TITLE OF THE SUBJECT						
Subject Code	**ADVANCED DIGITAL COMMUNICATION TECHNIQUES**	L	T	P	C	QP
MECPC 1010		3	1	0	4	

Pre-Requisites : Analog communications ,Digital communications ,Signals and systems

Course Educational Objectives

CEO1	To prepare mathematical background for communication signal analysis.
CEO2	To understand and analyze the signal flow in a digital communication system.
CEO3	To analyze error performance of a digital communication system in presence of noise .
CEO4	To understand concept of spread spectrum communication system.

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Employing various spread spectrum techniques in digital communication systems.
CO2	Classifythe multicarrier and multichannel systems.
CO3	Formulate different modulation schemes for digital communication system.
CO4	Justify the practical implementation of various Digital Modulation techniques.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3													
CO2	3	-													
CO3	3	2													
CO4	2	3													
Avg.	2.75	2.66													

SYLLABUS

Unit:1 (8hrs)

COHERENT AND NON-COHERENT COMMUNICATION

Coherent receivers – Optimum receivers in WGN – IQ modulation & demodulation – Noncoherent receivers in random phase channels; MFSK receivers – Rayleigh and Rician channels – Partially coherent receivers – DPSK; M-PSK; M-DPSK--BER Performance Analysis. Carrier Synchronization- Bit synchronization

Unit:2 (12hrs)

Carrier and Symbol Synchronization

Signal Parameter Estimation; TheLikelyhood Function, Carrier Recovery and Symbol Synchronization in Signal Demodulation. Carrier Phase Estimation; Maximum Likelyhood Carrier Phase Estimation, The Phase-Locked Loop, Effect of Additive Noise in the Phase Estimate. Symbol Timing Estimation; Maximum Likelyhood Timing Estimation.

[Proakis&Salehi Sections 5.1-1, 5.1-2, 5.2-1, 5.2-2,5.2-3]

Unit:3 (10hrs)
Digital Communication Through Band-Limited Channels

Characterization of Band-Limited Channels. Signal Design for Band-Limited Channels; Design of Band-Limited Signals for No Intersymbol Interference-The Nyquist Criterion, Optimum Maximum-Likelihood Receiver. [Proakis&Salehi Sections 9.1, 9.2-1, 9.3-1]

Unit:4 (10 hrs)
Spread Spectrum Signals for Digital Communication

Model of Spread spectrum Digital Communication System. Direct Sequence Spread Spectrum Signals; Error Rate Performance of the Decoder, Some Applications of DS Spread Spectrum Signals. Frequency-Hopped Spread-Spectrum Signals; Performance of FH Spread Spectrum Signals in an AWGN Channel, A CDMA System Based on FH Spread Spectrum Signals. [Proakis&Salehi Section 12.1]

Teaching Method(s): Chalk & Board/ PPT/Video Lectures/ MOOC/ Internship/Industry Guest Lecture/ Invited Guest lecture/ Demonstration. etc.(can be chosen one or many)

Text Books

1. John G. Proakis and MasoudSalehi, ***Digital Communication***, McGraw-Hill, 5th Edition John G. Proakis., 'Digital Communication', 4 th edition, McGraw Hill Publication, 2001

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

Reference Books

1. Simon Haykin, ***Digital Communication***, Willy

2. Tube & Schilling, ***Principle of Communication***, PHI

TITLE OF THE SUBJECT						
Subject Code	**INFORMATION THEORY & CODING**	L	T	P	C	QP
MECPC 1020		3	1	0	4	

Pre-Requisites : Probability and Random Processes, Digital Communications

Course Educational Objectives	
CEO1	To enhance knowledge of probabilities, entropy, measures of information.
CEO2	To understand information theory, the fundamentals of error control coding techniques and their applications, and basic cryptography.
CEO3	To Understand Encoding And Decoding Of Digital Data Streams.
CEO4	To understand the Compression And Decompression Techniques.

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Design the channel performance using Information theory.
CO2	Comprehend various error control code properties
CO3	Apply linear block codes for error detection and correction
CO4	Design BCH & RS codes for Channel performance improvement against burst errors.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	3													
CO2	2	2													
CO3	3	3													
CO4	2	3													
Avg.	2.25	2.75													

SYLLABUS

Unit:1 (10 hrs)

Information,uncertainty of information, Informationrate,Entropy,classificationofcodes, KraftMcMillaninequality,Sourcecodingtheorem,Shannon-Fanocoding,Huffmancoding, ExtendedHuffmancoding-Jointandconditionalentropies,Mutualinformation-

Discrete memoryless channels, run length encoding, rate distortion function, JPEG and MPEG standards in image compression. Channel Capacity and Coding Channel models, Channel Capacity, Channel Coding, Information Capacity Theorem, The Shannon Limit

Unit:2 (14hrs)

Error Control Coding

Linear Block Codes: Introduction, Basic definition, equivalent codes, parity - check matrix, decoding, syndrome decoding, Perfect Codes, Hamming Codes, Optimal Linear codes.

Cyclic Codes

Introduction polynomials, The division Algorithm, Method for generating cyclic codes, Burst Error correction, Fire Codes, Golay Codes, CRC Codes, Circuit implementation.

Bose ChaudhuriHocquenghem (BCH)

Introduction, Primitive elements, minimum polynomials, Examples of BCH codes, Decoding of BCH codes, Reed - Solomon codes.

Unit:3 (10 hrs)
Convolution Codes

Introduction, Tree Codes and Trellis Codes, Polynomial description, The Generating function, Matrix Description, Viterbi Decoding, Distance bounds, Turbo Codes, Turbo Decoding.

Trellis Coded Modulation (TCM)

Introduction, the concept of coded modulation, Mapping by set Partitioning, Design rules, TCM Decoder.

Unit:4 (6 hrs)

Coding for Secure Communication, Cryptography

Introduction, encryption techniques, Symmetric cryptography, data encryption standard, Asymmetric Algorithm the RSA Algorithm.

Teaching Method(s): Chalk & Board/ PPT/Video Lectures/ MOOC/ Internship/Industry Guest Lecture/ Invited Guest lecture/ Demonstration. etc.(can be chosen one or many)

Text Books

1. John G. Proakis and MasoudSalehi, ***Digital Communication***, McGraw-Hill, 5th Edition John G. Proakis., 'Digital Communication', 4 th edition, McGraw Hill Publication, 2001

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

Reference Books

1. Simon Haykin, ***Digital Communication***, Willy

2. Tube & Schilling, ***Principle of Communication***, PHI

TITLE OF THE SUBJECT						
Subject Code	**PRINCIPLES OF INTERNET OF THINGS**	L	T	P	C	QP
MECPC1030		3	1	0	4	

Pre-Requisites : Computer architecture ,Internet & computer networking.

Course Educational Objectives	
CEO1	To Understand the Architectural Overview of IoT
CEO2	To Understand the IoT Reference Architecture and Real World Design Constraints
CEO3	To Understand the various IoT Protocols .

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Use tools such as compilers for IoT development board using inertial sensors, system-level simulators and web-authoring tools for the final report.
CO2	Test the practical parameters involved in the specification, design and implementation of an IoT system
CO3	Create numerous IOT based prototypes.
CO4	Support other team member with complimentary skill sets, and develop skills in project management, requirements capture and negotiations.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2													
CO2	2	3													
CO3	3	2													
CO4	2	1													
Avg.	2.25	1.75													

SYLLABUS

Unit:1 (8hrs)

Introduction to Internet of Things:Introduction-Definition & Characteristics of IoT , Physical Design of IoT- Things in IoT , IoT Protocols, Logical Design of IoT- IoT Functional Blocks, IoT Communication Models, IoTCommunication APIs , IoT Enabling Technologies- Wireless Sensor Networks , Cloud Computing, Big DataAnalytics , Communication Protocols , Embedded Systems, IoT Levels & Deployment Templates.

Unit:2 (12hrs) Domain Specific IoTs: Home Automation: Smart Lighting, Smart Appliances, Intrusion Detection, Smoke/Gas Detectors, Cities-SmartParking, Smart Lighting, Smart Roads, Structural Health Monitoring, Surveillance, Emergency Response, Environment-Weather Monitoring, Air Pollution Monitoring, NoisePollution Monitoring, Forest Fire Detection, River Floods Detection, Energy- Smart Grids, Renewable Energy Systems, Prognostics, Retail-Inventory Management, Smart Payments, Smart Vending MachinesLogistics-Route Generation & Scheduling, FleetTracking, Shipment Monitoring, Remote Vehicle Diagnostics, Agriculture-Smart Irrigation, Green House Control,Industry - Machine Diagnosis & Prognosis Indoor Air Quality Monitoring,Health& Lifestyle -Health

&FitnessMonitoring, WearableElectronicsIoT and M2M Introduction, M2M-Difference between IoT and M2M, SDN and NFV for IoT-Software Defined Networking, Network Function Virtualization

Unit:3 (10hrs)

IoT Platforms Design Methodology ,IoT Design Methodology-Purpose & Requirements Specification ,Process Specification, Domain Model Specification, Information Model Specification , Service Specifications , IoT Level Specification, Functional View Specification ,Operational View Specification , Device & Component Integration , Application Developmnt, Case Study on IoT System for Weather Monitoring, Motivation for Using Python IoT Physical Devices & Endpoints What is an IoT Device-Basic building blocks of an IoTDevice,Exemplary Device: Raspberry Pi, About the Board, Linux on Raspberry Pi , Raspberry Pi Interfaces –Serial, SPI , I2C , Programming Raspberry Pi with Python-Controlling LED with Raspberry Pi , Interfacing an LED and Switch with Raspberry Pi ,Interfacing a Light Sensor (LDR) with RaspberryPi , Other IoT Devices-pcDuino, Beagle Bone Black , Cubieboard

Unit:4 (7 hrs)

IoT&Beyond :Use of Big Data and Visualization in IoT, Industry4.0 Concepts. Overview of RFID, Low-power design (Bluetooth Low Energy), range extension techniques (data mining and mesh networking), and data-intensive IoT for continuous recognition applications. Overview of Android / IOS App Development tools &Internet Of Everything

Teaching Method(s): Chalk & Board/ PPT/Video Lectures/ MOOC/ Internship/Industry Guest Lecture/ Invited Guest lecture/ Demonstration. etc.(can be chosen one or many)

Text Books

1 .Internet of Things, A Hands on Approach [ArshdeepBahga& Vijay Maudisetti, University Press.]

2. Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence [Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos, David Boyle, 1st Edition, Academic Press, 2014]

3. Rethinking the Internet of Things: A Scalable Approach to Connecting Everything,[Francis daCosta, 1st Edition, Apress Publications, 2013]

Reference Books

1.Getting Started with the Internet of Things [CunoPfisher, Maker Media, Inc,(O'Reilly)]The Internet of Things, [Michael Millen, Pearson]

TITLE OF THE SUBJECT						
Subject Code	**Advance VLSI Technology**	L	T	P	C	QP
MECPE1041		3	0	0	3	

Pre-Requisites : Digital logic circuits & fundamentals of VLSI design

Course Educational Objectives	
CEO1	To understand about the digital design in the context of VLSI technology.
CEO2	To understand the design of testable and low power digital VLSI systems.
CEO3	VLSI design and layout tools using state-of-the-art facilities.

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Implement FPGA based synthesis.
CO2	Analyze complex microelectronics circuits and their performance issue in systems.
CO3	Design layout and schematics related with various CMOS based application.
CO4	Appraise Prototype development and simulation using HDL

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	3		3											
CO2	3	2		3											
CO3	2	2		2											
CO4	2	3		3											
Avg.	2.25	2.5		2.75											

SYLLABUS

Unit:1 (8hrs)

Environment for VLSI Technology:

Clean room and safety requirements. Wafer cleaning processes and wet chemical etching techniques

Impurity incorporation: Solid State diffusion modeling and technology; Ion Implantation modeling, technology and damage annealing; characterization of Impurity profiles.

Unit:2 (8hrs)

Oxidation:

Kinetics of Silicon dioxide growth both for thick, thin and ultrathin films.Oxidation Technologies in VLSI and ULSI; Characterization of oxide films; High k and low k dielectrics for ULSI.

Lithography:

Photolithography, E-beam lithography and newer lithography techniques for VLSI/ULSI;Mask generation.

Unit:3 (10hrs)
Chemical Vapour Deposition techniques:

CVD techniques for deposition of polysilicon, silicon dioxide, silicon nitride and metal films; Epitaxial growth of silicon; modeling and technology.

Metal film deposition:

Evaporation and sputtering techniques. Failure mechanisms in metal Interconnects; Multi-level metallization schemes.

Unit - 4 **(10 Hours)**

Plasma and Rapid Thermal Processing:

PECVD, Plasma etching and RIE techniques; RTP techniques for annealing, growth and deposition of various films for use in ULSI.

Process integrationfor NMOS, CMOS and Bipolar circuits; Advanced MOS technology

Teaching Method(s): Chalk & Board/ PPT/Video Lectures/ MOOC/ Internship/Industry Guest Lecture/ Invited Guest lecture/ Demonstration. etc. (can be chosen one or many)

Text Books

1. S.M.Sze (Ed), "VLSI Technology", 2nd Edition, McGraw-Hill, 1988.Streetman," VLSI Technology".
2. C.Y. Chang and S.M. Sze (Ed), "ULSI Technology", McGraw-Hill Companies Inc., 1996.
3. S.K.Gandhi, "VLSI fabrication Principles",John Wiley Inc., New York, 1983. .
4. VLSI Fabrication Technology ,B.Raj& Singh , Laxmi Publications .Sorab K. Gandhi, "The Theory and Practice of Microelectronics", JohnWiley& Sons

Reference Books

1. B.G Streetman, "VLSI Technology", Prentice Hall, 1990.
2. A.S Grove, "Physics and Technology of semiconductor devices", John Wiley & Sons

TITLE OF THE SUBJECT

Subject Code	RF Solid State Devices	L	T	P	C	QP
MECPE1042		3	0	0	3	

Pre-Requisites : Semiconductor **Device** Fundamentals

Course Educational Objectives	
CEO1	To design and analyze basic of different semiconductor devices.
CEO2	To study the operation and device characteristics of RF components.
CEO3	To design and analyze RF transistor amplifier.
CEO4	To understand the operation of Oscillators and mixers used in RF design .

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Employ the solid-state device capabilities on electronic circuit performance.
CO2	Compare the basic physics of electrons in solids & carriers and carrier transport in semiconductors.
CO3	Organize the elements of p-n junctions and silicon MOSFETs.
CO4	Evaluate the working concepts of RF active components.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	3		3											
CO2	3	2		2											
CO3	3	2		3											
CO4	2	2		2											
Avg.	2.5	2.25		2.5											

SYLLABUS

Unit:1 (8hrs)

Semiconductor Concept, Energy Bands & Current Carriers in Semiconductors, Semiconductor operation ,Intrinsic & Extrinsic Semiconductor, Junctions, Carrier Process, Drift Diffusion, Generation and Recombination.

Unit:2 (10hrs)

Microwave Transistor, Transistor Operation, Transistor biasing, Diodes, Different type of Diodes, Tunnel Diode, Microwave Field Effect Transistor, FET operation , FET Biasing .

Unit:3 (10hrs)

Fundamentals of transferred Electron Devices, Concept of transit time device, Avalanche Transit Time Devices, Operation of transferred Electron Device, Operation of transferred Electron Device.

Unit:4 (8hrs)

Optoelectronics, LED, LED operation, Laser, Operation of LASER, Photo detector, Solar Cell, Operation of Solar cell. Different applications of Solar Cell

Teaching Method(s): Chalk & Board/ PPT/Video Lectures/ MOOC/ Internship/Industry Guest Lecture/ Invited Guest lecture/ Demonstration. etc.(can be chosen one or many)

Text Books

1.SemiconductorDevices,ByKanaan Kano, Pearson

2.Solid State Electronic Devices, By B G Streetman & S Banerjee , Pearson

Reference Books

1. Semiconductor Physics &Devices,By D A Neamen, Tata McGraw Hill

TITLE OF THE SUBJECT

Subject Code	**MICROWAVE SIGNALPROCESSING**	L	T	P	C	QP
MECPE1043		3	0	0	3	

Pre-Requisites : Signal & systems

Course Educational Objectives	
CEO1	To understand the multi rate signals & different filters.
CEO2	To analyze the different error correction methods.
CEO3	To design the different filters.

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Understanding of Multirate Digital Signal Processing& its concepts.
CO2	Understanding of the power spectrum estimation and error prediction.
CO3	Understanding of Adaptive Signal Processing through Least Mean Square Algorithm, Recursive Least Square Algorithm, etc.
CO4	Design of different type of filters & their application .

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3		3											
CO2	2	2		3											
CO3	3	2		2											
CO4	2	2		3											
Avg.	2.5	2.25		2.75											

SYLLABUS

Unit:1 (8hrs)

MultiRate Digital Signal Processing: Introduction, Decimation by a Factor D, Interpolation by a FactorI, Sampling Rate Conversion by Rational Factor I/D, Filter Design and Implementation for Sampling Rate, Multistage Implementation of Sampling Rate Conversion, Sampling Rate Conversion of Band Pass Signal, Application of Multi Rate Signal Processing: Design of Phase Shifters, Implementation of Narrowband Low Pass Filters. Implementation of Digital Filter Banks. Filter Bank and Sub band Filter Applications.

Unit:2 (15hrs)

Linear Prediction and Optimum Linear Filters: Innovations Representation of a Stationary Random Process, Forward and Backward Linear Prediction, Solution of the Normal Equations, Properties of the Linear Prediction Error Filters, AR Lattice and ARMA Lattice Ladder Filters, Wiener Filter for Filtering and
Prediction: FIR Wiener Filter, Orthogonality Principle in Linear Mean Square Estimation.

Unit:3 (10hrs)

Power Spectrum Estimation: Estimation of Spectra from Finite Duration Observation of Signals, Non Parametric Method for Power Spectrum Estimation: Bartlett Method, Blackman and Turkey Method, Parametric Method for Power Estimation: Yuke Walker Method, Burg Method, MA Model and ARMA Model. Higher Order Statics (HOS): Moments, Cumulants, Blind Parameters and Order Estimation of MA & ARMA Systems Application of Higher

Order Statistics.

Unit:4 (7 hrs)

Adaptive Signal Processing: Least Mean Square Algorithm, Recursive Least Square Algorithm, Variants of LMS Algorithm: SK LMS, N LMS, FX LMS. Adaptive FIR & IIR Filters, Application of Adaptive SignalProcessing: System Identification, Channel Equalization, Adaptive Noise Cancellation, Adaptive Line Enhancer.

Teaching Method(s): Chalk & Board/ PPT/Video Lectures/ MOOC/ Internship/Industry Guest Lecture/ Invited Guest lecture/ Demonstration. etc.(can be chosen one or many)

Text Books

1. Digital Signal Processing, ByJ.G. Proakis and D.G. Manolakis,Pearson
2. Adaptive Signal Processing,By B. Widrow and Stern, PHI

Reference Books

1. Adaptive Filter,BySimonHaykins, PHI.

TITLE OF THE SUBJECT

Subject Code	OPTICAL NETWORKS & PHOTONICS	L	T	P	C	QP
MECPE1044		3	0	0	3	

Pre-Requisites : Basic knowledge in Optical fiber fundamentals and communication

Course Educational Objectives	
CEO1	To understand Various components of optical networks
CEO2	To know about the Various photonic switches
CEO3	To understand Network management and access networks
CEO4	To understand Multiplexing techniques and fiber characteristics

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Learn the principles of optical sources and amplifiers used in optical communications.
CO2	Analyze optical systems for performance and utility.
CO3	Critically review and summarize modern topics in optical communications.
CO4	To be able to design optical networks, taking both physical transmission properties and optical networking .

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2		3											
CO2	3	3		3											
CO3	3	2		3											
CO4	2	3		2											
Avg.	2.75	2.5		2.75											

SYLLABUS

UNIT – 1 **(8 HOURS)**

Optical Networking Principles

Role of the Optical Networking Optical Network Structure WDM as a foundation of Optical Networking Principles of Multilayer Networks

Enabling Technologies for Optical Networks

Light Transmission in Optical Fibers Signal Impairments Along the Light path Optical Transmitters and Modulators Optical Receivers

UNIT – 2 **(10 HOURS)**

Optical Amplifiers Optical Switching Elements, Optical Networks Design, Core Optical Networks Metro Optical networks Access Optical Networks Wavelength Routing and Assignment Traffic Grooming and Protection Multilayer Network Structure

UNIT – 3 **(10 HOURS)**

Optical Devices for design ROADM and PXC design

Wavelength Agile Devices Wavelength Convertors,Optical Network Management and Routing Principles , Functions of Network Control and Management Impairment Aware Routing Optical Circuit Switching Optical Packet Switching Optical Burst Switching ,Energy Awareness in Optical Networking Network Modeling Tools Network Design Guidelines

UNIT – 4 **(8 HOURS)**

Advanced Techniques and Devices for Optical Networking

Techniques for Space and Spectral Signal Processing –MIMO and OFDM Elastic Modulation Coding as a Networking Tool

Teaching Method(s): Chalk & Board/ PPT/Video Lectures/ MOOC/ Internship/Industry Guest Lecture/ Invited Guest lecture/ Demonstration. etc.(can be chosen one or many)

Textbooks:

1. Cvijetic, M., Djordjevic. I. B.: Advanced Optical Communication Systems and Networks, Artech House 2012
2. 1. Fiber-Optic Communication System by Govind P. Agrawal

Reference Book :

1. Franz and Jain, " Optical communication system ", Narosa Publications, New Delhi, 1995

TITLE OF THE SUBJECT

Subject Code	**MICROSTRIP COMPONENTS & CIRCUITS**	L	T	P	C	QP
MECPE1051		3	0	0	3	

Pre-Requisites : Microwave devices and Circuits

Course Educational Objectives	
CEO1	To understand the concept of microstrip line and its interpretation in the analysis and design of microstrip line
CEO2	To analyze the non-reciprocal components, active devices, High Power and Low Power Circuits.
CEO3	To understand about the different Microwave Networks .
CEO4	

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Use of Microstrip antennas & losses in Microstrip line.
CO2	Differentiate different type of filters.
CO3	Design of Power divider & combiners.
CO4	Measure the losses for different components.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3		3											
CO2	3	3		2											
CO3	2	2		3											
CO4	3	2		3											
Avg.	2.75	2.5		2.75											

SYLLABUS

Unit:1 **(8hrs)**

Basics of Microstrip Patch Antenna, Operation of Patch Antenna, Fringing Effect, Introduction to Microstrip Line ,Methods of Microstrip analysis, Losses in Microstrip Line

Unit:2 **(8hrs)**

Transmission line model for patch antenna, Cavity model for Microstrip patch antenna ,Slot line and Coplanar Waveguide, Coupled Microstrip and Directional Coupler, S matrix for Directional Coupler

Unit:3 **(10hrs)**

Branch line coupler Impedance transformers, Filters, Different type of Filters Lumped components, Derivation of the expressions for filters, Application of filters

Unit:4 **(8 hrs)**

Power dividers and combiners, Circulators, S-Matrix calculation , Properties of S-Matrix, Introduction to HFSS and CST , Basic Design of microstrip component using HFSS and CST

Teaching Method(s): Chalk & Board/ PPT/Video Lectures/ MOOC/ Internship/Industry Guest Lecture/ Invited Guest lecture/ Demonstration. etc.(can be chosen one or many)

Text Books

1. Microwave engineering using Microstrip Circuits, By Fooks and Zakarevicius, Prentice Hall

2.Microstrip lines and slotlines, ByGupta,Garg,Bahl and Bhartia, Artech House

Reference Book

1. Foundations for Microstrip Circuit Design, By T. C. Edwards, Wiley & Sons

TITLE OF THE SUBJECT						
Subject Code	**COMPUTATIONAL INTELLIGENCE**	L	T	P	C	QP
MECPE1052		3	0	0	3	

Pre-Requisites: Discrete Mathematics, Software Engineering

Course Educational Objectives	
CEO1	Basic knowledge representation, problem solving, and learning methods of Artificial Intelligence
CEO2	Develop intelligent systems by assembling solutions to concrete computational problems
CEO3	Understand the role of knowledge representation, problem solving, and learning in intelligent-system engineering
CEO4	Develop an interest in the field sufficient to take more advanced subjects

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	To understand the fundamental theory and concepts of neural networks, neuro-modeling, several neural network paradigms and its applications
CO2	To understand the concepts of fuzzy sets, knowledge representation using fuzzy rules, approximate reasoning.
CO3	To understand the basics of an evolutionary computing paradigm known as genetic algorithms and its application to engineering optimization problems.
CO4	To understand fuzzy inference systems, and fuzzy logic control and other machine intelligence applications of fuzzy logic.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3													
CO2	2	3													
CO3	2	2													
CO4	2	2													
Avg.	2.25	2.5													

SYLLABUS

Unit:1 **(10 hrs)**

Introduction to Soft Computing: Soft computing constituents and conventional Artificial Intelligence, Neuro-Fuzzy and Soft Computing characteristics.

Fuzzy Sets, Fuzzy Rules and Fuzzy Reasoning: Introduction, Basic definitions and terminology, Set-theoretic operations, MF formulation and parameterization, More on fuzzy union, Intersection and Complement, Extension principle and fuzzy relations, Fuzzy If-Then rules, Fuzzy reasoning.

Fuzzy Interference System: Mamdani fuzzy models, Sugeno fuzzy models, Tsukamoto fuzzy models, Other considerations.

Unit:2 **(10 hrs)**

Least Square Method for System Identification: System Identification, Basic of matrix manipulations and calculus, Least-square estimator, Geometric interpretation of LSE, Recursive least-square estimator, Recursive LSE for time varying systems, Statistical properties and maximum likelihood estimator, LSE for nonlinear models.

Derivative based Optimization: Descent methods, Method of Steepest Descent, Newton's method, Step size determination, Conjugate gradient methods, Analysis of quadratic case, Nonlinear least-square problems, Incorporation of stochastic mechanism.

Unit:3 **(8 hrs)**

Derivative-free Optimization:

Genetic algorithm simulated annealing, Random search, Downhill simplex search.

Adaptive Networks: Architecture, Back propagation for feed forward networks, Extended back propagation for recurrent networks, Hybrid learning rule: combining steepest descent and LSE.

Unit:4 **(7 hrs)**

Supervised Learning Neural Networks: Perceptions, Adaline, Back propagation multilayer perceptions, Radial basis function networks.

Learning from Reinforcement: Failure is the surest path to success, Temporal difference learning, The art of dynamic programming, Adaptive heuristic critic, Q learning, A cost path problem, World modeling, Other network configurations, Reinforcement learning by evolutionary computations.

Teaching Method(s): Chalk & Board/ PPT/Video Lectures/ MOOC/ Internship/Industry Guest Lecture/ Invited Guest lecture/ Demonstration. etc.(can be chosen one or many)

Text Book

1. Neuro-Fuzzy and Soft Computing, - J.S.R. Jng, C.T.Sun and E. Mizutani, PHI

Reference Book

1. Neural Networks, Fuzzy Logic and Genetic Algorithms, S. Rajasekaran, G.A.Vijayalaksmi, PHI.

TITLE OF THE SUBJECT

Subject Code	**Digital Image Processing & Feature Extraction**	L	T	P	C	QP
MECPE1053		3	0	0	3	

Pre-Requisites : Signal processing, MATLAB

Course Educational Objectives	
CEO1	To understand the fundamentals of digital image processing
CEO2	To understand Image enhancement techniques used in digital image processing
CEO3	To understand Image compression and Segmentation used in digital image processing
CEO4	To understand Image transform used in digital image processing

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Apply to current technologies and issues that are specific to image processing systems.
CO2	Know how images are formed, sampled, quantized and represented digitally.
CO3	Compress the Digital image which is required for storage and transmission of digital images.
CO4	Know the principles of image compression, enhancement and restoration and segmentation

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3		3											
CO2	3	3		3											
CO3	2	2		3											
CO4	2	3		3											
Avg.	2.5	2.75		3											

SYLLABUS

Unit:1 **(8hrs)**

Introduction

Digital image, DIP system: components andfunctions, basic imaging process, multi-concept inRS data analysis, Elements of human andcomputer assisted interpretation. Formats of digital imagery, color look up tablesand transformations.

Unit:2 **(10 hrs)**

Preprocessing Of Remotely Sensed Images

Geometric distortions and their correctionSources of image geometry errors, altitude,attitude, scan skew, velocity, earth rotation, mapprojection, sensor mirror sweep, panoramic, andperspective effects.Correction of geometric distortions: model basedcorrection, ground control points, mappingpolynomials, image rectification, geo-referencing,registration, re-sampling, intensity interpolation.Radiometric distortions and their correction ,Sources of radiometric distortion, effect ofatmospheric condition on radiation, atmosphericeffects on remote sensing imagery, correction ofradiometric distortions.

Unit:3 **(10hrs)**

Image Enhancement

Image histogram, point operations and look-uptables, False Color Composite (FCC), Densityslicing, contrast enhancements, histogramequalization, histogram specification.Spatial and frequency filtering, linear and non-linear filters, smoothing, sharpening, High/Lowpass filters.

Edge detection and enhancement:

Edge Detectionoperators (Conventional filters): First derivative,Second derivative, Edge thinning and linking, Color edge detection.

Unit:4 **(8 hrs)**

Image Transformations

Principal component analysis (standardized /unstandardized).Tasseled cap transformation, band ratios andvegetation indices, change detect

Teaching Method(s): Chalk & Board/ PPT/Video Lectures/ MOOC/ Internship/Industry Guest Lecture/ Invited Guest lecture/ Demonstration. etc.(can be chosen one or many)

Text Book

1.Introductory Digital Image Processing: A Remote Sensing Perspective,Jensen, J.R.

Reference Book

1 .An Introduction to Digital ImageProcessing, Niblack, WDigital Image Processing, Pratt, W. K.