VEER SURENDRA SAI UNIVERSITY OF TECHNOLOGY: BURLA
ELECTRONICS & TELECOMMUNICATION ENGINEERING DEPARTMENT
Curriculum for M.TECH -- COMMUNICATION SYSTEM ENGG. (REGULAR)

First semester:-

Sub. No.	Subject	L	T	P	C
MEC-101	Modern Digital Communication Techniques	3	1	0	4
MEC-102	Information Theory and Coding	3	1	0	4
MEC-103	VLSI Design	3	1	0	4
MEC-104	Telecommunication Switching & Networks	3	1	0	4
	Elective-I (Any one from Group-I)	3	1	0	4
MEC-191	Telecommunication system Engineering Lab.-I	0	0	3	2
MEC-192	Design and Simulation Laboratory	0	0	3	2
MEC-193	Seminar-I	0	0	3	2
MEC-194	Comprehensive Viva Voce-I				2
	Total =	15	5	9	28

Second semester:-

Sub. No.	Subject	L	T	P	C
MEC-105	Mobile communication	3	1	0	4
MEC-106	Data Security & Cryptography	3	1	0	4
MEC-107	Optical & Satellite Communication Systems	3	1	0	4
	Elective-II (Any one from Group-II)	3	1	0	4
	Elective-III (Any one from Group-III)	3	1	0	4
MEC-195	Telecommunication system Engineering Lab.-II	0	0	3	2
MEC-196	Wireless & Fiber optics Communication Lab.	0	0	3	2
MEC-197	Seminar-II	0	0	3	2
MEC-198	Comprehensive Viva Voce-II				2
	Total =	15	5	9	28

Third Semester:-

Sub. No.	Subject	L	T	P	C
MEC-291	Dissertation Interim Evaluation				10
MEC-292	Comprehensive Viva -Voce				3
MEC-293	Seminar on Dissertation				2
	Total=				15

Fourth Semester:-

Sub no	Subject	L	T	P	C
MEC-294	Dissertation Open Defense				5
MEC-295	Dissertation Final Evaluation				20
	Total=				25
	Grand Total			**=**	**96**

Group-I (In first semester) :-
MEC-108 Advanced Digital signal Processing
MEC-109 Advanced Electromagnetic fields
MEC-110 Advanced Microprocessors

Group-II (In second semester) :-
MEC-111 Fiber Optics Devices & Components
MEC-112 Computational Intelligence
MEC-113 Internet Technology

Group-III (In second semester) :-
MEC-114 Adaptive Signal Processing
MEC-115 Digital Image Processing
MEC-116 Embedded system

MEC-101: MODERN DIGITAL COMMUNICATION TECHNIQUES: (3-1-0) Credit: 4

Module-I

Formatting And Modulation of Baseband (6 Hours)

Baseband Systems, Formatting Textual Data (Character Coding), Messages, Characters, and Symbol, Formatting Analog Information, Sources of Corruption, Pulse Code Modulation, Uniform and Nonuniform Quantization, Baseband Modulation, Correlative Coding

Baseband Demodulation/ Detection (3 Hours)

Signals and Noise, Detection of Binary Signals in Gaussian Noise, Intersymbol Interference, Equalization

Module-II

Bandpass Modulation And Demodulation / Detection (8 Hours)

Digital Bandpass Modulation Techniques, Detection of Signals in Gaussian Noise, Coherent Detection, Noncoherent Detection, Complex Envelope, Error Performance for Binary Systems, M-ary Signaling and Performance, Symbol Error Performance for M-ary Systems

Communications Link Analysis (5 Hours)

Received Signal: Power and Noise Power, Link Budget Analysis, Noise Figure, Noise Temperature, and System Temperature, Sample Link Analysis , Satellite Repeaters

Module-III

Synchronization: (2 Hours)

Introduction, Receiver Synchronization, Network Synchronization

Multiplexing And Multiple Access (6 Hours)

Allocation of the Communications Resources, Multiple Access, Communications System and Architecture, Access Algorithms, Multiple Access Techniques Employed with INTELSAT, Multiple Access Techniques for Local Area Network

Module-IV

Spread Spectrum Techniques (5 Hours)

Spread-Spectrum Overviews, Pseudo-noise Sequences, Direct-Sequence, Spread-Spectrum Systems, Frequency Hopping Systems, Synchronization, Jamming Considerations, Commercial Applications, Cellular Systems

Fading Channels (10 Hours)

The Challenge of Communicating over Fading Channels, Characterizing, Mobile-Radio Propagation, Signal Time-Spreading, Time Variance of the Channel Caused by Motion Mitigating the Degradation Effects of Fading, Summary of the Key Parameters Characterizing Fading Channels, Applications: Mitigating the Effects of Frequency Selective Fading

Text Books:

(1) Digital Communications – Fundamentals and applications by Bernard sklar, 2nd Edition of Pearson education Publication.

Reference Books:

(1) Digital Communications, J. G. Proakis, 3rd edition, Mc Graw Hill Publication.
(2) Principles of Communications, Taub and Scheling, TMH Publication.

MEC-102: INFORMATION THEORY AND CODING : (3-1-0) Credit: 4

Module-I

Channel Coding (8 Hours)

Waveform Coding and Structured Sequences, Types of Error Control, Structured Sequences, Linear Block Codes, Error Detecting and Correcting Capability, Usefulness of the Standard Array, Cyclic Code, Well Known Block Codes

Module-II

Channel Coding (7 Hours)

Convolutional Encoding, Convolutional Encoder Representation, Formulation of the Convolutional Decoding Problem, Properties of Convolutional Codes, Other Convolutional Decoding Algorithms

Module-III

Channel Coding (5 Hours)

Reed Solomon Codes, Interleaving and Concatenated Codes, Coding and Interleaving Applied to the Compact Disc, Digital Audio Systems, Turbo Codes.

Module-IV

Modulation And Coding Trade Offs (12 Hours)

Goals of the Communications System Designer, Error Probability Plane, Nyquist Minimum Bandwidth, Shannon-Hartley Capacity Theorem, Bandwidth Efficiency Plane, Modulation and Coding Trade-Offs, Defining, Designing, and Evaluating Digital Communication Systems, Bandwidth Efficient modulation, Modulation and Coding for Bandlimited Channels, Trellis-Coded Modulation.

Source Coding (7 Hours)

Sources, Amplitude Quantizing, Differential Pulse-Code Modulation, Adaptive-Prediction, Transform Coding, Source Coding for Digital Data, Examples of Source Coding.

Text Books:

(1) Digital Communications – Fundamentals and applications by Bernard sklar, 2nd Edition of Pearson education Publication.

Reference Books:

(1) Information Theory, coding and Cryptography by Ranjan Bose, TMH Publication.
(2) Digital Communications, J. G. Proakis, 3rd edition, Mc Graw Hill Publication.

MEC-103: VLSI DESIGN : (3-1-0) Credit: 4

Module-I (8 Hours)

Introduction to VLSI Design Methodologies, Full Custom Design, Semi Custom Design & Programmable Design, VLSI Design Flow, Design Entry, Synthesis, Floor Planning, Place & Route, Timing analysis, Front-end and Backend design

Module-II: Front End Design (10 Hours)

Introduction to high level Design, Hardware description language.
VHDL: Introduction, Behavioral Modeling, sequential processing, Data types, Sub program & Packages, Attributes, Configurations**.**
Synthesis: HDL (RTL), Constraints, Technology Library m Synthesis: transaction, Boolean Optimization, Flattening, Factoring and Mapping gates.
High level Design flow
Synthesis tools: Synopsis**.**

Module-III Backend Design (10 Hours)

Introduction to low level Design.
MOS Structure: Band Diagram, NMOS, PMOS, CMOS digital logic gates Inverters.
Digital Design: Static Logic, Switch logic & dynamic logic design styles.
Analog Design: Differential Amplifiers, Current Mirrors, Design of Operational Amplifiers.
Introduction to SPICE (T-Spice) for circuit simulation VLSI Technology.

Module-IV: Fabrication Process (NMOS & CMOS) (4 Hours)

Wafer Preparation, Oxidation, Photo & Ion Lithography, Etching, Diffusion, Ion implementation, Metallization.

MODULE-V: Layout Design (5 Hours)

Stick diagram and layout of digital circuit, introduction to Layout generation tools. (VLSI Software: Tanner L-Edit), CiF & GDS-II formats.

MODULE-VI: Design of Telecom Chips (5 Hours)

Introduction to VLSI Design of modulators, Demodulators, Trans-receiver ICs, Coder & Decoders, Companies involved in communication chip design.

Text Books:

1. Application Specific Integrated Circuits by Smith (for Module:I)
2. VHDL by Douglas Perry, TMH Publication (for Module-II)
3. VLSI Design & Techniques, Puknell & Eshraghian, PHI,(for Module-III and Module-V)
4. VLSI Technology S. M. Sze, McGraw Hill (for INIT-IV)
5. Resource from internet: www.ti.com

MEC-104: TELECOMMUNICATION SWITCHING AND NETWORKS: (3-1-0)
Credit : 4

Module-I

Introduction: (5 Hours)

Evolution, simple telephone communication, basics of switching systems, telecommunication networks.

Electronic space division switching: (7 Hours)

Stored program control, centralized and distributed SPC, Software Architecture, Application Software, Enhanced Software, two and three stage networks.

Module-II

Time Division Switching: (7 Hours)

Basic time division space switching, basic time division time switching, time multiplexed space and time switching, combination switching, three-stage combination switching.

Traffic Engineering: (5 Hours)

Network traffic load and parameters, Grade of Service, Modeling switching systems, incoming traffic, Blocking models and loss estimates.

Telephone Networks: (6 Hours)

Subscriber loop systems, switching hierarchy and routing, transmission plan, transmission systems, signaling techniques.

Module-III

Data Networks: (12 Hours)

Data transmission in PSTN, switching techniques, Data communication architecture, link-to-link layers, end-to-end layers, satellite based data networks, LAN, MAN, Fiber optic networks, an overview of data network standards.

Module-IV

ISDN:

Integrated Service Digital Network, motivation, new services, transmission channels, signaling, service characterization, ISDN standards, broad band ISDN, voice data integration.

Text Books:

1. Telecommunication Switching Systems and Networks by Thiagarajan Viswanathan, PHI.

Reference Books:

2. Communication Networks by Leon Gracia and Widjaja, TMH.

MEC-108: ADVANCED DIGITAL SIGNAL PROCESSING : (3-1-0) Credit: 4

Module-I: Multirate Digital Signal Processing (10 Hours)

Introduction, Decimation by a factor D, Interpolation by a factor I, 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 pf narrowband lowpass filters. Implementation of Digital filter banks.

Module-II: Linear prediction and Optimum Linear Filters (10 Hours)

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.

Module-III: Power Spectrum Estimation (15 Hours)

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

Filter Bank and Subband Filters and its applications

Module-IV: Adaptive Signal Processing (8 Hours)

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.

MEC-109: ADVANCED ELECTROMAGNETIC FIELDS : (3-1-0) Credit: 4

Module-I:

Electrostatic Fields (8 Hours)

Coulomb's Law, Electric field Intensity, Gauss's law, Green's function, Electrostatic Potential, Conductor and Dielectrics, Boundary conditions, Poisson's & Laplace's Equation, Uniqueness of solution, Method of Images, Electro static Forces.

Module-II:

Magnetostatic Fields (8 Hours)

Charges in motion, Ampere's law, Magnetic Flux Density, Biot-Savart law & Lorentz force equation, Magneto-static potential and flux, Magnetic Materials, Boundary condition, Magneto-static Circuit parameters, Magneto-static stored energy, Magnetic circuits.

Module-III:

Maxwell's Equation (6 Hours)

Faraday's law. Gauss's law, Conservation of charge, Ampere's law, Constitutive properties of the medium, Boundary condition, power flow and pointing vector, sinusoidal steady state.

Propagation plane Waves (8 Hours)

The wave equation, Uniform plane waves, conductors & Dielectrics, skin depth, polarization of Uniform plane waves, Group velocity, Normal incidence of Uniform Plane waves on Plane Boundaries, Oblique incidence of Uniform plane waves on plane waves on plane boundaries and loss less media

Module-IV

Wave Guides (14 Hours)

Parallel wave guides, Rectangular wave guides, Cavity resonator, Dielectric wave guides

Antenna

Elemental Dipole Antenna array, Antenna Directivity and gain, Antenna Coupling, Different advanced antenna structures.

Bioelectromagnetics

Introduction, The Axon, Retinal optics fibers, Heart dipole field, Defibrillators and pacemakers. Biological fields, Electromagnetic Hazards and the environment.

Text Books:

1. Introduction to Electromagnetic Fields, 3rd Edition, Clayton R. Paul, Keith W. Whites, Syed A.Nasar, McGraw Hill Publication
2. Electro Magnetic Waves and Radiating System, 2nd Edition, Edwards C. Jordan, Keith G. Balmain, Prentice Hall(PHI) publication
3. Electromagnetics with Applications, 5th edition, Kraus/ Fleich, Mc-Graw Hill Publication (for Module-III)

MEC-110: ADVANCED MICROPROCESSORS: (3-1-0) Credit: 4

Module-I

Intel 8086 Microprocessor (12 Hours)

Register Organization, Architecture, Pin Description, Memory Organization, Bus operation, I/O addressing Capability, Minimum modes and Maximum modes of operation. Interfacing 8086 with memory & I/O devices. Instruction set, formats of instructions, Addressing modes, Assemblers & Directives.

Module-II

Intel 80286 Microprocessor (8 Hours)

80287 math coprocessor, Salient feature of 80286, Architecture, Pin description, Addressing modes, Special operation, 80286 bus interface, Interfacing 80286 with memory and I/O devices. Interrupt sequencing, Instruction set features.

Module-III

80386 Microprocessor-80387 Math Co-processor and 80486 (8 Hours)

Salient features of 80386, Architecture, Pin description, Register organization, Addressing modes, Data types, Real address modes of 80386, segmentation, paging, virtual 80386 modes, The co-processor 80387, The CPU with a Numeric Coprocessor-80486.

Module-IV:

Pentium Processor (16 Hours)

Salient features of 80586(Pentium), Architecture, instruction set, Pentium-II

Assembler, DOS, Basic I/O system, Mouse and DPMI Memory Manager using MASM, TASM, DEBUG, link a program

Text Book:

1. Intel 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium and Pentium processor 5/e.
3. Architecture, programming and Interfacing, Bary B Brey, Pearson Education
2. Advanced Microprocessor & Peripherals, A.k. Ray & K.M. Bhurchandi, TMH Publication.

MEC-191: Telecommunication System Engineering Laboratory-I: (0-0-3)credit : 2

1. Simulation of White Uniform noise, Gaussian Noise, Colored noise.
2 Simulation of Tap Delay Digital Filters.
3. Simulation of Adaptive Filters (LMS based).
4. Simulation of Adaptive Channel Equalization – Learning Curves and Bit Error.
5. Simulation of data Compression using DCT.
6. Simulation of PCM and TDM.
7. Simulation of PSK and DPSK Signal.
8. Experiments on Digital Communication Trainers.

MEC-192: Design and Simulation Laboratory: (0-0-3) credit: 2

1. Simulation of various codes.
2. Simulation of Adaptive System Identification (All zero types).
3. Simulation of Adaptive Filtering of sine wave extraction from mixed harmonics and…..).
4. SPICE Simulation of inverters(N-MOS, P-MOS and C-MOS).
5. SPICE Simulation of Digital Systems (Static, Switch logic and Dynamic types).
6. VHDL Simulation of Digital Circuits (Multiplexer, ALU and n-bit adder).

MEC-105: MOBILE COMMUNICATION : (3-1-0) Credit : 4

Module-I

Introduction: (8 Hours)
Evolution, Mobile radio standards, examples: paging systems, cordless telephone systems, cellular telephone systems, comparison of common wireless communication systems, Third generation wireless networks.
The Cellular System Design: (8 Hours)
Introduction, frequency reuse, channel assignment, Hand-off mechanism, interface and system capacity, trunking and grade of service, cell splitting, sectoring, repeaters.
Cell site antennas, mobile antennas Data links, available frequencies, link design and diversity requirement.

Module-II

Mobile Radio Propagation: (8 Hours)
(a) Large-scale path loss:
Outdoor propagation model
(i) O Kumura Model (ii) Hata Model
Indoor propagation model: (i) Attenuation factor model
(b) Small scale fading and multi path:
Small scale multi path propagation, parameters of mobile multi path channels, Fading effects due to multi path time delay spread and due to Doppler spread, Clark and Gans fading model.

Module-III

Modulation Techniques for Mobile Radio: (6 Hours)
QPSK, Constant envelope modulation, MFSK, OFDM, DS and FH spread spectrum techniques.

Frequency Management and channel Assignment: (6 Hours)
Frequency management set up channels, channel assignment and algorithms, traffic and channel assignment.

Module-IV

Equalization, Diversity and Channel Coding: (6 Hours)
Fundamentals of equalization, training, linear and non linear equalizers, LMS and Zero forcing algorithms, diversity techniques, RAKE receivers, fundamental of channel coding, Reed-Solomon codes, Turbo and Trellis codes.
Multiple Access Techniques: (3 Hours)
FDMA, TDMA FHMA, CDMA and SDMA, capacity of CDMA and SDMA.

Reference Books*:*

1. Wireless Communication: Principle and Practice, - T.S.Rapport, 2nd Edition, Pearson Education;
2. Mobile Cellular Telecommunications, - William Y.C. Lee, 2nd Edition, Mc GrawHill International Editions.
3. Wireless and Personal Communication Systems, - V.K.Garg and J.E. Wilkess, Prentice Hall.

MEC-106: DATA SECURITY AND CRYPTOGRAPHY : (3-1-0) Credit: 4

Module-I

Introduction To The Concepts Of Security (2 Hours)

Introduction, The Need for Security, Security Approaches, Principles of Security, Types of Attacks.

Cryptographic Techniques: (7 Hours)

Introduction, Plain Text and Cipher Text, Substitution Techniques, Transposition Techniques, Encryption and Decryption, Symmetric and Asymmetric Key Cryptography, Stegnography, Key Range and Key Size, Possible Types of Attacks.

Module-II

Computer Based Symmetric Key Cryptographic Algorithms: (7 Hours)

Introduction, Algorithm Types and modes, An Overview of Symmetric Key Cryptography, Data Encryption Standard (DES), International Data Encryption Algorithm (DEA), RC5, Blowfish, Advanced Encryption, Standard (AEC), Differential and Linear Cryptanalysis.

Computer Based Asymmetric Key Cryptographic Algorithms: (8 Hours)

Introduction, Brief history of Asymmetric Key Cryptography, An Overview of Asymmetric Key Cryptography, the RSA Algorithm, Symmetric and Asymmetric Key Cryptography Together, Digital Signatures, Knapsack Algorithm, Some other Algorithms.

Module-III

Public Key Infrastructure : (4 Hours)

Introduction, Digital Certificates, Private Key Management, the PKIX,
Public Key Cryptography Standards (PKCS), XML, PKI and Security.

Internet Security Protocols: (8 Hours)

Basic Concepts, Secure Socket Layer (SSL), Secure Hyper Text Transfer Protocols (SHTTP), Time Stamping Protocol (TSP), Secure Electronic Transaction (SET), SSL versus SET, 3-D Secure Protocol, Electronic money, Email Security, Wireless Application Protocol (WAP), Security in GSM.

User Authentication Mechanisms: (5 Hours)

Introduction, Authentication Basics, Passwords, Authentication Tokens, Certificate-based Authentication, Biometric Authentication, Kerberos, Single Sign On (SSO) Approaches.

Module-IV

Practical Implementations Of Cryptography/Security: (3 Hours)

Cryptographic Solutions Using Java, Cryptographic Solutions Using Microsoft, Cryptographic Toolkits, Security, and Operating Systems.

Network Security: (2 Hours)

Brief Introduction to TCP/IP, Firewalls, IP Security, Virtual Private Networks (VPN).

Text Book:

(1) Cryptography and Network Security by A. Kahate, PHI Publication

MEC-107: OPTICAL & SATELLITE COMMUNICATION SYSTEM: (3-1-0)
CREDIT : 4

A) OPTICAL FIBER COMMUNICATIONS

Module-I

Digital Transmission Systems: - (4 Hours)
Point – to – Point Links
Analog Systems:-
Overview of Analog Links, Carrier-to-Noise Ratio, Multichannel Transmission Techniques
WDM Concepts and components: - (3 Hours)
Operational Principles of WDM, Passive Components, Tunable Sources, Tunable filters

Module-II

Optical Amplifiers:- (8 Hours)
Basic Applications and Types of Optical Amplifiers , Semiconductor Optical amplifiers, Erbium-Doped Fiber amplifiers, Amplifier Noise, System Applications, Wavelength Converters.
Optical Networks:- (8 Hours)
Basic Networks, SONET/SDH, Broadcast-and-Select WDM Networks, Wavelength-Routed Networks, Solitons, Optical CDMA, Ultrahigh Capacity Networks.

B) SATELLITE COMMUNICATIONS

Module-III

Orbital Mechanics and Launchers: - (5 Hours)
Orbital Mechanics, Look Angle Determination, Orbital Perturbations, Orbit Determination, Launches and Launch Vehicles, Orbital Effects in Communications systems Performance
Satellite Link Design: - (5 Hours)
Basic Transmission Theory, System Noise Temperature and G/T Ratio, Design of Downlinks, Uplink Design, Design for Specified C/N: Combining C/N & C/I Values in Satellite Links
Propagation Effects and their Impact on Satellite-Earth Links: - (4 Hours)
Quantifying Attenuation and Depolarization, Propagation Effects that are not associated with Hydrometers, Rain and Ice Effects.

Module-IV

VSAT System:- (5 Hours)
Overview of VSAT Systems, Network Architectures, Access Control Protocols, Basic Techniques, VSAT Earth Station Engineering
Low Earth Orbit and Non-Geostationary Satellite Systems:- (4 Hours)
Orbit Considerations, Coverage and Frequency Considerations, Delay and Throughput Considerations, System Considerations.

Text Books:

1. Optical Fiber Communication – Gerd.Keiser, Third Edition, TMH.
2. Satellite Communications – T.Pratt and C.Bostian & J.Allnutt, 2nd Edition, John Wiley & Sons.

MEC-111: FIBER-OPTIC DEVICES AND COMPONENTS: (3-1-0) Credit : 4

Module-I

Fiber-Optic Light Sources: (11 Hours)

Light Emitting Diodes (LEDs), LED structures, Light source materials, Internal Quantum efficiency, Modulation capability, Transient response, Power-Bandwidth product, Laser diodes, Laser diodes modes, Threshold conditions, Resonant frequencies, Laser diode structures, Single mode lasers, modulation of laser diodes, Temperature effects, Light source linearity, Modal, partition, Reflection.

Module-II

Fiber-Optic Detectors: (10 Hours)

Physical principles of photodiodes, PIN photo detector, Avalanche photodiodes, Photo-detector noise, Noise sources, Signal-to-Noise ratio, Detector response time, Depletion layer photo-current, Response time, Avalanche multiplication noise, Temperature effect on avalanche gain.

Module-III

Optical Fibre Connection: (11 Hours)

Joint loss, Multi mode fibre joints, Singe mode fibre joints, Fibre splices, Fusion splices, Mechanical splices, Multiple splices, Fibre connectors, Cylindrical ferrule connectors, Biconical ferrule connections, Double eccentric connectors, Duplex fibre connectors, Expanded beam connectors, Fibre couplers, Three port couplers, Four port couplers, Start couplers, WOM couplers.

Module-IV

Optical Amplification and Integrated Optics: (12 Hours)

Optical amplifiers, Semiconductor laser amplifiers, Fibre amplifiers, Rare earth doped fibre amplifiers, Raman fibre amplifiers, Brillouin fibre amplifiers, Integrated optics, Integrated optical devices, Beam splitters, Directional couplers, switches, Modulators, Periodic structures for filters and injection lasers, Opto-electronic integration, Optical bistability and digital optics, Optical computation.

Reference Books*:*

1. Optical Fiber Communications, - G.Keiser, McGraw Hill.
2. Optical Fiber Communications Principles and Practice, - J.M.Senior, PHI

MEC-112: COMPUTATIONAL INTELLIGENCE: (3-1-0) Credit : 4

Module-I (8 Hours)

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.

Module-II (13 Hours)

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, Non-linear least-square problems, Incorporation of stochastic mechanism.

Derivative-free Optimization:

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

Module-III (7 Hours)

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

Supervised Learning Neural Networks: Preceptrons, Adaline, Back propagation multi layer preceptrons, 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.

Module-IV (15 Hours)

Unsupervised Learning and other Neural Networks: Competitive learning networks, Kohonen self-organizing networks, Learning vector quantization, Hebbian learning, Principal component networks, Hopfield network.

Adaptive Neuro-Fuzzy Inference Systems: ANFIS architecture, Hybrid learning algorithms, Learning methods that cross-fertilize ANFIS and RBNF, ANFIS as universal approximator, Simulation examples, Extensions and advance topics.

Coactive Neuro-Fussy Modeling towards generalized ANFIS: Framework, Neuro functions for adaptive networks, Neuro-Fuzzy spectrum, Analysis of adaptive learning capability.

Reference Books*:*

1. Neuro-Fuzzy and Soft Computing, - J.S.R. Jng, C.T.Sun and E. Mizutani, PHI
2. Neural Networks, Fuzzy Logic and Genetic Algorithms, S. Rajasekaran, G.A.Vijayalaksmi, PHI.

MEC-113: INTERNET TECHNOLOGY: (3-1-0) Credit : 4

Module-I

TCP/ IP: (7 Hours)

TCP/ IP Overview, TCP / IP and Internet, Layers of TCP / IP, Network Layer: Addressing, Sub-netting, concepts of ARP, RARP, ICMP, IGMP. Transport Layer: UDP & TCP, Application Layer: Client server model, BOOTP, DHCP, DNS, TELNET, FTP, SMTP model, HTTP, idea of WWW and CGI.

Module-II

Web Design: (6 Hours)

HTML and Tags, Image, color and background, Image map, style sheet, table, frame, creating hyperlinks and anchors, text formatting tags, Designing forms and controls, DHTML, DHTML object model.

Jave Script and XML: (7 Hours)

Java script, programming overview, detailed of language, server side and client side scripting, example of simple email program, Introduction to XML, XML document syntax, document type definition, example XML technology.

Module-III

Core JAVA: (6 Hours)

JAVA fundamentals, overview of JAVA operators, control statements, introducing classes, inheritance, exception handling, AWT, working with window graphics and text, AWT controls, Layout manager.

Advanced JAVA: (6 Hours)

Introducing threading, advantages, Multi-threading, JAVA and networking, TCP / IP client sockets, Whois, URL, Server sockets, Overview of a caching Proxy HTTP server.

Module-IV

Applets and JDBC: (7 Hours)

Introducing Applets, Architecture of an applet, skeleton, HTML APPLET tag, Event Handling, JDBC, Connecting to a database, transactions and executing SQL query, JDBC interface, Callable and prepared statements, Introducing to swing.

Network Security: (7 Hours)

Network security basics and needs, cryptography, encryption and decryption, Cipher-text, types of cryptography symmetric and asymmetric, RSA algorithm, Digital Signature, Organizational security issues and firewall architecture.

Reference Books*:*

1. Data communication and Networking, - Forouzan.
2. HTML and DHTML, - Laura Leray, SAMS, Techmedia.
3. Complete Reference JAVA, - Naughton Schildt.
4. Web Technologies, - Achyut S Godbole and Atul Kahate.

MEC-114: ADAPTIVE SIGNAL PROCESSING: (3-1-0) Credit : 4

Module-I

Introduction: (3 Hours)

The following problem, Adaptive filters, approaches to adaptive filter theory, classification.

The Adaptive Linear Combiner: (3 Hours)

General description, the performance function, Gradient and minimum MSE, example

The LMS Algorithm: (6 Hours)

Derivation, convergence of the weight vector, learning curve, mis-adjustment. Modified version of LMS algorithm (Complex LMS, NLMS, sign error LMS, sign data LMS, sign-sign LMS, leaky LMS). Filtered-X LMS Algorithm.

Module-II

Frequency-Domain and Sub band Adaptive Filters: (6 Hours)

Block Adaptive Filters (Circular and liner), Fast BLMS algorithm, unconstraint frequency-domain adaptive filters, self-orthogonalizing adaptive filters, sub band adaptive filters.

Module-III

Recursive Least Square (RLS) Algorithm: (7 Hours)

Derivation algorithm and computational complexity, the Fast RLS algorithm.

Algorithm for adaptive HR filtering simple algorithm.

Adaptive Lattice Filter algorithm structure.

Finite precision effects:

Quantization errors, finite precision effects of LMS algorithm. (3 Hours)

Module-IV

Applications of Adaptive Filters: (14 Hours)

Direct Modeling: Adaptive System modeling, Inverse Modeling: Adaptive Channel Equalization, Adaptive Line Enhancement, Adaptive Model Control and Adaptive Inverse Control, Adaptive Interference Cancellation, Adaptive Notch filter, Adaptive High pass filter, cancellation of 60Hz interference in ECG. Application of AF in Heart Transplantation and Fetal Electrocardiography, canceling noise in speech signal, canceling echoes in telephone circuits, Adaptive self tunings filter. Adaptive Antenna Array.

Reference Books*:*

1. Adaptive Filter Theory, - 4th Edition by S. Haykin, Pearson Education.
2. Adaptive Signal Processing, - B. Widrow and S.D. Sterns, Pearson Education.
3. Theory and Design of Adaptive Filters, - J.R. Treichler, C.R. Johnson Jr. and M.G. Larimore, PHI.
4. Adaptive Filters, - C.F.N. Cowan and P.M. Grant, Prentice Hall.

MEC-115: DIGITAL IMAGE PROCESSING: (3-1-0) Credit : 4

Module-I

Digital Image Fundamentals: (5 Hours)

A simple image model, Sampling and Quantization, Imaging geometry, Digital geometry, Image Acquisition Systems, Different types of digital images.

Bi-level Image Processing: (6 Hours)

Basic concepts of digital distances, Distance transform, Medial axis transform, Component labeling, Thinning Morphological processing, Extension to grey scale morphology.

Module-II

Binarisation and Segmentation of Grey level Images: (8 Hours)

Histogram of grey level Images, Optimal thresholding using Bayesian classification, Multilevel thresholding, Segmentation of grey level images, Water shade algorithm for segmentation grey level image.

Detection of edges and lines in 2D Images: (6 Hours)

First order and second order edge operators, Multi-scale edge detection, Canny's edge detection algorithm, Hough transform for detecting lines and curves, Edge linking.

Module-III

Image Enhancement: (6 Hours)

Point processing, Spatial filtering, Frequency domain filtering, Multi-spectral image enhancement, Image restoration.

Color Image Processing: (5 Hours)

Color representation, Laws of color matching, Chromaticity diagram, Color enhancement, Color image segmentation, Color edge detection, Color demosaicing.

Image Restoration and Depth Estimation: (3 Hours)

Registration algorithms, Setreo Imaging, Computation of disparity map.

Module-IV

Image Compression: (7 Hours)

Lossy and lossless compression schemes, Prediction based compression schemes, Vector quantization, Sub-band encoding schemes, JPEG compression standard, Fractal compression scheme, Wavelet compression scheme.

Reference Books:

1. Fundamentals of Digital Image Processing, - A.K.Jain, PHI, 1995.
2. Fundamentals of Electronic Image Processing, - Arthur R.Weeks, Jr., PHI.
3. Digital Image Processing and Analysis, - B.Chanda, D.Dutta Majumadar, PHI.
4. Digital Image Processing,- Rafael C.Gonzalez, Richard E. Woods, Pearson Education.

MEC-116: EMBEDDED SYSTEMS: (3-1-0) Credit : 4

Module-I

Introduction: (6 Hours)

An Embedded system, Processor in the system, Other hardware MODULEs, Software embedded into a system, Exemplary embedded systems, Embedded System-on-chip (SOC) and in VLSI circuit.

Devices and Device Drivers: (10 Hours)

I/O Devices, Timer and counting devices, Serial communication using the 'I^2C', 'CAN' and advanced I/O buses between the networked multiple devices, Host system or computer parallel communication between the networked I/O multiple devices using the ISA, PCI, PCI-X and advanced buses, Device drivers, Parallel port device drivers in a system, serial port device drivers in a system, Interrupt servicing (Handling) mechanism.

Module-II

Software and Programming Concept: (8 Hours)

Processor selection for an embedded system, Memory selection for an embedded system, Embedded programming in C++, Embedded programming in Java, Unified Modeling Language (UML), Multiple processes and application, Problem of sharing data by multiple tasks and routines, Inter process communication.

Module-III

Real Time Operating System: (6 Hours)

Operating system services, I/O subsystems, Network operating systems, Real-Time and embedded system operating systems, Need of a well tested and debugged Real-Time Operating System (RTOS), Introduction to MC/OS-II.

Module-IV

Case Studies of Programming with RTOS: (11 Hours)

Case study of an embedded system for a smart card.

Hardware and Software Co-design: Embedded system project management, Embedded system design and co-design issues in system development process, Design cycle in the development phase for an embedded system, Use of software tools for development of embedded system, Issues in embedded system design.

Reference Books:

1. Embedded Systems-Architecture, Programming and Design – Raj Kamal, TMH New Delhi.
2. Hardware Software Co-design of Embedded Systems – Ralf Niemann, Kluwer Academic.
3. Design Principles of Distributed Embedded Applications – Hermann Kopetz, Kluwer Academic.
4. Embedded Real-Time Systems Programming – Sriram V. Iyer & Pankaj Gupta, TMH.

MEC-195: Telecommunication System Engineering Lab – II: (0-0-3) Credit: 2

1) Simulation of error sources in digital channel.
2) Channel Simulation.
3) Protocol Analysis.
4) Rake Receiver.
5) Two experiment on Satellite Communication System.
6) One experiment on Optical Communication System.

MEC-196: Wireless and Fibre Optic Communication Lab : (0-0-3) Credit: 2

A) **Wireless Communication (Any Four)**

1) Simulation of larger scale path loss.
2) Simulation of small scale fading and multi-path (Any one model).
3) Simulation of QPSK transmitter and receiver.
4) Simulation of DS spread spectrum transmitter and receiver.
5) Simulation of channel Equalizer for mobile channel.
6) Simulation of Read-Solomon or Turbo and Trellis codes.

B) **Fiber Optic (Any Four)**

1) Fiber to Fiber Coupling Loss.
2) Measurement of Connector Loss.
3) Fiber bending Loss.
4) Fiber Optic Analog Link.
5) Fiber optic digital ling.
6) Intensity modulated fiber pressure sensor.