wireless Communication Systems, Comparison of common wireless communication systems, trends of cellular radio and personal communications, Second generation (2G) cellular Networks, Third generation (3G) cellular Networks, wireless local loops and LMDS

06Hrs

UNIT II : The Cellular Concept :
Cellular telephone system, frequency reuse, channel assignment and handoff strategies, interference and system capacity, trunking and grade of service, improving capacity in cellular system

06Hrs

UNIT III : Mobile Radio Propagation- Large & Small Scale Path Loss & Fading:
Introduction to Radio Wave Propagation, Reflection, Diffraction, Scattering Practical Link Budget Design Using Path Loss Models, Signal Penetration into Buildings, Ray Tracing & Site Specific Modeling. Small Scale Multipath Propagation, Small Scale Multipath Measurements, Parameters of Mobile Multipath Channels, Types Of Small Scale Fading, Rayleigh & Rician Distribution

06Hrs

UNIT IV : Equalization & Diversity:
Fundamentals of equalization, space polarization, frequency and time diversity techniques, space diversity, polarization diversity, frequency and time diversity. RAKE Receiver

06Hrs

UNIT V: Wireless Systems and Standards:
GSM- global system for mobile: services and features, GSM system architecture, GSM radio subsystem, GSM channel types, GSM frame structure, signal processing in GSM, introduction to CDMA digital cellular standard (IS-95)

06Hrs

UNIT VI: Wireless Networking:
Introduction to wireless networks, Differences Between Wireless & Fixed Telephone Networks, Development of wireless networks, Traffic routing in wireless networks, Wireless data services, Common channel signaling, Signaling System No 7.An Example of SS7, SIP -Global Cellular Network Interoperability

06Hrs

Text books:				
1	Wireless Communication – Principles and practice	Second edition	by T S. Rappaport	(Prentice Hall PTR, upper saddle river, New Jersey.)

Reference books:				
1	Wireless digital communication	1995	by Kamilo Feher	PHI
2	Mobile Communications Design fundamentals	1993	by William C. Y. Lee	John Willey
3	Mobile Cellular Communication	2005	by W .C .Y. Lee	Mc Graw Hill
4	The Mobile Radio Propagation channel	1996	by J.D. Parson	John Willey

8th Semester

ET1433	PE IV : Satellite Communication & Radar Engineering	L= 3	T = 0	P = 0	Credits = 3

Course Objective	Course Outcome
Students should be able to 1. To become familiar with satellites and satellite services. 2. To understand the satellite Propagation on satellite 3. To understand earth station technology 4. To make the student understand the principles of Radar and its use in military and civilian environment 5. To make the RADAR antennas, Lens antenns & RADAR, Receiver 6. To explain Effects of weather on RADAR	Students will be able to 1. Analyze satellite services and satellite system 2. Work with Propagation on satellite 3. Describe the Earth station technology 4. Analyze the RADAR range equation and Doppler principle to radars and hence detect moving targets and cluster **5.** Analyze RADAR antennas and Reflectors **6.** Analyze the effects of satellite on weather

UNIT I : Introduction: Origin of Satellite communication, Current state of satellite communication. Orbital aspect of satellite communication: Orbital mechanism, equation of orbit, locating satellite in orbit, orbital elements, and orbital perturbation. Space craft subsystem: Attitude and orbit control system, Telemetry tracking and command power system, and communication subsystem. Satellite link design: System noise temperature and T / T ratio, down link design, domestic satellite system, uplink design, design of satellite link for specified (C / N).

06Hrs

UNIT II : Propagation on satellite: Earth's path – propagation effects, atmospheric absorption, Scintillation effects, Land and Sea multipath, Rain and ice effects, Rain drop distribution, calculation of attenuation. Rain effects on Antenna noise temperature

06Hrs

UNIT III : Earth Station technology: Earth Station design; antennas tracking, LNA, HPA, RF multiplexing, factors affecting orbit utilization, tracking, equipment for earth station.

06Hrs

UNIT IV :

RADAR Range Equation, CW and FM modulated RADAR, MTI and Pulse Doppler RADAR, Tracking RADAR

06Hrs

UNIT V:

RADAR antennas, parabolic reflector, Scanning field reflector, Lens **antennas**.
RADAR Receivers, Displays and Duplexer, Detection of RADAR; signals in noise

06Hrs

UNIT VI:

RADAR clutter, Effects of weather on RADAR, Detection of targets in Precipitation, Synthetic Aperture RADAR, HF over the Horizon RADAR.

06Hrs

Text books:				
1	Introduction of RADAR system		Skolnik	McGraw Hill
2	Satellite Communication		Dennis Roddy	
Reference books:				
1	Satellite Communications		Varsha Agrawal Anil	Wiley India Pvt Ltd
2	Satellite Communication Systems		M. Richharia	Mcgraw Hill Telecommunications
3	Radar Systems Principle		Harold R.Raemer	

8th Semester

ET1434	PE IV: Bio-medical Instrumentation	L= 3	T = 0	P = 0	Credits = 3

Course Objective	Course Outcome
Students should be able to 1. Know the physiology of heart , brain and skin. 2. Understand the basic principles of physical parameters such as blood pressure, heart rate and body temperature. 3. Comprehend the working principle of recording instruments such as ECG,EEG EMG and phonocardiograph. 4. Comprehend the working principle of instrumentation for Blood Pressure, Blood flow , Pulse oximeters, Heart rate , respiration rate ,temperature and hearing Aid. 5. Know the physical concepts of radiography related to X rays. 6. Learn working principles of advanced medical imaging system	Students will be able to 1. Analyze various parameters using ECG,EEG and EMG 2. Analyze various physical measurements such as blood pressure, heart rate, temperature etc. 3. Measure and analyze various parameters using ECG,EEG EMG and phonocardiograph. 4. Measure and analyze various parameters such as - Blood Pressure, Blood flow rate, Pulse rate, Heart rate, respiration rate and temperature and hearing ability. 5. Interpret the working principle of X-ray equipments 6. Describe working principles of advanced medical imaging systems.

Unit 1 : Cell as bio electric generator:
Heart and Circulatory system, ECG, Brain and nervous system, EEG, Skeletal , Muscle and Skin Systems, EMG
06Hrs

Unit 2 : Physical Measurement
Blood pressure and Flow, Heart rate and Heart sounds, Respiration and temperature
06Hrs

Unit 3 : Recording Instrumentation
Electrodes, Basic Instrumentation, Electrocardiograph, Electroencephalograph Electromyography and Phonocardiograph.
06Hrs

Unit 4 : Measuring Instrumentation
Transducers, Blood Pressure, Blood flow and Pulse oximeters, Heart rate , respiration rate and temperature meters, Audiometer and hearing Aid
06Hrs

Unit 5 : X-rays
X-ray Physics, Fluoroscopy and radiography, X-ray tubes and X-ray Equipments
06Hrs

Unit 6 : Advanced Imaging Systems
Ultrasonic scanner, CT scan, MRI, Endoscope and Electron microscope
06Hrs

Text books:				
1	Biomedical Instrumentation and Measurements	2007	Prentice Hall of India, New Delhi	Cromwell
2	Biomedical Instrumentation	2006	Anuradha Agencies Publishers, Kumbakonam	Arumugam.M.
3	Handbook of Biomedical Instrumentation	2003	Prentice Hall of India, New Delhi	R.B.Khandpur
Reference books:				
1	Introduction to Biomedical Equipment Technology	2004	Pearson Education India, Delhi	Joseph J. Carr and John M. Brown
2	Standard Handbook of Biomedical Engineering & Design	2003	McGraw-Hill Publisher, New York	Myer Kutz
3	Medical Instrumentation – Application & Design	2009	John Wiley and sons Inc, Netherlands	Webster
4	Medical Electronics	2003	ISTE Excel book	Patil A. G.

8th Semester

ET1437	PE IV : Display Technology	L= 3	T = 0	P = 0	Credits = 3

Course Objective	Course Outcome
Students should be able 1. To learn fundamental concepts of different display technologies related to manufacturing techniques and materials selection. 2. To explore specifications required for display technologies 3. To understand properties of Luminescence materials 4. To understand different displays and addressing of displays 5. To learn backplane technology and driver integration 6. To understand properties of materials and its modes	Students will be able to 1. Identify different display technologies and manufacturing processes. 2. Characterize and analyze specifications of display technology. 3. Analyze properties of Luminescence materials 4. Explore design parameters for displays and analyze matrix addressing. 5. Comprehend the fundamentals of backlight unit technologies. 6. Elaborate applications of displays.

UNIT I : Overview of display technologies, information capacity of displays, introduction to different flat panel display technologies. Fundamentals of Photometry, Colorimetry, CIE colorimetry

06Hrs

UNIT II : Characterization and performance of displays: Concepts of aspect ratio, color gamut, contrast and gradation, directional visibility, driving power, efficiency, speed, memory and storage, degradation, resolution, addressability, physiological factors, and measurement instrumentation;

06Hrs

UNIT III : Luminescence and luminescent materials: Physical processes and interactions leading to emission of light, processes responsible for the transfer of energy in luminescent materials, chemistry and preparation of luminescent materials, and emission properties of the prepared materials;

06Hrs

UNIT IV : Basics of matrix addressing of displays: active and passive matrix.
Technical discussion of display technologies: LEDs, OLEDs, LCDs, Active matrix TFT backplanes for OLED and LCD displays. Other displays and associated technologies.

06Hrs

UNIT V: Advanced TFT Backplane Technologies (IGZO, LTPS, etc.) and Driver Integration.
Back Light Unit Technologies (CCFL, LED, QD, etc.)

06Hrs

UNIT VI: Future and New Applications of Displays. Materials for Display – TFT, EL and LC Materials and Modes

06Hrs

Text books:				
1	Liquid crystal flat panel displays: manufacturing science & technology.	W. Mara	2012	Springer, Science & Business Media,
2	Introduction to Flat Panel Displays	Jiun-Haw Lee, David N. Liu, Shin-Tson Wu		Wiley publications
Reference books:				
1	Liquid crystal displays: fundamental physics and technology.	R. H. Chen	2011	John Wiley and Sons
2	Fundamentals of Solid-State Lighting: LEDs, OLEDs, and Their Applications in Illumination and Displays	Vinod Kumar Khanna		CRC press

8th Semester

ET1438	PE IV : Digital Image Analysis for Remote Sensing	L= 3	T = 0	P = 0	Credits = 3

Course Objective	Course Outcome
Students should be able to 1. Understand the fundamentals and image characteristics of remote sensing. 2. Learn image enhancement techniques 3. Study image classification technique and hyperspectral image analysis	Students will be able to 1. Elaborate image charactesistics and analysis methods for remote sensing 2. Apply the image enhancement, transforms and correction techniques on remote sensing images 3. Apply acquired knowledge and critical thinking skills to solve a real-world problem with appropriate remote sensing data and processing methods.

UNIT-1:
Review of Remote Sensing Concepts: spatial and radiometric characteristics – spectral and temporal characteristics, Optical Radiation Model: The wave/ particle models - energy/matter interaction – Radiometric Correction–Atmospheric Correction **06 Hrs**

UNIT-2:
Digital Image Formation: point spread functions – sampling and quantization Digital Image Characteristics: Univariate and multivariate image statistics – noise models- power spectral density- co-occurrence matrix **06 Hrs**

UNIT-3:
Image Enhancement and Spectral Transforms: contrast enhancement – band rationing – principal component analysis – vegetation transforms – texture transforms, Spatial Transforms: convolution concept - low and high pass filtering – spatial transformations – Fourier transform – wavelet transforms **06 Hrs**

UNIT-4:
Geometric Correction: sensor geometry and empirical models for geometric corrections **06 Hrs**

UNIT-5:
Thematic Information Extraction: review of supervised and unsupervised Image classification – Maximum Likelihood and Bayesian classification, Non-parametric & parametric classification **06 Hrs**

UNIT-6:
Subpixel classification: Linear mixing model, fuzzy set classification, Hyperspectral Image Analysis:Feature extraction, classification algorithms for hyperspectral data **06 Hrs**

8th Semester

ET1438	PE IV : Digital Image Analysis for Remote Sensing	L= 3	T = 0	P = 0	Credits = 3

Text books:			
Remote Sensing: Models and Methods for Image Processing	Third Edition	Robert A. Schowengerdt	Elsevier
Remote Sensing Digital Image Analysis	4th Edition	John A. Richards, Xiuping Jia	Springer
Reference books:			
Introductory Digital Image Processing: A Remote Sensing Perspective	Second Edition	Jhon R. Jensen	Pearson Series
Physical Principles of Remote Sensing	Third Edition	W.G. Rees	Cambridge University Press

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

8th Semester

ET1422	PE V: Fuzzy Logic & Neural Network	L= 3	T = 0	P = 0	Credits = 3

Course Objective	Course Outcome
Students should be able to 1. Learn the concepts of Neural network. 2. Understand the supervised and unsupervised algorithms in neural networks. 3. Learn the concepts of Fuzzy sets and logic. 4. Understand fuzzy logic and reasoning, operations and relations. 5. Learn design parameters for fuzzy logic controller.	Students will be able to 1. Describe neural network architecture and apply single layer supervised algorithms for pattern classification problems. 2. Extract learning rules and apply multilayer supervised algorithms for problems solving. 3. Apply unsupervised algorithms for pattern classification, association problems. 4. Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems. 5. Prove and Apply fuzzy arithmetic operations and relations for problem solving. 6. Design Fuzzy logic controller for solving real life problems.

UNIT I : Introduction of neural networks, NN Architecture Neural learning and laws, Applications of ANN Evaluation of network,
Supervised Learning : Single layer network : MP neuron, Perceptron, Perceptron training algorithm, LMS algorithm , ADALINE

06Hrs

UNIT II : Supervised Learning :
Multiplayer network: Multilevel Discrimination, Backpropogation Algorithm, Setting the parameter values, Accelerating the learning Process, MADALINE, Recurrent Network, RBF networks

06Hrs

UNIT III : Unsupervised Learning :
Winner Take Network, ART Networks, self-organizing feature maps, Associate Models

06Hrs

UNIT IV :
Overview of Crisp Sets, Concepts of Fuzzy sets, representation of fuzzy sets, extension principle, fuzzy compliments, t-norms and t- conforms

06Hrs

UNIT V:
Fuzzy numbers, arithmetic operation on intervals and on fuzzy sets, lattice of fuzzy numbers, fuzzy equations, fuzzy relations, projections and cylendric extensions, binary fuzzy relations, fuzzy equivalence, compatibility and ordering relations, fuzzy morphism

06Hrs

UNIT VI:
Fuzzy controllers, Defuzzification Methods , Fuzzy Inference Techniques, applications of fuzzy logic in pattern recognition and image processing

06Hrs

Text books:				
1	Fuzzy sets and Fuzzy logic	1995	by George Klir, Bo Yuan	PHI
2	Elements of Artificial Neural Network	1997	K. Mehrotra	MIT Cognet

Reference books:				
1	Neural Networks, a comprehensive foundation	1999	By Simon Haykins	PHI
2	Artificial Neural Networks	2004	By B. Yegnanarayana	PHI
3	Fuzzy Logic & Applications	2003	J. Ross, TMH/Mc	Mc Graw Hill
4	Neural Networks, Fuzzy logic and Genetic Algorithms, Synthesis and applications	2003	By S. Rajsekharan, Vijayalaxmi Pai	PHI Timothy Ross

8th Semester

ET1423	Lab. : PE V: Fuzzy Logic & Neural Network	L = 0	T = 0	P = 2	Credits = 1

Course Objective	Course Outcome
Students should be able to 1. Acquaint student with various computing algorithms in FLNN using software tools. 2. Understand operation of basic elements in fuzzy logic and neural network through simulation. 3. Learn development of algorithms to solve real life applications.	Students will be able to 1. Demonstrate basic concepts fuzzy logic and neural network through simulation. 2. Develop the logic given in problem statement using algorithms in NN and basics of toolbox studied. 3. Develop the logic given in problem statement using operations in fuzzy logic and basics of toolbox studied. 4. Develop real life applications using NN and Fuzzy Logic.

Sr. No.	Experiments based on
1.	Learning Rules and Activation functions in NN
2.	MP Neuron, Hebb Neuron
3.	Perceptron/ LMS/Adaline
4.	Backpropogation Algorithm
5.	Unsupervised Learning:
6.	Fuzzy sets and representation of fuzzy sets
7.	Fuzzy numbers
8.	Arithmetic operation on fuzzy sets
9.	Fuzzy Relations
10.	Fuzzy Controller
11.	Application Development using NN and Fuzzy Logic

8th Semester

ET1424	PE V : R.F. Circuit Design	L= 3	T = 0	P = 0	Credits = 3

Course Objective	Course Outcome
Students should be able to 1. Learn fundamentals of RF circuits. 2. Understand the use of HF component in design the RF circuit. 3. Study the bandwidth estimation techniques. 4. Learn the design of high frequency amplifier 5. Understand the concept of CMOS technology in RF circuits. 6. Study the PLL, phase detector principle at high frequency.	Students will be able to 1. Apply the fundamentals for design of RF circuits. 2. Analyze the HF circuit design and its behavior. 3. Compare the behavior of series and parallel RLC circuit at HF. 4. Distinguish the different bandwidth estimation techniques. 5. Apply the knowledge of CMOS technology for design of supply independent bias circuit. 6. Compare the power amplifier parameters with HF amplifier.

UNIT I :
Introduction, History of wireless Communication, Noncellular wireless Applications, Shannon , Modulations, Propagation, Parallel RLC Tank Circuit, Series RLC Circuit , RLC Network as Impedance Transformer ,Skin Effect, Resistor, Capactor, Inductor, Transformer

06Hrs

UNIT II :
MOSFET Physics, MOS Device Physics in Short Channel Regime , Other Effects, Link Between Lumped and Distributed Regime ,Driving Point impedance at iterated structures , Transmission line , Behavior of finite length Transmission line, Artificial lines

06Hrs

UNIT III :
Review of Smith Chart and S- Parameter, Bandwidth Estimation Techniques , Rise time , Delay , Open Circuit Time Constant , Short Circuit Time constant

06Hrs

UNIT IV :
Introduction to High Frequency Amplifier Design, Zeros as Bandwidth Enhancer , The shunt series Amplifier, Tuned Amplifiers, Neutralization and Unilateralization Cascaded Amplifiers, AM-PM Conversion

06Hrs

UNIT V:
Introduction to Voltage references and Biasing, Review of Diode Behavior, Diodes and Bipolar transistors in CMOS Technology Supply independent bias circuits, Band gap Voltage References, Amplifier linearity, Noise and Noise Figure analysis, Introduction to Mixers

06Hrs

UNIT VI:
Introduction to RF Power Amplifiers, Classification of Power Amplifiers, Modulation of Power Amplifiers, Introduction to Phase lock loops , Linear zed PLL Model, Phase Detector, Sequential Phase Detector, Loop Filters and Charge Pumps

06Hrs

Text books:				
1	The Design of CMOS Radio-Frequency Integrated Circuits	Second Edition	by Thomas H. Lee	The Design of CMOS Radio-Frequency Integrated Circuits
2	RF Circuit Design Theory and Applications		R. Ludwig & P. Bretchko	RF Circuit Design Theory and Applications
Reference books:				
1	Analysis and Design of Analog Integrated Circuits		By Paul R. Gray	Razavi

8th Semester

ET1425	Lab. : PE V: R.F. Circuit Design	L = 0	T = 0	P = 2	Credits = 1

Course Objective	Course Outcomes
Students should be able to 1. Understand the concept of RF circuit behavior at different HF. 2. Learn various bandwidth estimation techniques 3. Study various plots to analyze results of HF circuits. 4. Study amplifier design and its analysis.	Students will be able to 1. Design and simulate the circuit at different frequency levels 2. Analyze different output at various plots 3. Reduce the power requirement and bandwidth of HF circuits. 4. Apply the different concept for designing of HF amplifiers.

Sr. No.	Experiments based on
1	Importing the data files
2	Series RLC circuit
3	Parallel RLC circuit
4	High frequency amplifier design
5	High frequency filters design
6	RF Tuned Amplifier
7	RF Oscillator
8	RF Crystal Oscillator
9	IF Amplifier
10	RF Mixer

8th Semester

ET1426	PE V : Multimedia Communications	L= 3	T = 0	P = 0	Credits = 3

Course Objective	Course Outcome
Students should be able to 1. Learn the basics of image data types, file formats and color models used for image and video. 2. Understand various Fundamental concepts in video and audio 3. Get acquainted with various algorithms used for multimedia data compression 4. Understand basic concepts of video compression 5. Learn basic concepts of multimedia communication networks. 6. Understand basic concepts of Content-Based Retrieval in Digital Libraries	Students will be able to 1. Compare different color models and file formats used for video and audio. 2. Analyze and compare digital/ analog video signal and quantization techniques for digital audio signals. 3. Compare different compression scheme used for image. 4. Compare different compression standards used for video. 5. Describe the multimedia networks communication protocols. 6. Comprehend different steps used in content based image retrieval.

UNIT I :
Fundamental concepts in Text and Image: Multimedia and hypermedia, world wide web,overview of multimedia software tools. Graphics and image data representation graphics/image data types, file formats, Color in image and video: color science, color models in images, color models in video

06Hrs

UNIT II :
Fundamental concepts in video and digital audio: Types of video signals, analog video,digital video, digitization of sound, MIDI, quantization and transmission of audio

06Hrs

UNIT III :
Multimedia data compression: Lossless compression algorithm: DCT, Wavelet- Based Coding, Embedded Zerotree of Wavelet Coefficients Set Partitioning in Hierarchical Trees (SPIHT), Basic Audio Compression Techniques

06Hrs

UNIT IV :
Basic Video Compression Techniques: Introduction to video compression, video compression based on motion compensation, search for motion vectors, MPEG, MPEG2, MPEG4

06Hrs

UNIT V:
Multimedia Networks: Basics of Multimedia Networks, Multimedia Network Communications and Applications : Quality of Multimedia Data Transmission, Multimedia over IP, RTCP,RTP,SIP Transport of MPEG-4, Media-on Demand(MOD)

06Hrs

UNIT VI:
Content-Based Retrieval in Digital Libraries C-BIRD— A Case Study ,C-BIRD GUI Color Histogram Color Density Color Layout Texture Layout Search by Illumination Invariance Search by Object Model

06Hrs

Text books:				
1	Fundamentals of Multimedia	2004	Ze-Nian Li , Mark S Drew	PHI/Pearson Education
2	Multimedia Applications	2004	Steinmetz, Nahrst	Springer
Reference books:				
1	Multimedia Communications: Applications, Networks, Protocols and Standards	2001	Fred Halsall	Addison-Wesley

8th Semester

ET1427	Lab. : PE V: Multimedia Communications	L = 0	T = 0	P = 2	Credits = 1

Course Objective	**Course Outcomes**
Students should be able to 1. Study different color models. 2. Understand transmission of audio using Delta and ADPC modulation technique 3. Understand the concept of dithering. 4. Learn the SPIHT and EZW algorithm. 5. Understand different steps of DCT compression. 6. Study the concept of motion vector.	Students will be able to 1. Write program MALTLAB to implement the concept of multimedia. 2. Implement SPIHT, EZW algorithm for image compression technique. 3. Implement DCT for image compression technique. 4. Utilize the concept of motion vector for video compression.

Sr. No.	Experiments based on
1.	Convert given image from one color model to another using inbuilt MATLAB functions and conversion formulae
2.	Write MATLAB program to implement delta modulation and ADPCM
3.	Write MATLAB program to implement DCT image compression scheme and find Root Mean Square Error for different quantization level.
4.	Write MATLAB program to convert given image to its dithered version using 2X2 dithered matrix**.**
5.	Write MATLAB program to implement EZW encoder on given 4X4 matrix of Wavelet coefficient.
6.	Write MATLAB program to decode output of EZW encoder and generate the matrix of Wavelet coefficient.
7.	Write MATLAB program to implement SPIHT encoder on given 4X4 matrix of Wavelet coefficient.
8.	Write MATLAB program to decode output of SPIHT encoder and generate the matrix of wavelet coefficient.
9.	Write MATLAB program to play video file and display any two frames from video.
10.	Write MATLAB program to obtain motion vector using Sequential Search Method.

8th Semester

ET1435	PE V : Advances in Communication	L= 3	T = 0	P = 0	Credits = 3

Course Objective	Course Outcome
Students should be able to 1. The fundamental principles of advanced communication system. 2. To introduce fundamentals functions of a telecom switching and digital subscriber access. 3. Learn ISDN protocol & architecture. 4. Understand the working principles of digital telephony. 5. Understand the broadband communication. 6. Understand Basic Probability & Random variables.	Students will be able to 1. Understand the working principles of digital telephony. 2. Apply his knowledge of switching technologies. 3. Apply his knowledge of ISDN protocol & SONET 4. Model digital subscriber & wireless local loop. 5. Apply the concept of random variables to characterize the signal behavior in communication. 6. Apply the concept of density function to analyze the performance of communication system.

UNIT-1:

Telephony Background

An overview of telephone networks, transmission system, switching system, Signaling, echo cancellation, working principles of telephone, DC (pulse) and DTMF (tone) signaling Traffic analysis Traffic characterization, loss systems, network blocking probabilities, delay systems

06 Hrs

UNIT-2:

Digital switching and networks

Space division switching, time division switching, time space time (TST) switch, space time space (STS) switch, comparison of TST and STS switches, network synchronization, control and management, timing, timing inaccuracies, network synchronization, network control, Network management

06 Hrs

UNIT-3:

ISDN protocol & SONET

Integrated service digital network (ISDN) ISDN overview, ISDN interfaces and functions, user network interface, ISDN protocol architecture, ISDN physical layer: basic user -network interface, primary rate user- network interface, U interface. SONET/SDH: SONET Multiplexing Overview, SONET Frame Formats, SONET Operations

06 Hrs

UNIT-4:

Broadband Communication

ISDN data link layer: LPAD protocol, terminal adaptation, bearer channel data link control, ISDN network layer: basic call control, control of supplementary services,Broadband ISDN (B - ISDN)-Architecture , Protocols Digital subscriber loop (DSL)-ADSL, HDSL, VDSL, Fiber in loop, wireless local loop (WLL)

06 Hrs

UNIT-5:

Basic Probability & Random variables

Introduction, definitions of probability, axioms of probability, Conditional probability, Total probability and Bayes' theorem.

Random variables: Definition, cumulative distribution function (CDF), continuous, discrete and mixed random variables, probability density function (pdf), probability mass function(PMF),properties of distribution functions, Specific random variables: Gaussian, Exponential, Rayleigh, Uniform, Binomial and Poisson distributions

06 Hrs

UNIT-6:

Random processes

Definition, Statistics of stochastic processes, mean, autocorrelation and autocovariance, independent process, Stationary and ergodic processes: strict-sense stationary, wide-sense stationary random processes, transmission of random process through a linear filter - relationship between input and output processes, power spectral density (PSD) - definition and properties, cross spectral densities, Gaussian random process – properties.

06 Hrs

8th Semester

ET1435	**PE V : Advances in Communication**	L= 3	T = 0	P = 0	Credits = 3

Text books:				
6.	Digital Telephony		JOHN BELLAMY	Wiley Series
7.	Probability, Random Variables and Stochastic Processes		Papoulis, S. U. Pillai,	Tata McGraw Hill
Reference books:				
1	Telecommunication Switching and Networks		Thiagrajan Viswanathan	PHI Publication
2	ISDN and Broadband ISDN with Frame Relay and ATM	4th Edition	William Stalling	Pearson education Asia publication
3	Probability and Random Process for Electrical Engineers		A L Garcia	1. Pearson Education

8th Semester

ET1436	Lab. : PE V: Advances in Communication	L = 0	T = 0	P = 2	Credits = 1

Course Objective	Course Outcomes
Students should be able to 1. Understand the basics of communication system. 2. Verify the working of ISDN protocol and digital telephony. 3. Understand the concept a telecomm switching and digital subscriber access. 4. Understand the Basics of Probability & Random Process to analyze the communication system.	Students will be able to 1. Apply the concept of digital telephony to understand the telecommunication system. 2. Understand the switching network. 3. Apply his knowledge of ISDN protocol & SONET in communication field. 4. Understand and compare different distribution techniques of random variable.

Sr. No.	Experiments based on
1.	Study of DTMF signaling
2.	Study of ISDN protocol
3.	Study of Digital subscriber loop
4.	Study of wireless local loop (WLL).
5.	Study of cumulative distribution function (CDF)
6.	Study of probability density function (pdf)
7.	Study of Binomial and Poisson distributions
8.	Study of power spectral density in AWGN channel
9.	Study of Gaussian random communication system'

8th Semester

ET1428	Project Phase-II C	L = 0	T = 0	P = 8	Credits = 8

Course Objectives
1. Work on the defined problem. 2. Define and prepare road map to get a desired output. 3. Gain knowledge about the project. 4. Improve the communication skills and stage daring through effective presentation. 5. Write effective reports and design documentation.

Course Outcome
1. Identify, formulate and analyze complex engineering problems. 2. Apply knowledge to assess health, social, safety and environmental issues. 3. Deal with multidisciplinary and industry based projects. 4. Communicate technical information by means of written reports and presentations.

8th Semester

ET1429	Comprehensive Viva-Voce	L = 0	T = 0	P = 0	Credits = 3

Course Objectives
To prepare the students for various competitive exams and personal interviews

Course Outcome
The students will be able to demonstrate their technical knowledge which they have learnt throughout the program.

8th Semester

ET1430	Extra/ Co-Curricular Activities	L = 0	T = 0	P = 0	Credits = 2

Course Objectives
To develop the students personality to face the challenges in life.

Course Outcome
The students will be able to demonstrate their technical knowledge which they have learnt throughout the program.