REGULATION 2017

COURSE STRUCTURE

SYLLABUS

2 Years M.Tech Degree Programme

ELECTRONICS AND COMMUNICATION ENGINEERING

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

GIET (AUTONOMOUS) GUNUPUR – 765022

(Affiliated to Biju Patnaik University of Technology, Rourkela)

Accredited by NAAC with 'A' Grade with a CGPA of 3.28/4.00

Regulation 2017

CURRICULUM STRUCTURE

SL. NO.	COURSE WORK - SUBJECTS AREA	CREDITS / SEMESTER				TOTAL CREDITS
		I	II	III	IV	
1	Professional Core Courses	12	8	0	0	**20**
2	Professional Elective Courses relevant to chosen specialization / branch	6	9	0	0	**15**
3	Open subjects - Electives from other technical and/or emerging Subjects	0	0	3	0	**3**
4	Project work, Seminar and Internship in industry or elsewhere	0	2	20	22	**44**
5	Laboratories	4	4	0	0	**8**
6	Mandatory Courses [Environmental Sciences, Induction Training, Indian Constitution, Essence of Indian Traditional Knowledge]	0	0	0	0	**0**
	TOTAL	**22**	**23**	**23**	**22**	**90**

SEMESTER WISE COURSE STRUCTURE

I SEMESTER								
S.No	**Course Category**	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**	**QP**
THEORY								
1	PC	MECPC1010	ADVANCED DIGITAL COMMUNICATION TECHNIQUES	3	1	0	4	A
2	PC	MECPC1020	INFORMATION THEORY & CODING	3	1	0	4	A
3	PC	MECPC1030	PRINCIPLES OF INTERNET OF THINGS	3	1	0	4	A
4	PE	MECPE1041	ADVANCED VLSI TECHNOLOGY	3	0	0	3	A
		MECPE1042	RF SOLID STATE DEVICES					
		MECPE1043	MICROWAVE SIGNAL PROCESSING					
		MECPE1044	OPTICAL NETWORKS & PHOTONICS					
5	PE	MECPE1051	MICROSTRIP COMPONENTS & CIRCUIT	3	0	0	3	A
		MECPE1052	COMPUTATIONAL INTELLIGENCE					
		MECPE1053	DIGITAL IMAGE PROCESSING & FEATURE EXTRACTION					
PRACTICAL								
6	ES	MECES1160	COMMUNICATION SYSTEM LABORATORY	0	0	8	4	
TOTAL				**15**	**3**	**8**	**22**	

II SEMESTER								
SL.No	**Course Category**	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**	**QP**
THEORY								
1	PC	MECPC2010	MICROWAVE ENGINEERING & ANTENNA THEORY	3	1	0	4	A
2	PC	MECPC2020	ADVANCED WIRELESS & MOBILE TECHNOLOGY	3	1	0	4	A
3	PE	MECPE2031	ADAPTIVE SIGNAL PROCESSING	3	0	0	3	A
		MECPE2032	ANTENNA DESIGN & SIMULATION					
		MECPE2033	SEMICONDUCTOR DEVICE MODELLING					
4	PE	MECPE2041	ADVANCED DIGITAL SIGNAL PROCESSING	3	0	0	3	A
		MECPE2042	INTERNET & WEB TECHNOLOGY					
		MECPE2043	ADVANCED MICROPROCESSOR & MIRCROCONTROLLER					
5	PE	MECPE2051	NETWORK SECURITY & CRYPTOGRAPHY	3	0	0	3	A
		MECPE2052	RF MEMS FOR WIRELESS COMMUNICATION					
		MECPE2053	ADVANCED ANTENNAS FOR WIRELESS COMMUNICATION					
PRACTICAL								
6	ES	MECES2160	MICROWAVE ENGINEERING LABORATORY	0	0	8	4	
7	ES	MECES2170	SEMINAR I	0	0	4	2	
TOTAL				**15**	**2**	**12**	**23**	

III SEMESTER								
SL.No	**Course Category**	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**	**QP**
THEORY								
1	OE	MECOE3011	HUMAN RESOURCE MANAGEMENT	3	0	0	3	A
		MECOE3012	RESEARCH METHODOLOGY					
		MECOE3013	EMBEDDED SYSTEM DESIGN					
PRACTICAL								
2	ES	MECES3120	SEMINAR II	0	0	4	2	
3	ES	MECES3130	THESIS I	0	0	36	18	
TOTAL				**3**	**0**	**40**	**23**	

IV SEMESTER								
SL.No	**Course Category**	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**	
PRACTICAL								
1	ES	MECES4110	SEMINAR III	0	0	4	2	
2	ES	MECES4120	THESIS II	0	0	36	18	
3	ES	MECES4130	COMPREHENSIVE VIVA VOCE	0	0	4	2	
TOTAL				**0**	**0**	**44**	**22**	

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

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.

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]

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	A

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.

Unit:1 (10 hrs)

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

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	A

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.

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

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	A

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

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

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	A

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.

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

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	A

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 .

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.

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	A

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 .

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

Textbooks:

1. Cvijetic, M., Djordjevic. I. B.: Advanced Optical Communication Systems and Networks, Artech House 2012
2. 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	A

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.

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

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

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	A

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.

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	A

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

Unit:1 **(8hrs)**

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 **Preprocessing Of Remotely Sensed Images** **(10 hrs)**

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 **Image Enhancement** **(10hrs)**

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 **Image Transformations** **(8 hrs)**

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

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.

TITLE OF THE SUBJECT						
Subject Code	**COMMUNICATION SYSTEM LABORATORY**	L	T	P	C	QP
MECES1160		0	0	8	4	

CO1	Know about the different advanced communication systems.
CO2	Apply the underlying principles for up-to-date examples of real world systems.
CO3	Emphasize on modern digital data transmission concepts and optimization of receivers.
CO4	Build a basis for subsequent related courses such as optical and satellite communication Simulation of QPSK transmitter and receiver.

1. Simulation of PCM and TDM
2. Simulation of BPSK and DPSK Signal
3. Simulation of QPSK transmitter and receiver.
4. Simulation of DS spread spectrum transmitter and receiver.
5. Fiber Optic Analog Link. Fiber optic digital ling
6. To measure numerical aperture and various types of losses in fiber
7. Simulation of Adaptive Channel Equalization – Learning Curves and Bit Error.
8. Simulation of Tap Delay Digital Filters
9. Simulation of White Uniform noise, Gaussian Noise, Colored noise
10. Simulation of larger scale path loss.
11. Simulation of small scale fading and multi-path (Any one model).
12. Designing of optical communication systems and photonic devices as per the given Specifications using simulation software. Do investigations in terms of BER, Eye diagram for systems and mode calculation for devices.

II SEMESTER								
SL.No	**Course Category**	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**	
THEORY								
1	PC	MECPC2010	MICROWAVE ENGINEERING & ANTENNA THEORY	3	1	0	4	
2	PC	MECPC2020	ADVANCED WIRELESS & MOBILE TECHNOLOGY	3	1	0	4	
3	PE	MECPE2031	ADAPTIVE SIGNAL PROCESSING	3	0	0	3	
		MECPE2032	ANTENNA DESIGN & SIMULATION					
		MECPE2033	SEMICONDUCTOR DEVICE MODELLING					
4	PE	MECPE2041	ADVANCED DIGITAL SIGNAL PROCESSING	3	0	0	3	
		MECPE2042	INTERNET & WEB TECHNOLOGY					
		MECPE2043	ADVANCED MICROPROCESSOR & MIRCROCONTROLLER					
5	PE	MECPE2051	NETWORK SECURITY & CRYPTOGRAPHY	3	0	0	3	
		MECPE2052	RF MEMS FOR WIRELESS COMMUNICATION					
		MECPE2053	ADVANCED ANTENNAS FOR WIRELESS COMMUNICATION					
PRACTICAL								
6	ES	MECES2160	MICROWAVE ENGINEERING LABORATORY	0	0	8	4	
7	ES	MECES2170	SEMINAR I	0	0	4	2	
TOTAL				**15**	**2**	**12**	**23**	

TITLE OF THE SUBJECT						
Subject Code	**MICROWAVE ENGINEERING & ANTENNA THEORY**	L	T	P	C	QP
MECPC2010		3	1	0	4	A

Course Educational Objectives	
CEO1	To understand analysis, design and development of microwave circuits & system.
CEO2	To understand about Microwave transmission modes, Transmission lines.
CEO3	To understand about Microwave Antennas, Microwave Measurements, Microwave Systems.
CEO4	To understand Microwave Network Analysis.

Course Outcomes: ***Upon successful completion of this course, students should be able to:***	
CO1	Characterize microwave devices in terms of the directionality of communication.
CO2	Explain the operation of a given antenna based on its geometry; and describe its expected performance in terms of radiation pattern, efficiency, bandwidth, and polarization.
CO3	Design an antenna for some given feasible and realistic specifications.
CO4	To find, understand and use relevant technical literature to solve antenna problems.

Unit:1 **(10 hrs)**

Mathematical model of Microwave Transmission. Concept of Mode, Characteristics of TEM, TE and TM Modes, Losses associated with microwave transmission, Concept of Impedance in Microwave transmission

Analysis of RF and Microwave Transmission Lines.

Coaxial Line, Rectangular Waveguide, Circular waveguide, Strip line, Microstrip Line.

Unit:2 **(10 hrs)**

Passive and Active microwave Devices.

Microwave Passive components: Directional Coupler, Power Divider, Microwave Passive components: Magic Tee, attenuator, resonator, Microwave Active components: Diodes, Transistors, Microwave Active components: oscillators, mixers, Microwave Semiconductor Devices: Gunn Diodes, IMPATT diodes, Schottky Barrier diodes, PIN diodes, Microwave tubes: Klystron, TWT, Magnetron**.**

Unit:3 **(10hrs)**

Fundamental Concepts: Physical concept of radiation, Radiation pattern, near-and far-field regions, directivity and gain, effective aperture, polarization, input impedance, efficiency, Friis transmission equation. Radiation from Wires and Loops: Infinitesimal dipole, finite-length dipole, linear elements near conductors, small circular loop. Aperture and Reflector Antennas: Radiation from rectangular and circular apertures, design considerations, Babinet's principle, Radiation from sectoral and pyramidal horns, design concepts, prime focus parabolic reflector and cassegrain antennas.

Unit:4 **(10 hrs)**

Microstrip Antennas: Basic characteristics of microstrip antennas, feeding methods, methods of analysis, design of rectangular and circular patch antennas. Antenna Arrays: Analysis of uniformly spaced arrays with uniform excitation amplitudes, extension to planar arrays, synthesis of antenna

Text Books

1. R.E. Collins,"Foundations of Microwave Engg", –, TMH,2001

2. P.A. Rizzi ,"Microwave Engineering", Pearson Education, 2007

3. Joseph Helszajn ,"Microwave Engineering - Non-reciprocal active and passive circuits", McGraw Hill, 1992.

4. David M. Pozar, "Microwave Engineering", Third Edition, Wiley India.

Reference Books

1. M. Kulkarni ,"Microwave & Radar Engineering ", Umesh Publications, 2003.

2. Annapurna Das and Sisir K. Das ,"Microwave Engineering ",TMH, 2000.

3. Jordan, E.C. and Balmain, K.G., "Electromagnetic Waves and Radiating Systems",2nd Ed., Prentice-Hall of India. 1993

TITLE OF THE SUBJECT

Subject Code	**ADVANCED WIRELESS & MOBILE TECHNOLOGY**	L	T	P	C	QP
MECPC2020		3	1	0	4	A

Course Educational Objectives	
CEO1	To understand The fundamentals of mobile wireless channels, and the limitations of mobile channels imposed on communication systems
CEO2	To know the The architectures of mobile communications, and recent standard mobile systems
CEO3	To understand The foundation of understanding and working for future generation of wireless systems
CEO4	To understand the Advanced modulation and transmission techniques, and practical channel coding schemes.

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

CO1	Know of frequency reuse and Co-channel Interference and different methods of cell splitting and sectoring.
CO2	Measure the real time Co-Channel Interference.
CO3	Apply the different methods of Handoff mechanisms.
CO4	Design and analyze Basic Cellular System.

Unit:1 **(8hrs)**

Cellular concepts: Cell structure, frequency reuse, cell splitting, channel assignment, handoff, interference, capacity, power control; Wireless Standards: Overview of 2G ,3G and 4G cellular standards.

Unit:2 **(12 hrs)**

Signal propagation: Propagation mechanism, reflection, refraction, diffraction and scattering, large scale signal propagation and lognormal shadowing.

Fading channels: multipath and small scale fading Doppler shift, statistical multipath channel models, narrowband and wideband fading models, power delay profile, average and rms delay spread, coherence bandwidth and coherence time, flat and frequency selective fading, slow and fast fading, average fade duration and level crossing rate. Capacity of flat and frequency selective channels. Antennas: antennas for mobile terminal- monopole antennas, PIFA, base station antennas and arrays.

Unit:3 **(10hrs)**

Multiple access schemes: FDMA, TDMA, CDMA and SDMA. Modulation schemes: BPSK, QPSK and variants, QAM, MSK and GMSK, multicarrier modulation, OFDM. Receiver structure: diversity receivers- selection and MRC receivers, RAKE receiver

Unit:4 **(10 hrs)**

Equalization: linear-ZFE and adaptive, DFE. Transmit diversity-Alamouti scheme. MIMO and space time signal processing, spatial multiplexing, diversity/multiplexing tradeoff. Performance measures: outage, average snr, average symbol/bit error rate. System examples: GSM, EDGE, GPRS, IS-95, CDMA 2000 and WCDMA

Text Books

1. T. S. Rappaport, Wireless digital communications: Principles and practice, 2nd Ed., Prentice Hall India, 2007.

2. W. C. Y. Lee, Wireless and cellular telecommunications, 3rd Ed., MGH, 2006

Reference Books

1. G. L. Stuber, Principles of mobile communications, 2nd Ed., Springer, 2007.

2. Simon Haykin and Michael Moher, Modern Wireless Communication, Pearson education, 2005

TITLE OF THE SUBJECT						
Subject Code	**ADAPTIVE SIGNAL PROCESSING**	L	T	P	C	QP
MECPE2031		3	0	0	3	A

Course Educational Objectives	
CEO1	To understand about the adaptive filters.
CEO2	To study the first-order adaptive algorithm.
CEO3	To study the Linear Prediction and Recursive Order Algorithm.
CEO4	To Analyze the basic adaptive signal processing methods, especially linear adaptive filters.

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

CO1	Understand the basics of digital signal processing and digital filter design and its realizations.
CO2	Analyze the basic adaptive signal processing methods, especially linear adaptive filters.
CO3	Apply important structures of adaptive filters and algorithms.
CO4	Design and integrate an adaptive filter in communication systems.

Unit:1 **(8hrs) Introduction to Discrete Random processes**

Random variables, random processes, filtered random processes, Ensemble averages, correlation, covariance, power spectrum, cross power spectrum, Ergodicity, time averages, biased & nbiased estimators, consistent estimators.

Unit:2 **(8 hrs)**

Linear prediction

Direct form linear prediction filtering, Normal equations for linear prediction filtering, Levinson algorithm, Linear prediction lattice filtering.

Unit:3 **(10hrs)**

Digital Wiener filtering

Wiener smoothing and prediction filters, Application of Wiener smoothing to noise cancelling, Application of Wiener prediction filters,Constrained, linear MMSE filtering, Minimum variance beamforming.

Unit:4 **(10 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 signal processing: System identification, Channel equalization, adaptive noise cancellation, adaptive line enhancer.

Text Books

1. Digital Signal Processing, Third Edition, Prentice Hall, J.G. Proakis and D.G. Manolakis
2. Adaptive Signal Processing, B. Widrow and Stern
3. Digital Signal Processing, Oppenhein and Schafer.

Reference Books

1.Fundamentals of Adaptive Filtering, Ali H. Sayed, John Wiley, 2003
2. Adaptive Filtering: Algorithms and Practical Implementation, P. Diniz, Kluwer, 1997.

TITLE OF THE SUBJECT						
Subject Code	**ANTENNA DESIGN & SIMULATION**	L	T	P	C	QP
MECPE2032		3	0	0	3	A

Course Educational Objectives	
CEO1	sign wire antennas, loop antennas, reflector antennas, lens antennas, horn antennas and micro strip antennas.
CEO2	To understand the fields radiated by various types of antennas.
CEO3	To know the different types of arrays and their radiation patterns.
CEO4	To Analyze antenna measurements to assess antenna's performance.

Course Outcomes: ***Upon successful completion of this course, students should be able to:***	
CO1	Illustrate the different types of arrays and their radiation patterns.
CO2	Analyze antenna measurements to assess antenna's performance.
CO3	Quantify the fields radiated by various types of antennas.
CO4	Design wire antennas, loop antennas, reflector antennas, lens antennas, horn antennas and micro strip antennas.

Unit:1 **(8hrs)**

Radiation process, mechanism of radiation of EM energy from a dipole and horn (concept only) radiation pattern, Antenna parameters (concept and expressions) Radiation equation, pattern, beam width, aperture, effective height, antenna field region/zone.

Unit:2 **(10 hrs)**

Reciprocity theorem,self impedance and mutual impedance (concepts).Effect of ground plane –image theory, Small loop antenna, Duality theorem and applications. Communication link – receiving and transmitting antenna, electrical equivalent ckt, Point source concept

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

Unit:3 **(8 hrs)**

Introduction, General structure of phased array, linear array theory, Variation of gain as a function of pointing direction, Effects of phase quantization, frequency scanned arrays, analog beam forming matrices, Active modules, digital beam forming,MEMS technology in phased arrays, Retrodirective and self phased arrays.

Unit:4 **(10 hrs)**

Radiation Mechanism from patch; Excitation techniques,Microstrip dipole; Rectangular patch, Circular patch, and Ring antenna, Radiation analysis from transmission line model, cavity model, Input impedance of rectangular and circular patch antenna. Microstrip array and feed network ,Application of microstrip array antenna, Mobile phone antenna, base station, hand set antenna

Text Books

1. Constantine A Balanis, "Antenna theory: analysis and design", Wiley India, 3rd Edition,

2011.

2. Hubregt.J.Visser “Antenna Theory and Applications” 1st Edition, John Wiley & Sons Ltd, Newyork,2012.

Reference Books

1. Zhijun Zhang” Antenna Design for Mobile Devices” 1st Edition, John Wiley & Sons (Asia) Ltd, Newyork,2011.

2. Xavier Begaud, “Ultra Wide Band Antennas” , 1st Edition, ISTE Ltd and John Wiley & Sons Ltd,Newyork,2013.

TITLE OF THE SUBJECT						
Subject Code	**SEMICONDUCTOR DEVICE MODELING**	L	T	P	C	QP
MECPE2033		3	0	0	3	A

Course Educational Objectives	
CEO1	To understand the behavior of the electrical devices based on fundamental physics.
CEO2	To create some compact models (such as the SPICE transistor models).
CEO3	To understand the modeling of devices in integrated circuits .
CEO4	To understand about MOS and bipolar transistor modeling.

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

CO1	Explain the equations, approximations and techniques available for deriving a model with specified properties, for a general device characteristic with known qualitative theory.
CO2	Apply suitable approximations and techniques to derive the model referred to above starting from drift-diffusion transport equations .
CO3	Explain how the equations get lengthy and parameters increase in number while developing a compact model .
CO4	List mathematical functions representing various non-linear shapes.

Unit:1 **(8hrs)**

PN Junction Diode and Schottky Diode: DC Current Voltage Circuits, Static Model, Large Signal Model, Small signal Model, Schottky Diode and its Implementation in SPICE 2, Temperature and Area Effect on the Diode Model Parameters, SPICE3, HSPICE & PSPICE Models.

Unit:2 **(10 hrs)**

BJT: Transistor Conversion and Symbols, Ebers-Moll Static, Large Signal and Small Signal Models, Gummel-Poon Static, Large Signal Models, Temperature and Area Effect on the BJT Parameters, Power BJT Models, SPICE3, HSPICE & PSPICE Models

JFET: Static Model, Large Signal Model, Small signal Model and its Implementation in SPICE 2, Temperature and Area Effect on the JFET Model Parameters, SPICE3, HSPICE & PSPICE Models.

Unit:3 **(10hrs)**

Metal Oxide Semiconductor Transistor (MOST): Structure and Operating Regions of the MOST, Level-1 and Level-2 Static Models, Level-1 and Level-2 Large-Signal Models, Comment on the Three Models, The Effect of Series Resistance, Small-Signal Models, The Effect of Temperature on the MOST Model Parameters, BSIM1 & BSIM2 Models, SPICE3, HSPICE & PSPICE Models.

Unit:4 **(8 hrs)**

Noise and Distortion: Noise, Distortion in MOSEFT, ISFET, THYRISTOR.

Text Book

1. G. Massobrio and P.Antognetti, *Semiconductor Device Modeling by SPICE*, Second Edition, McGraw Hill, 1993

Reference Book

1. N. Dasgupta and A. Dasgupta, *Semiconductor Device Modeling*, PHI Publication

TITLE OF THE SUBJECT						
Subject Code	**ADVANCED DIGITAL SIGNAL PROCESSING**	L	T	P	C	QP
MECPE2041		3	0	0	3	A

Course Educational Objectives	
CEO1	To understand the applications of linear filters and their real-time implementation challenges.
CEO2	To understand about different DSP Processors.
CEO3	To implement linear filters in real-time DSP chips;
CEO4	To represent real world signals in digital format and understand transform-domain representation of the signals

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

CO1	Learn to represent real world signals in digital format and understand transform-domain (Fourier and z-transforms) representation of the signals
CO2	Introduce applications of linear filters and their real-time implementation challenges.
CO3	Learn to implement linear filters in real-time DSP chips;
CO4	Provide the basic knowledge of different DSP Processors.

Unit:1 **(8hrs)**

INTRODUCTION TO DSP: Signals and their origin- Noise-Classification of continuous time signals- discrete time signals classification and properties of systems- Sampling Theorem sampling-digitizing-aliasing- anti-alias filter - Convolution theorem-linear convolution and circular convolution - Applications of filters - Advantages of DSP

Unit:2 **(10hrs)**

Z-TRANSFORMS: Z-Transform and its properties –Inverse Z-transform –Discrete Fourier Transforms DFT and its properties-Radix 2FFT, Computational advantages of FFT over DFT-13 Decimation in time FFT algorithm-Decimation-in Frequency FFT algorithm

Unit:3 **(8 hrs)**

IIR DIGITAL FILTER DESIGN:Block diagram Representation of digital filter-Basic IIR digital filter structures.

FIR DIGITAL FILTER DESIGN:Basic FIR Filter Structure, Structure realization, FIR Filter design based on windowed Fourier series-Frequency sampling method, equiripple linear, phase FIR filter design

Unit:4 **(10 hrs)**

DSP PROCESSOR- TMS320C5X:Introduction to programmable DSPS- Architecture of TMS 320 C5X, TMS 320C5X Assembly language Instructions-Instruction Pipelining in C5X Programming using DSP Processor: Convolution using MAC and MACD Instructions- Square wave generation-Ramp signal generation- Triangular wave generation.

Text Books

1. John .G.Proakis, “Digital Signal Processing Principles, Algorithms and Applications”,

Addison – Wesley ISBN-81-203-1129-9, 2002.

2. 1. Sanjit .K. Mitra, “Digital Signal Processing A Computer based approach”, Tata McGraw Hill Edition, ISBN 0-07-044705-5, 2001.

Reference Books

1. B.Venkataramani, M Bhasker, “Digital Signal Processors”, Tata McGraw-Hill Publishing Company limited, ISBN 0-07-047334-X, 2002.

2. Emmanuel C.Ifeachor, “Digital Signal Processing A Practical Approach”, Pearson Education Asia, ISBN 81-7808-609-3, 2002

TITLE OF THE SUBJECT						
Subject Code	**INTERNET & WEB TECHNOLOGY**	L	T	P	C	QP
MECPE2042		3	0	0	3	A

Course Educational Objectives	
CEO1	To study about designing of dynamic web pages using JavaScript.
CEO2	To study about web pages using XHTML and Cascading Styles sheets.
CEO3	To study about XML documents.
CEO4	To analyze a web page and identify its elements and attributes.

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

CO1	Analyze a web page and identify its elements and attributes.
CO2	Create web pages using XHTML and Cascading Styles sheets.
CO3	Build dynamic web pages using JavaScript (client side programming).
CO4	Create XML documents.

Unit:1 **(8hrs)**

INTRODUCTION : The Internet and WWW Understanding the WWW and the Internet, Emergence of Web, Web Servers, Web Browsers, Protocols, Building Web Sites HTML Planning for designing Web pages, Model and structure for a Website, Developing Websites, Basic HTML using images links, Lists, Tables and Forms, Frames for designing a good interactive website

Unit:2 **(10hrs)**

Web Essentials: Clients, Servers and Communications. The Internet-Basic Protocols-The World Wide Web-Http request message-response message Web Clients and Web Servers.HTML5: Basic Tags-Canvas, SVG, Drag/Drop, Geolocation, Video, Audio, Input types-Form elements, form Attributes.CSS3: Borders-Backgrounds-TextEffects-Fonts-2D and 3D Transforms-Transitions-Animations

Unit:3 **(10hrs)**

JavaScript: An Introduction to JavaScript -Objects in JavaScript: Data and Objects - Built-in objects - Events - DHTML with JavaScript. jQuery: 12 Selectors, Events-jQuery Effects: Hide/Show, Fade ,Animate, stop, callback, chaining-jQuery DOM manipulation

SERVLETS AND JSP Servlets 3.1: Web servers and Java web containers-Lifecycle-content handling-cookies-session tracking-filters- Annotations- Filters-Event handling-Exception Handling -Asynchronous processing -Debugging - Security – Internationalization. Java server pages(JSP) 2.2:Expressions-and declarations-directives-JSP and java beans-include and forward directives-- Standard Tag Library- Database Access- XML - Java Beans - Custom Tags - Expression Language(EL)-JSTL.

Unit:4 **(8 hrs)**

XML: Introduction and Overview-XML Fundamentals-XML Syntax-XML Namespaces-XML Document Type Definitions (DTD)-XML Schema Definition (XSD)-XQuery and Xpath-Presenting XML-XML Transformation with XSLT-XML Parsers:DOM and SAX

Text Books

1. Jeffrey C. Jackson, "Web Technologies: A Computer Science Perspective", Pearson Education, 2006.

2. Chris Bates, "Web Programming – Building Intranet applications", Wiley Publications, 3rd Edition, 2009.

Reference Books

.1. Jonathan Chaffer, Karl Swedberg, "Learning jQuery: Better interaction Design and Web Development with Simple JavaScript Techniques", PACKT publishing, 2007.

2. Deitel, Deitel& Nieto, "Internet and World Wide Web - How to Program", Prentice Hall, 4th Edition, 2008. 5. Marty Hall,"Core Servlets and Java Server Pages", JAVA 2 Platform, Enterprise Edition services

TITLE OF THE SUBJECT

Subject Code	ADVANCED MICROPROCESSOR & MIRCROCONTROLLER	L	T	P	C	QP
MECPE2043		3	0	0	3	A

Course Educational Objectives	
CEO1	To study about the different microprocessor and microcontroller.
CEO2	To design automated system with programming module.
CEO3	To understand the impact of microprocessor based system in process of automation.
CEO4	To understand the microprocessor based data acquisition system.

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

CO1	State the internal organization of 8086 microprocessor & microcontrollers (8051, PIC).
CO2	Understand the impact of microprocessor based system in process of automation.
CO3	Apply knowledge of soft skill and other resources to design automated system with programming module.
CO4	Conduct experiments for real time data collection by microprocessor based data acquisition system.
CO5	Design interfacing circuits of various devices with the microprocessor and microcontroller.

Unit:1 **(8hrs)**

INTEL 8086 MICROPROCESSOR: 8086 internal architecture, addressing modes, pin diagram, Minimum mode and maximum mode of operation, timing diagrams, Memory interfacing to 8086 (Static RAM & EPROM), 8086 interrupts and interrupt responses

Unit:2 **(8 hrs)**

8086 PROGRAMMING: Instruction set of 8086, assembler directives, program development Steps, constructing the machine course Codes for 8086 instructions, writing programs for Use with an assembler, writing and using procedures and assembler macros.

Unit:3 **(10hrs)**

PROGRAMMABLE DEVICES AND INTERFACING OF I/O: Priority interrupt controller Intel 8259A, programmable peripheral interface 8255A, USART 8251, KEYBOARD/ DISPLAY CONTROLLER 8279 and DMA Controller 8257

Unit:4 **(10 hrs)**

8051 MICRO CONTROLLER: Overview of 8051 family, Pin description of the 8051, 256-byte on-chip RAM, 8051 flag bits and PSW register, 8051 register banks and stack, instruction set, Programming 8051 timers, counter programming, Basics of serial communication, 8051 serial port programming in Assembly.

PIC MICROCONTROLLER

CPU Architecture, instruction sets, interrupts, Timers,I2C interfacing-UART-A/D converter

Text Books

1. A.K.Ray and K.M.Bhurchandi, "Advanced Microprocessors and Peripherals", 2nd Edn,

TMH, 2006.

2. Mazidi and Mazidi, “The 8051 Microcontroller and Embedded Systems”, 2nd Edn, PHI, 2004.

Reference Books

.1. Barry B. Brey, “The Intel Microprocessors-Architecture, Programming & Interfacing”, 6th Edn., Pearson Education, 2004.

4. Raj Kamal “Microcontrollers Architecture, Programming, Interfacing and System Design”, 1st Edn., Pearson Education, 2005.

TITLE OF THE SUBJECT

Subject Code	NETWORK SECURITY & CRYPTOGRAPHY	L	T	P	C	QP
MECPE2051		3	0	0	3	A

Course Educational Objectives	
CEO1	To understand the information security awareness and its importance.
CEO2	To master fundamentals of secret and public cryptography.
CEO3	To be exposed to original research in network security.
CEO4	To be familiar with network security threats and countermeasures.

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

CO1	To be familiar with information security awareness and a clear understanding of its importance,
CO2	To master fundamentals of secret and public cryptography
CO3	To be familiar with network security threats and countermeasures,
CO4	To be exposed to original research in network security

Unit:1 **(8hrs)**

NETWORK SECURITY: Authentication Application – Kerbros – Email Security – PGP – Network Security – IPSec – Web Security – SSL – SET. UNIT V- SYSTEM SECURITY (9 hours) Intrusion Detection – Password management – Malicious software – Viruses and countermeasures – Firewall Types and Configurations – Trusted System

Unit:2 **(8 hrs)**

Security Services, Mechanisms and Attacks – Network Security Model-Classical Encryption Techniques – Steganography – Data Encryption Standard (DES).

Unit:3 **(10hrs)**

ADVANCED BLOCK CIPHERS AND PUBLIC KEY CRYPTOSYSTEMS: Block cipher modes operation – Overview of IDEA, Blowfish, RC5, CAST-128 – Characteristics of advanced symmetric Block ciphers – Key Distribution – Principle – RSA algorithm – Public Key Management – DiffieHellmen Key Exchange – X.509 Public Key Certificate Format.

Unit:4 **(10 hrs)**

MESSAGE AUTHENTICATION AND DIGITAL SIGNATURE: Message Authentication codes – MAC – HASH function – Principle of MD5, SHA-1 and HMAC algorithms-Digital Signature algorithm.

Text Books

1.Forouzan.B.A. andMukhopadhyay.D, “Cryptography and Network Security”, Tata Mc-Graw Hill, 2nd Edition, 2010.

2.William Stallings, “Cryptography and Network Security”, Pearson Education, 5th Edition, New Delhi, 2011.

Reference Books

1. . William Stallings, “Cryptography and Network Security”, PHI, New Delhi, 2nd Edition, 1999.

TITLE OF THE SUBJECT

Subject Code	RF MEMS FOR WIRLESS COMMUNICATION	L	T	P	C	QP
MECPE2052		3	0	0	3	A

Course Educational Objectives

CEO1	To understand the limitations of the RF MEMS technology for wireless applications.
CEO2	To design practical RF MEMS devices using analytical and numerical techniques
CEO3	To design high-performance circuits and sub-systems using RF MEMS components
CEO4	To understand the simple linear and non-linear mechanical, electromagnetic and electromechanical models of RF MEMS structures

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

CO1	Learn the modeling and designing of MEMS inductors and capacitors.
CO2	Design micro machined RF filters.
CO3	Understand the operation of RF MEMS relays and switches.
CO4	Understand the design of oscillators.

Unit:1 **(8hrs)**

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

Unit:2 **(10hrs)**

ENABLED CIRCUIT ELEMENTS : RF/Microwave substrate properties, Micro machined – enhanced elements – capacitors, inductors, varactors, MEM switches – shunt MEM switch, low voltage hinged MEM switch approaches, push-pull series switch, folded – beam – springs suspension series switch

RESONATORS & ENABLED CIRCUITS: Transmission line planar resonators, cavity resonators, micromechanical resonators, film bulk acousticwave resonators, MEMS modeling – mechanical modeling, electromagnetic modeling. Enabled circuits –reconfigurable circuits – the resonant MEMS switch, Capacitors, inductors, tunable CPW resonator,MEMS micro switch arrays,

Unit:3 **(10hrs)**

RECONFIGURABLE CIRCUITS : Double – stud tuner, Nth – stub tuner, filters, resonator tuning system, massively parallel switchable RFfront ends, true time-delay digital phase shifters, Reconfigurable antennas – tunable dipole antennas,tunablemicrostrip patch-array antenna. Phase shifters- fundamentals, X-Band RF MEMS Phase shifter forphased array applications, Ka-Band RF MEMS Phase shifter for radar systems applications

Unit:4 **(8 hrs)**

FILTERS & OSCILLATORS: Film bulk acoustic wave filters – FBAR filter fundamentals, FBAR filter for PCS applications, RF MEMSfilters – A Ka-Band millimeter-wave Micromachined tunable filter, A High-Q 8-MHz MEM Resonatorfilter, RF MEMS Oscillators – fundamentals, A 14-GHz MEM Oscillator, A Ka- Band Micromachinedcavity oscillator, A 2.4 GHz MEMS based voltage controlled oscillator.

Text Book

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

Reference Books

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

2. Gabriel M. Rebeiz, "RF MEMS Theory, Design & Technology", Wiley Interscience, 2002

TITLE OF THE SUBJECT						
Subject Code	**ADVANCED ANTENNAS FOR WIRELESS COMMUNICATION**	L	T	P	C	QP
MECPE2053		3	0	0	3	A

Course Educational Objectives	
CEO1	To introduce about various wireless channel models
CEO2	To understand various antennas & their operations.
CEO3	To understand the design issues in spread spectrum and multi user communication systems

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

CO1	To provide comprehensive knowledge of different design and performance parameters of antenna.
CO2	To provide the overall idea about various existing antennas and different advance antennas presently in practice.
CO3	To provide principle of operation, analysis and application of different antennas such as microstrip antenna, smart antenna, etc.
CO4	Determine the type and appropriate model of wireless fading channel based on the system parameters and the property of the wireless medium.

Unit:1 **(8hrs)**

Fundamental Parameters of Antenna and cellular concepts:

Radio communication link with transmission and receiving antenna, radiation patterns, antenna equivalent circuits reciprocity theorem, beam area, beam width, directivity, gain, antenna apertures, effective height, field zones, radiation resistance, radiation efficiency, antenna polarization. Potential functions and the elect electric dipole-derivations for E and H field systems in spherical co-ordinate systems, power radia current element, Principal operation of a cellular mobile system, analogue and digital cellular

Unit:2 **(10hrs)**

Mobile antennas and mobile Radio Propagation and Modeling: Introduction and basics of mobile radio propagation, free-space propagation model, link budget design, propagation models, types of small-scale fading, statistical models for multipath propagation. Antennas fo Mobile Communication: Mean effective gain, Human body interactions and specific absorption rate, mobile satellite antennas, Macrocell antennas, microcell antennas, Picocell antennas, femtocell antennas, space diversity antennas.

Introduction to Smart Antennas:

Need for smart antennas, standards for smart antennas, types of smart antennas, features and benefits ,architecture, advantages and disadvantages of smart antennas, introduction to orthogonal signals, signal propagation: multipath and co-channel Interference

Unit:3 **(10hrs)**

Introduction to Smart Antennas: Spatial Processing for Wireless Systems :

The Vector Channel Impulse Response and the Spatial Signature, Spatial Processing Receivers, Fixed Beam forming networks, Switched Beam Systems.

Adaptive Antenna Systems:

Wideband Smart Antennas, Spatial Diversity, Diversity Combining, and Sectoring, Transmission

Beam forming, Array Calculation

Smart Antennas Techniques for CDMA:
Non-Coherent CDMA Spatial Processors, Coherent CDMA Spatial Processors and the Spatial Processing Rake Receiver, Multi-User Spatial Processing, multi-carrier communication, Dynamic Re-sectoring Using Smart Antennas, Downlink Beam-forming for CDMA

Unit:4 **(10 hrs)**

CDMA System Range and Capacity Improvement Using Spatial Filtering:
Range Extension in CDMA, Reverse Channel Performance of Multi-cell Systems with Spatial Filtering at the Base Station, Range and Capacity Analysis Using Smart Antennas – A Vector Based Approach

RF Position Locating Systems: Direction finding PL systems, True ranging PL Systems, Elliptical PL Systems, Hyperbolic PL Systems, Hyperbolic Vs DF PL Systems, TDOA Estimation Techniques: General Model for TDOA Estimation, Measures of Position Location Accuracy: Circular Error Probability and Geometric Dilution of Precision.

Text Books

1. Constantine A Balanis, ”Antenna theory: analysis and design”, Wiley India, 3rd Edition, 2011.
2. 1. Zhijun Zhang” Antenna Design for Mobile Devices” 1st Edition, John Wiley & Sons (Asia) Ltd, Newyork,2011.
3. T. S. Rappaport, Wireless digital communications: Principles and practice, 2nd Ed., Prentice Hall India, 2007.

Reference Books

1. Balanis, C.A., “Antenna Theory and Design”, 3rd Ed., John Wiley & Sons. 2005
2. W. C. Y. Lee, Wireless and cellular telecommunications, 3rd Ed., MGH, 2006.

TITLE OF THE SUBJECT						
Subject Code	**MICROWAVE ENGINEERING LABORATORY**	L	T	P	C	QP
MECES2160		0	0	8	4	-

Course Educational Objectives	
CEO1	To explain the evolution and basics of microwave engineering and characteristics of microwave devices
CEO2	To describe radar systems, scanning and tracking techniques used in radar systems.
CEO3	To analyze various microwave devices, their characteristics and microwave measurements using test bench.

Course Outcomes: ***Upon successful completion of this course, students should be able to:***	
CO1	Study a wide range of Microwave components and their characteristics.
CO2	Describe radar systems, scanning and tracking techniques used in radar systems.
CO3	Characterize Microwave devices in terms of the directionality of communication.
CO4	Use a Microwave test bench in analyzing various types of Microwave measurements.
	1. Plot the radiation characteristics of the horn antenna. 2. Draw the V-I characteristics of Reflex Klystron. 3. Measure the insertion loss and isolation of a circulator. 4. Plot the power output v/s frequency characteristics of a Gunn source. 5. Design an antenna and calculate Gain, directivity, antenna efficiency, bandwidth and 3 dB beam width using empirical formulas. Compare the simulated results obtained by software and theoretical results and Observe the effect of feed location on center frequency, return loss and bandwidth. 6. Design a Schottky diode at S Band frequencies structure using software. 7. Design a GaN MOSFET at K band using Software.

III SEMESTER								
SL.No	**Course Category**	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**	QP
THEORY								
1	OE	MECOE3011	HUMAN RESOURCE MANAGEMENT	3	0	0	3	A
		MECOE3012	RESEARCH METHODOLOGY					
		MECOE3013	EMBEDDED SYSTEM DESIGN					
PRACTICAL								
2	ES	MECES3120	SEMINAR II	0	0	4	2	
3	ES	MECES3130	THESIS I	0	0	36	18	
TOTAL				**3**	**0**	**40**	**23**	

TITLE OF THE SUBJECT						
Subject Code	**HUMAN RESOURCE MANAGEMENT**	L	T	P	C	QP
MECOE 3011		3	0	0	3	A

Course Educational Objectives	
CEO1	To understand, implement, and evaluate organizational development strategies.
CEO2	To understand the development and communication of the organization's total compensation plan.
CEO3	To learn about labour relations in both non-union and union environments.
CEO4	To understand about the development, implementation, and evaluation of employee recruitment, selection, and retention plans and processes.

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

CO1	Understand the implementation and evaluation of employee recruitment & selection processes.
CO2	Recognize and evaluate employee &labour relationship.
CO3	Identify and analyze communication of the organization's total compensation plan.
CO4	Implement, and examine organizational development strategies aimed at promoting organizational effectiveness.

Unit:1 **(12 hrs)**

Human Resource Development Strategies, Design And Experience

Human Resource Development: HRD-An Overview, Line Managers and HRD, Task Analysis, Motivational Aspects of HRD, Developmental Supervision, Counseling and Mentoring , HRD for Health and Family Welfare in Select HRD Culture and Climate, HRD for Workers, HRD/OD Approach to IR Corporate Business.

Unit:2 **(8 hrs)**

Basics of Human Resource Planning

Macro Level Scenario of Human Resource Planning, Concepts and Process of Human Resource Planning, Methods and Techniques-Demand Forecasting, Methods and Techniques-Supply Forecasting, Job Evaluation: Concepts, Scope and Limitations, Selection and Recruitment, Induction and Placement, Performance and Potential Appraisal, Transfer, Promotion and Reward Policies, Training and Retraining.

Unit:3 **(10hrs)**

Wage and Salary Administration &LabourLegislation

Wage Concepts and Definition of Wages Under Various Labour Legislation, Norms for Wage Determination, Law relating to Payment of Wages and Bonus, Pay Packet Composition, Design of Performance-linked Reward System,

Philosophy of Labour Laws, Labour Laws, Industrial Relations and Human Resource Management, Indian Constitution and Labour Legislations

Unit:4 **(6 hrs)**

Time Management: Importance of Time factor, Time waster, Prioritizing Work Scheduling, Functions of the Time Office, Flexible Work arrangements.

Text Books

1. Beardwell and Len Holder, Human Resource Management Macmillan India Ltd.,
2. Graham H.T., &R.Bennet, Human Resource Management – Pitman, London
3. Performance Appraisal, Theory and Practice – AIMA VIKAS Management Series,

Reference Books

1. C.B. Manmoria, Personnel Management – Himalayan Publishing Co., New Delhi.
2. Pattanayak: Human Resource Management, PHI,
3. Nair,N.G. &LathaNair:Personnel Management & Industrial Relations–S.Chand& Co.

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TITLE OF THE SUBJECT

Subject Code	RESEARCH METHODOLOGY	L	T	P	C	QP
MECOE3012		3	0	0	3	A

Course Educational Objectives	
CEO1	To learn about different appropriate research topics.
CEO2	To understand some basic concepts of research and its methodologies.
CEO3	To analyze the appropriate research problem and parameters.
CEO4	To analyze &Organize and conduct research in a more appropriate manner.

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

CO1	Understand and analyze basic concepts of research and its methodologies.
CO2	Identify appropriate research topics.
CO3	Select and examine appropriate research problem and parameters.
CO4	Recognize advanced project in sophisticated manner.

Unit:1 **(12 hrs)**

Introduction to RM: Meaning and significance of research. Importance of scientific research in decision making. Types of research and research process. Identification of research problem and formulation of hypothesis. Research Designs. Measurement and Data Collection. Primary data, Secondary data, Design of questionnaire; Sampling fundamentals and sample designs. Measurement and Scaling Techniques, Data Processing.

Unit:2(10 hrs) Data Analysis – I: Hypothesis testing; Z-test, t-test, F-test, Chi-square test. Analysis of variance. Non-parametric Test – Sign Test, Run test, Krushall – Wallis test

Unit:3 **(8 hrs)**

Data Analysis – II: Factor analysis, Multiple Regressions Analysis. Discriminant Analysis, Use of SPS Package.

Unit:4 **(6 hrs)**Essentials of Report writing and Ethical issues: Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Precautions for Writing Research Reports.

Text Books

1. Research Methodology, Chawla and Sondhi, Vikas
2. Research methodology by C.R. KOTHARI

Reference Book

1. Research Methodology, Paneersevam, PHI

TITLE OF THE SUBJECT						
Subject Code	**EMBEDDED SYSTEM DESIGN**	L	T	P	C	QP
MECOE3013		3	0	0	3	A

Course Educational Objectives	
CEO1	To understand thedebugging techniques for an embedded system.
CEO2	To understand different programming environment used to develop embedded systems.
CEO3	To understand different components of a micro-controller and their interactions.
CEO4	To learn about different microcontroller, micro computer , embedded system.

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

CO1	Understand and analyze microcontroller, microcomputer & embedded system.
CO2	Identify different components of a micro-controller and their interactions
CO3	Select and examine programming environment used to develop embedded systems
CO4	Implement and examine debugging techniques for an embedded system.

Unit:1 **(10 hrs)**

Introduction to Embedded systems design:

Introduction to Embedded system, Embedded System Project Management, ESD and Co-design issues in System development Process, Design cycle in the development phase for an embedded system, Use of target system or its emulator and In-circuit emulator, Use of software tools for development of an ES.

Unit:2 (8 hrs)

Embedded C Programming: Embedded C V/s C language, DDR, PORT and PIN commands, special data types, Infinite while loop, if conditions

Unit:3 **(10hrs)**

AVR Interfacing and Applications:

Interfacing External Memory, Keyboard and Display Devices: LED, 7-segment LED display, LCD, Ultrasonic Sensor and IR Sensor.

Proteus Design Suite: Circuit building for all applications

Unit:4 **(8 hrs)**

Advanced Microcontrollers:

Only brief general architecture of ARM microcontrollers, NodeMCU

Text Books

1. AVR Microcontroller and Embedded Systems : Using Assembly and C 1 Edition (Author:

Muhammad Ali
2. Mazidi, SarmadNaimi, SepehrNaimi)
3. Atmega8 Datasheet: An ATMEL Document
https://www.mouser.com/ds/2/268/Atmel-2486-8-bit-AVR-microcontroller-ATmega8_L_dat-1065398.pdf

Reference Books

1. . Designing Embedded Hardware by Catsoulis (Author)
2. Embedded System Design with the Atmel AVR Microcontroller I (Synthesis Lectures on Digital Circuits and Systems) by Steven Barrett (Author).
3. Making Embedded Systems: Design Patterns for Great Software 1st Edition by Elecia White (Author)
4. ARM System-on-Chip Architecture (2nd Edition) by Steve Furber (Author)