KONGU ENGINEERING COLLEGE, PERUNDURAI, ERODE – 638 052
(Autonomous Institution affiliated to Anna University of Technology, Coimbatore)

M.E. DEGREE IN COMMUNICATION SYSTEMS (FULL TIME)

CURRICULUM

(For the candidates admitted from academic year 2011 – 12 onwards)

SEMESTER - I

Course Code	Course Title	Hours / Week			Credit	Maximum Marks		
		L	T	P		CA	ESE	Total
	THEORY							
11VL101	Applied Mathematics for Electronic Engineers	3	1	0	4	50	50	100
11AE102	Advanced Digital Signal Processing	3	1	0	4	50	50	100
11CO101	Advanced Antenna Systems	3	0	0	3	50	50	100
11CO102	Advanced Digital Communication Techniques	3	1	0	4	50	50	100
11CO103	Optical Networks	3	0	0	3	50	50	100
11CO104	Transform Techniques	3	0	0	3	50	50	100
	PRACTICAL							
11CO105	Communication System Design Laboratory	0	0	4	2	100	0	100
				Total	**23**			

CA – Continuous Assessment, ESE – End Semester Examination

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M.E. DEGREE IN COMMUNICATION SYSTEMS (FULL TIME)

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(For the candidates admitted from academic year 2011 – 12 onwards)

EMESTER - II

Course Code	Course Title	Hours / Week			Credit	Maximum Marks		
		L	T	P		CA	ESE	Total
	THEORY							
11CO201	Advanced Wireless Communication Networks	3	0	0	3	50	50	100
11CO202	RF System Design	3	0	0	3	50	50	100
11CO203	Digital Communication Receivers	3	0	0	3	50	50	100
11CO204	Advanced Microwave Communication	3	0	0	3	50	50	100
	Elective-I	3	0	0	3	50	50	100
	Elective-II	3	0	0	3	50	50	100
	PRACTICAL							
11CO205	RF Communication Systems Laboratory	0	0	4	2	100	0	100
11CO206	Wireless Communication and Network System Laboratory	0	0	4	2	100	0	100
				Total	**22**			

CA – Continuous Assessment, ESE – End Semester Examination

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M.E. DEGREE IN COMMUNICATION SYSTEMS (FULL TIME)

CURRICULUM

(For the candidates admitted from academic year 2011 – 12 onwards)

SEMESTER - III

Course Code	Course Title	Hours / Week			Credit	Maximum Marks		
		L	T	P		CA	ESE	Total
	THEORY							
	Elective - III	3	0	0	3	50	50	100
	Elective – IV	3	0	0	3	50	50	100
	Elective - V	3	0	0	3	50	50	100
	PRACTICAL							
11CO301	Project Work – Phase- I	0	0	12	6	50	50	100
				Total	**15**			

CA – Continuous Assessment, ESE – End Semester Examination

SEMESTER - IV

Course Code	Course Title	Hours / Week			Credit	Maximum Marks		
		L	T	P		CA	ESE	Total
	PRACTICAL							
11CO401	Project Work – Phase- II	0	0	24	12	100	100	200
				Total	**12**			

CA – Continuous Assessment, ESE – End Semester Examination

LIST OF ELECTIVES

Course Code	Course Title	L	T	P	C
11CO011	CDMA Engineering	3	0	0	3
11CO012	Global Positioning System	3	0	0	3
11CO013	Mobile Ad-Hoc Networks	3	0	0	3
11CO014	Advanced Soft Computing Techniques	3	0	0	3
11CO015	Advanced Digital Image Processing Techniques	3	0	0	3
11CO016	Telecommunication System Modeling and Simulation	3	0	0	3
11CO017	Advanced Satellite Communication	3	0	0	3
11CO018	Principles of Remote Sensing	3	0	0	3
11CO019	Microwave Integrated Circuits	3	0	0	3
11CO020	Speech Processing	3	0	0	3
11CO021	Multicarrier Communications	3	0	0	3
11CO022	Spread Spectrum Communication	3	0	0	3
11CO023	Advanced Communication Networks	3	0	0	3
11CO024	Wireless Systems and Standards	3	0	0	3
11CO025	RF MEMS for Wireless Communication	3	0	0	3
11MS204	Network Security	3	0	0	3
11AE015	Electromagnetic Interference and Compatibility in System Design	3	0	0	3
11CN012	Wireless Sensor Networks	3	0	0	3
11CN017	Network Routing Algorithms	3	0	0	3
11CN019	Multimedia Compression Techniques	3	0	0	3
11CO026	Data Hiding Techniques	3	0	0	3

11VL101 APPLIED MATHEMATICS FOR ELECTRONIC ENGINEERS

(Common to VLSI Design, Communication System & Computer and Communication Engineering Branches)

3 1 0 4

Objective:

On completion of the course the students are expected

- To understand the numerical techniques of linear algebraic equations and solution of boundary value problem using Laplace Transforms.
- To know the properties and applications of Special functions.
- To understand the basic concepts and properties of random variables and queuing theory.

MODULE – I **15**

Numerical Methods: System of equations- Solution by Gauss Elimination, Gauss-Jordan and LU decomposition method- Jacobi, Gauss-Seidal iteration method- Eigen values of a matrix by Jacobi and Power method.

Wave Equation: Solution of initial and boundary value problems- Characteristics- D'Alembert's Solution - Laplace transform solutions for displacement in a long string - a long string under its weight - a bar with prescribed force on one end.

MODULE– II **15**

Bessel Functions : Bessel's equation - Bessel Functions- Series Representation of Bessel functions – Recurrence relations of Bessel functions – Generating function – Jacobi series – Orthogonal property for Bessel functions

Legendre Polynomials: Legendre's equation - Legendre polynomials -Rodrigue's formula - Recurrence relations- Generating functions – Orthogonal property for Legendre polynomials – Expansion of an arbitrary function in a series of Legendre polynomials.

MODULE–III **15**

Random Variables: One dimensional Random Variable - Moments and MGF – Binomial, Poisson, Geometrical, Normal Distributions- Two dimensional Random Variables – Marginal and Conditional Distributions – Covariance and Correlation Coefficient.

Queuing Theory: Single and Multiple server Markovian queueing models - Steady state system size probabilities – Little's formula – Priority queues – M/G/1 queueing system – P.K. formula.

Lecture: 45, Tutorial: 15, TOTAL: 60

REFERENCE BOOKS

1. Kapur, J.N. and Saxena, H.C., "Mathematical Statistics", S.Chand & Co., New Delhi, 2007.
2. Grewal, B.S. "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 2007.
3. Sankara Rao, K. "Introduction to Partial Differential Equation", Prentice Hall of India, New Delhi, 1995.
4. Taha, H.A., "Operations Research- An Introduction", 6th Edition, Prentice Hall of India, New Delhi, Reprint 2010.
5. Jain, M.K., Iyengar, S.R.K. and Jain, R.K., "Numerical Methods for Scientific and Engineering Computation", New Age International (P) Ltd, Publishers, New Delhi, 2008.

11AE102 ADVANCED DIGITAL SIGNAL PROCESSING

(Common to M.E. Applied Electronics, Communication Systems, Power Electronics, Control and Instrumentation, Computer and Communication)

3 1 0 4

Objective:

- To introduce the concept of discrete random signal processing.
- To understand the spectrum estimation and analysis using parametric and non-parametric approach.
- To estimate the signal by linear prediction.
- To study the concepts of adaptive filter and various error minimization algorithm.
- To understand the concepts of multirate digital signal processing.

MODULE – I **15**

Discrete Random Signal Processing: Discrete time random process – Random process: Ensemble averages- Gaussian process – stationary process – The autocovariance and autocorrelation metrices – ergodicity – white noise the power spectrum. Filtering random process – spectral factorization. Parseval's theorem – Wiener Khintchine relation.

Spectrum Estimation and Analysis: Non parmetric methods: Periodogram, performance of periodogram, modified periodogram, Bartlett's method, Welch's method.

MODULE - II **15**

Parametric methods: AR model – Yule-Walker method, MA model – ARMA model.

Linear Prediction: Forward and backward linear predictions, Solution of the normal equations – Levinson-Durbin algorithms. Least mean squared error criterion – The FIR Wiener filter – filtering – linear prediction and The IIR Wiener filters – Non causal IIR Wiener filter – the causal IIR Wiener filter.

Adaptive Filter: Concepts of adaptive filter – FIR adaptive filters – LMS algorithm – Applications: Noise cancellation

MODULE -III **15**

Adaptive Filter: Adaptive recursive filers– AR lattice structure and ARMA process, lattice – ladder filters.

Multirate Digital Signal Processing: Mathematical description of sampling rate – Interpolation and Decimation by integer factor – Sampling rate conversion by rational factor- Filter design for sampling rate conversion; direct form FIR structures, Polyphase structures, time-varient structures. Multistage implementation of sampling rate conversion. Applications – Subband coding of speech signals.

Lecture : 45, Tutorial : 15, TOTAL : 60

REFERENCE BOOKS

1. Hayes, Monson H. "Statistical Digital Signal processing and Modeling", John Wiley and Sons, Inc., 1996.
2. Proakis, John G. and Manolakis, Dimitris G. "Digital Signal Processing: Principles Algorithms and Applications", PHI, 2006.
3 Ifeachor, Emmanuel C. and Jervis, Barrie N. "Digital Signal Processing: A Practical Approach", Addison-Wesley Publishing Company, 2002.
4 George Box, Gwilym M. Jenkins, Gregory Reinsel, "Time Series Analysis: Forecasting & Control", 3rd Edition,

11CO101 ADVANCED ANTENNA SYSTEMS

3 0 0 3

Objective:

- To measure the fundamental parameters of antennas
- To understand about the radiation from apertures with the field equivalence principles
- To design various array antenna structures
- To analyse EMC measurements of antennas.

MODULE - I **15**

Antenna Fundamentals and Measurements: Antenna fundamental parameters; Radiation integrals, Radiation from surface and line current distributions – dipole, monopole, loop antenna; Mobile phone antenna- base station, hand set antenna; Image; Induction, reciprocity theorem, Broadband antennas and matching techniques, Balance to unbalance transformer, Introduction to numerical techniques. Antenna measurement and instrumentation – Gain, Impedance and antenna factor measurement; Antenna test range Design, Concept of EMC measuring antenna.
Tx and Rx antenna factors; Log periodic dipole, Bi-conical, Ridge guide, Multi turn loop

MODULE - II **15**

Radiation From Apertures and Microstrip Antennas: 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 considerations.
Radiation Mechanism and Excitation techniques : Microstrip dipole; Patch ,Rectangular patch, Circular patch, and Ring antenna – radiation analysis from cavity model; input impedance of rectangular and circular patch antenna

MODULE - III **15**

Array Antenna and Microstrip Array: Linear array –uniform array, end fire and broad side array, gain, beam width, side lobe level; Two dimensional uniform array; Phased array, beam scanning, grating lobe, feed network,; Linear array synthesis techniques – Binomial and Chebyshev distributions.
Microstrip array and feed network; Application of microstrip array antenna.

TOTAL : 45

REFERENCE BOOKS

1 Balanis.A, "Antenna Theory Analysis and Design", John Wiley and Sons, New York, 3rd Edidtion 2011
2 Krauss.J.D, "Antennas", II edition, John Wiley and sons, New York, Reprint 2011
3 Bahl.J and Bhartia.P," Microstrip Antennas",Artech House,Inc.,1997
4 Stutzman W.L and Thiele G.A,"Antenna Theory and Design", John Wiley& Sons Inc, 2nd edition, 2005
5 Prasad K. D, "Antennas and Wave Propagation", Tech India Publications, New Delhi, 2009

11CO102 ADVANCED DIGITAL COMMUNICATION TECHNIQUES

3 1 0 4

Objective :

- To analyze various modulation techniques
- To explore various applications of OFDM modulation
- To study and analyse various coding techniques used in communication systems

MODULE - I **15**

Constant Envelope Modulation and Trellis Coded Modulation: Advantages of Constant Envelope Modulation; Binary Frequency Shift Keying-Coherent and Non-coherent Detection of BFSK; Minimum Shift Keying-; Gaussian Minimum Shift Keying; M-ary Phase Shift Keying; M-ary Quadrature Amplitude Modulation; M-ary Frequency Shift Keying.

Coded modulation for bandwidth-constrained channels-Trellis coded modulation; Set Partitioning, Four –state Trellis-coded modulation with 8-PSK signal constellation, Eight-state Trellis code for coded 8-PSK modulation, Eight-state Trellis for rectangular QAM signal constellations.

MODULE - II **15**

OFDM Modulation: Generation of sub-carriers using the IFFT; Guard Time and Cyclic Extension; Windowing; OFDM signal processing; Peak Power Problem: PAP reduction schemes-Clipping, Filtering, Coding and Scrambling.

MODULE - III **15**

Turbo Coding and Space-Time Coding: Introduction-Turbo Encoder, Turbo Decoder, Iterative Turbo Decoding Principles; Modifications of the MAP Algorithm-The Soft-Output Viterbi Algorithm(SOVA); Turbo Coded BPSK Performance over Gaussian channels, Turbo Coding Performance over Rayleigh Channels.

Maximum Ratio combining; Space-time Block codes; Space-time Trellis codes-The 4-state, 4-PSK Space-time Trellis Encoder, The 4-state,4-PSK Space-time Trellis Decoder, MIMO-OFDM Systems.

Lecture : 45, Tutorial : 15, TOTAL : 60

REFERENCE BOOKS

1. Bernard Sklar., 'Digital Communications', second edition, Pearson Education,2001.
2. John G. Proakis., 'Digital Communication', 4 th edition, Mc Graw Hill Publication, 2001
3. Richard Van Nee & Ramjee Prasad., 'OFDM for Multimedia Communications' Artech House Publication,2001.
4. Theodore S.Rappaport., 'Wireless Communications', 2nd edition, Pearson Education, 2002.
5. Stephen G. Wilson., 'Digital Modulation and Coding', First Indian Reprint ,Pearson Education, 2003.

11CO103 OPTICAL NETWORKS

3 0 0 3

Objective:

- To have a detailed understanding of various components of fiber optic networks
- To have a knowledge on optical network management
- To understand the principles of wavelength routing and the concepts of OTDM in fiber optic networking.

MODULE - I **15**

Optical System Components and Network Design: Optical System Components – Couplers, Isolators & Circulators, Multiplexers and Filters, Optical Amplifiers, Transmitters, Detectors, Switches, Wavelength converters; Transmission System Engineering – System Model, Power Penalty, Transmitter, Receiver, Optical amplifiers, Crosstalk, Dispersion, Fiber Non-linearities, Wavelength Stabilization, Overall design considerations

MODULE - II **15**

Optical Network Architecture and Management: Introduction to Optical Networks; SONET / SDH, Layered Architecture, Broadcast and Select Networks, IP, MAC Protocols and Test beds.
Control and Management – Network management functions, Configuration management, Performance and Fault management, Optical safety; Network Survivability – Protection in SONET / SDH and IP Networks, Optical Layer Protection, Internetworking between layers

MODULE - III **15**

Wavelength Routing and Packet Switching: WDM Network Elements; WDM Network Design – Cost trade-offs, LTD and RWA, Dimensioning Wavelength-Routing Network, Statistical Dimensioning models; Photonic Packet Switching – OTDM, Multiplexing and De-multiplexing, Synchronization, Header Processing, Buffering, Burst Switching, Test beds; Access Networks.

TOTAL : 45

REFERENCE BOOKS

1. Rajiv Ramaswami and Kumar N.Sivarajan, “Optical Networks: A Practical Perspective”, Harcourt Asia Pte Ltd., Second Edition 2006.
2. Siva Rama Moorthy C and Mohan Gurusamy, “WDM Optical Networks: Concept Design and Algorithms”, PHI, 1st Edition 2002.
3. Biswanath Mukherjee, “Optical WDM Networks”, Springer, 2006.
4. Keiser Gerd., “Optical Fiber Communication”, Fourth Edition, Tata McGraw-Hill, New Delhi, 2009
5. Franz and Jain, “Optical Communication System”, Narosa Publications, New Delhi, 2001.

11CO104 TRANSFORM TECHNIQUES

3 0 0 3

Objective:

- To obtain knowledge about various transforms
- To know the necessity of transform techniques in different area of communication.
- To study and analyse various applications of transform techniques in communication systems.

MODULE - I **15**

Orthogonal Functions: Orthogonal signal spaces, approximations of functions by a set of mutually orthogonal functions, Orthogonality in complex functions, trigonometric & exponential Fourier series, Hilbert Transforms, Properties and its applications in communication..

Two dimensional Fourier Transforms and its applications: Concept of two dimensional Fourier transforms – properties & their significance, energy & power spectral density functions.

MODULE - II **15**

Two Dimensional Transforms and its Applications: Two Dimensional Transforms And Its Applications – I: Walsh transforms, Hadamard transform, Discrete Cosine Transforms, Haar Transform, Transform based lossy and lossless compression, implementing in CDMA & WCDMA

Two dimensional Transform and its applications – II: Slant, KL transforms, Hough Transforms, Radon Transforms. Short time Fourier transforms & properties of STFT.

MODULE - III **15**

Continuous Wavelet Transforms: CWT - inverse CWT, Introduction to Discrete Wavelet Transform & orthogonal wavelet decomposition.

Multi-resolution analysis (MRA), Two scale relations, Orthogonal wavelets, their relationships to filter banks, PR, QMF filter banks, applications

TOTAL : 45

REFERENCE BOOKS

1. Lathi B.P, “Signals & Systems”, BS Publishers 1/e, 2004
2. Raghuveer.M.Rao, Ajit S Bopardikar “Wavelet transforms-introduction to theory & applications”, Pearson education, Asia.
3. Anil.K.Jain, “Fundamentals of Digital Image processing” 2/e, Pearson.
4. Gonzalez.C& Redwoods “Digital Image Processing”, 1/e 2001
5. Jaideva C.Goswami, Andrew K.Chan, “Fundamentals of wavelets-Theory, Algorithms & applications”, John Willey & Sons.

11CO105 COMMUNICATION SYSTEM DESIGN LABORATORY

0 0 4 2

Objective:

- To design and implement the various coding techniques and the advanced modulation techniques used in Communication systems.
- To analyze the characteristics of wireless channel and equalization techniques

LIST OF EXPERIMENTS

1. Design and performance analysis of error control encoder and decoder (CRC, Convolutional Codes)
2. Determination of Maximum bit rate of a digital fiber optic link
3. Signal transmission and reception using WDM and spectral characterization
4. Wireless Channel estimation and characterization
5. Design and analysis of digital communication techniques on an SDR platform
6. Simulation of OFDM transceiver design
7. Simulation of Channel equalizer design (LMS, RLS)
8. Design and Analysis of Spectrum Estimators (Bartlett , Welch)
9. Simulation of MIMO systems
10. Simulation of Turbo coding and SOVA
11. Data Compression

Software :
MATLAB

11CO201 ADVANCED WIRELESS COMMUNICATION NETWORKS

3 0 0 3

Objective:

- To understand the characteristics of wireless medium and wireless network fundamentals.
- To know the various techniques and standards of wireless communication
- To analyse the features of wireless LAN,PAN,WAN networks.

MODULE - I **15**

Characteristics of Wireless Medium: Introduction, Radio propagation mechanism, path loss Modeling and Signal Coverage, Effects of Multipath and Doppler, Considerations in the design of Wireless Radio communication; Medium Access Alternatives: Fixed assignment for voice oriented networks, Random Access for data oriented networks, Integration of voice and data traffic.

MODULE - II **15**

Wireless Network Fundamentals: Principle of Wireless network operation: wireless network topologies, Cellular topology, Cell fundamentals, Signal to interference ratio calculation and Capacity expansion techniques, Network planning for CDMA system, Mobility management, Radio resources and power management, security in wireless networks

Wirless WANs – Communication in the infrastructure, GSM, CDMA, IMT 2000, The data oriented CDPD Network, GPRS and High data rates, Short message service in GSM, Mobile Application Protocols.

MODULE - III **15**

Wireless LANs and Adhoc Networks: Introduction to wireless LANs - IEEE 802.11 WLANs - Physical Layer- MAC sublayer- MAC Management Sublayer- Wireless ATM - HIPERLAN- HIPERLAN-2, WiMax IEEE 802.15 WPAN – Home RF, Bluetooth, Zigbee, Wireless Geolocation system 4G features and challenges, 4G technologies, Advanced Broadband Wireless Access and Services.

TOTAL: 45

REFERENCE BOOKS

1. Kaveh Pahlavan,. K. Prashanth Krishnamuorthy, "Principles of Wireless Networks", Prentice Hall of India, 2006.
2. Leon Garcia, Widjaja, “Communication Networks”, Tata McGraw Hill, New Delhi 2000.
3. William Stallings, "Wireless Communications and networks" Pearson / Prentice Hall of India, 2nd Ed., 2007.
4. Rappaport T.S, “Wireless Communications: Principles and Practice”, Second Edition, Pearson Education/ Prentice Hall of India, New Delhi, 2003.
5. Lee William C.Y, “Wireless and Cellular Telecommunications:, Third Edition, Tata McGraw-Hill, New Delhi, 2005.

11CO202 RF SYSTEM DESIGN

3 0 0 3

Objective:

- To understand the importance of CMOS technology in designing RF receivers.
- To design RF amplifiers, oscillators and mixers used in RF transceivers.
- To know the role of feedback in RF power amplifiers and oscillators.

MODULE - I **15**

CMOS Physics, Transceiver Specifications and Architectures: CMOS: Introduction to MOSFET Physics – Noise: Thermal, shot, flicker, popcorn noise Transceiver Specifications: Two port Noise theory, Noise Figure, THD, IP2, IP3, Sensitivity, SFDR, Phase noise , Specification distribution over a communication link, Transceiver Architectures: Receiver- Homodyne, Heterodyne, Image reject, Low IF Architectures , Transmitter: Direct upconversion, Two step upconversion
S-parameters with Smith chart ,Passive IC components ,Impedance matching networks

MODULE - II **15**

Feedback Systems and Power Amplifiers: Feedback Systems: Stability of feedback systems, Gain and phase margin, Root-locus techniques , Time and Frequency domain considerations , Compensation.
Amplifiers: Common Gate, Common Source Amplifiers – OC Time constants in bandwidth estimation and enhancement , High frequency amplifier design
Low Noise Amplifiers: Power match and Noise match , Single ended and Differential LNA , Terminated with Resistors and Source Degeneration LNA.
Power Amplifiers: General model – Class A, AB, B, C, D, E and F amplifiers ,Linearisation Techniques Efficiency boosting techniques, ACPR metric , Design considerations

MODULE - III **15**

Frequency Synthesizers and Mixers: PLL: Linearised Model , Noise properties , Phase detectors ,Loop filters and Charge pumps Frequency Synthesizers: Integer-N frequency synthesizers , Direct Digital Frequency synthesizers
Oscillators: Describing Functions, Colpitts oscillators , Resonators ,Tuned Oscillators , Negative resistance oscillators , Phase noise
Mixer: characteristics , Non-linear based mixers, Quadratic mixers , Multiplier based mixers, Single balanced and double balanced mixers , sub sampling mixers

TOTAL: 45

REFERNCE BOOKS

1. Thomas.H..Lee, “Design of CMOS RF Integrated Circuits”, Cambridge University press, 2004
2. Razavi B, “RF Microelectronics”, Pearson Education, 1997
3. Jan Crols, Michiel Steyaert, “CMOS Wireless Transceiver Design”, Kluwer Academic Publishers, 1997
4. Razavi B, “Design of Analog CMOS Integrated Circuits”, McGraw Hill, 2001.
5 Qizheng, Gu , “RF system design of transceivers for wireless communications”, New Age International, 2005

11CO203 DIGITAL COMMUNICATION RECEIVERS

3 0 0 3

Objective:

- To be familiar with the various receiver architectures used in digital communication.
- To understand the synchronization and various equalization techniques used in communication systems.
- To analyse and optimize the performance of receivers.

MODULE - I **15**

PLL Tracking, Acquisition and Control: Phase detectors, multiplier type phase detector; PLL tracking performance: phase detector in the presence of AWGN, effect of oscillator phase noise, optimization – unaided and aided acquisition: phase acquisition and frequency acquisition. Amplitude control - limiters, AGC circuits, AGC loop; Frequency control - structure of frequency detectors, optimal frequency estimator.

Complex envelope representation of deterministic and random signals, bandlimited signals, sampling of bandpass signals, fundamentals of estimation theory, introduction to digital baseband communication

MODULE - II **15**

Optimum Receivers for AWGN channel and Fading channel: Correlation demodulator, matched filter, maximum likelihood sequence detector; Optimum receiver for CPM signals, Optimum receiver for signals with random phase.

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

MODULE - III **15**

Synchronization Techniques and Adaptive Equalization: Carrier and signal synchronization, carrier phase estimation-PLL, Decision directed loops, symbol timing estimation, maximum likelihood and non-decision directed timing estimation, joint estimation

Optimum ML receiver for bandlimited channels, MSE equalizer, Zero forcing algorithm, LMS algorithm, adaptive decision-feedback equalizer and Equalization of Trellis-coded signals. Kalman algorithm, Blind equalizers and Stochastic gradient algorithm.

TOTAL : 45

REFERENCE BOOKS

1 John.G.Proakis, “Digital communication “4th Edition, McGraw-Hill, New York, 2001.
2 Simon M.K, Hinedi S.M and Lindsey Acirc W.C, “Digital Communication Techniques”, Prentice Hall of India, 1998.
3 Heinrich Meyer, Mare Moeneclacy, Stefan.A.Fechtel, “Digital Communication Receivers ",Vol I & Vol II, John Wiley, New York, 1997.
4 Lee E.A and Messerschmitt D.G, “Digital communication ", 2nd Edition, Allied Publishers, New Delhi, 1994.
5 Simon Marvin, “Digital communication over fading channel; An unified approach to performance Analysis ", John Wiley, New York, 2000.

11CO204 ADVANCED MICROWAVE COMMUNICATION

3 0 0 3

Objective:

- To review various microwave components.
- To analyse impedance matchning techniques
- To understand various microwave systems.

MODULE - I **15**

Microwave Components: Scattering matrix, Theory and Design of Ferromagnetic components: Basic properties of Ferrimagnetic materials, Plane wave propagation in a Ferrite medium, Ferrite Isolators, Ferrite Phase Shifters, Ferrite Circulators, Mixers, Power Dividers: Basic properties of Dividers and Couplers – T junction power divider, Electronically controlled phase shifters and attenuators

MODULE - II **15**

Impedance Matching And Filters: Impedance Matching And Tuning**:** Matching with Lumped Elements, Single-stub Tuning, Double-stub Tuning, The Quarter-wave Transformer – Microwave Resonators: Series and Parallel Resonant Circuits, Transmission Line Resonators. Microwave filters: Periodic Structures, Filter Design by the Insertion Loss Methods

MODULE -III **15**

Microwave Systems: System aspects of antennas, Wireless communication systems, Microwave propagation, Radar Systems, Detection of Signals in noise- matched filter receiver, detection criteria, Information from Radar Signals –Basic Radar measurements, Theoretical accuracy of Radar measurements, Propagation of Radar Waves- Forward Scattering from a flat earth, Scattering from the Round Earth's surface, Atmospheric refraction, Diffraction.

TOTAL : 45

REFERENCE BOOKS

1 David M Pozar, "Microwave Engineering", Third Edition John Wiley and Sons, Inc., 2005.
2 Collin R E, "Foundations Microwave Engineering", McGraw Hill International Education, 1992.
3 Merrill I.Skolnik, "Introduction to Radar Systems ",Tata McGraw Hill Education, New Delhi 2001

11CO205 RF COMMUNICATION SYSTEMS LABORATORY

0 0 4 2

Objective:

- To analyze and evaluate the performance of various components / elements of RF communication.
- To learn the performance of various networking protocols

LIST OF EXPERIMENTS

1. Transmission line parameters – Measurement using Network Analyser
2. Design and characterization of Antennas using ADS/IE3D/HFSS
3. Spectral Characterisation of communication signals (using Spectrum Analyzer)
4. LNA / Mixer / VCO design and characterization using ADS/IE3D/HFSS
5. Design and budget analysis of communication links using ADS/IE3D/HFSS
6. Study of a RF link
7. Design of AM transceivers
8. Design of FM transceivers
9. Design of Optimal Receiver-Matched filter techniques / Coherent receiver
10. Simulation of trellis coded modulation and demodulation
11. Design and simulation of dual band / multiband antennas
12. Estimation and removal of carrier frequency offset / carrier phase offset in OFDM

Software :
MATLAB
ADS

11CO206 WIRELESS COMMUNICATION AND NETWORK SYSTEMS LABORATORY

0 0 4 2

Objective:

- To estimate and analyze the performance of various detection techniques.
- To obtain knowledge about the designing of transceivers
- To analyze the cellular networks and signal propagation

LIST OF EXPERIMENTS

1 Signal power levels, Data Rates, Routing Protocols, Antenna Weighting, Link Scheduling, and Weak Performance of Network Components for Sensor Networks –IEEE 802.15.4 (Zigbee).
2 Modeling of GSM Cellular Networks.
3 Satellite Modeling and Ground Station design Using Emulator.
4 Propagation Model analysis for Indoor, Urban, Suburban, and Forested terrain effects.
5 Study of ZIGBEE / Bluetooth.
6 Simulation and performance evaluation of entity mobility models using GLOMOSIM / NS2
7 Simulation and performance evaluation of Ad-hoc routing protocols using GLOMOSIM / NS2
8 Simulation and performance evaluation of Wireless MAC protocols using GLOMOSIM / NS2
9 Simulation and performance evaluation of Wi –Fi LAN
10 Simulation and performance evaluation of Wi max
11 Simulation and performance evaluation of GPRS / GSM

Software:
NS2
EXATA Emulator

11CO011 CDMA ENGINEERING

3 0 0 3

Objective:

- To be familiar with fundamentals of CDMA
- To know about various techniques used in WCDMA and MC-CDMA
- To understand the concepts used in optical CDMA.

MODULE - I **15**

Fundamentals of CDMA and IS-95: Spread spectrum communication techniques (DS-CDMA, FH-CDMA), Synchronization in CDMA system, Detection and False alarm probabilities, Early-Late gate measurement statistics, Information capacity of Spread Spectrum Systems.
Spreading Codes in IS-95, Power control, Handover techniques, Physical and logical channels and processing (Forward and reverse links)

MODULE - II **15**

WCDMA and MC-CDMA: Introduction to IMT 2000, CDMA 2000 - Physical layer characteristics, modulation & demodulation process , Handoff and power control in 3G systems.
Multicarrier CDMA, System design, Performance parameters – BER lower bound, Multiuser detection, UTRA, FDD and TDD systems.

MODULE - III **15**

Optical CDMA: Prime Codes and it's properties, Generalized and Extended Prime Codes, Experimental demonstration of Optical CDMA, Synchronization of Optical CDMA networks, Multiwavelength Optical CDMA networks.

TOTAL : 45

REFERENCE BOOKS

1. John G.Proakis, "Digital Communications", Fourth Edition, McGraw Hill International Ltd, Singapore, 2001.
2. Andrew J. Viterbi, "CDMA: Principles of Spread Spectrum Communication", First Edition, Addison - Wesley, 1995.
3. Kaveth Pahlavan,. And K. Prashanth Krishnamuorthy, "Principles of Wireless Networks", Prentice Hall of India, 2006.
4. Vijay Kumar Garg, "IS –95 CDMA and CDMA 2000: Cellular/PCS Systems Implementation", Second Edition, Pearson Education , 2003.
5. Andreas F. Molisch, "Wireless Communication", Wiley India, 2006.
6. Raymond Steele, Chin-Chun Lee, Peter Gould, "GSM CDMA One and 3G Systems", Wiley India, 2004.
7. Guu-Chang Yang, "Prime Codes with Application to Optical and Wireless Networks", Artech House, Inc., 2002.

11CO012 GLOBAL POSITIONING SYSTEMS

3 0 0 3

Objective:

- To develop a strong foundation in the field of Global Positioning Systems.
- To gain knowledge about working of Global positioning receivers.
- To analyse various errors occurring in GPS
- To understand the concepts advanced variant DGPS receivers

MODULE - I **15**

Introduction: GPS and GLONASS - GALILEO Satellite System – COMPASS - Indian Regional Navigation Satellite System Overview - Differential and Augmented GPS, Applications, Fundamentals of Satellite and Inertial Navigation - Navigation Systems Considered, Fundamentals of Inertial Navigation, Satellite Navigation, Time and GPS, User Position Calculations with No Errors, User Velocity Calculation with No Errors -Signal Characteristics and Information Extraction - GPS Signal Components, Purposes and Properties, Signal Power Levels, Signal Acquisition and Tracking, Extraction of Information for Navigation Solution, Theoretical Considerations in Pseudo range and Frequency, Estimation, Modernization of GPS..

MODULE - II **15**

Receiver and Antenna Design and GPS Data Errors: Receiver Architecture, Receiver Design Choices, Antenna Design; Data errors - Selective Availability Errors, Ionospheric Propagation Errors, Tropospheric Propagation Errors, The Multipath Problem, How Multipath Causes Ranging Errors, Methods of Multipath Mitigation,Theoretical Limits for Multipath Mitigation, Ephemeris Data Errors, Onboard Clock Errors, Receiver Clock Errors, Error Budgets; Inertial Navigation - Inertial Sensors, Navigation Coordinates, System Implementations, System-Level Error Models

MODULE - III **15**

Differential GPS and Applications of GNSS: Introduction of Kalman Filter in GPS, GPS Receiver Example, GPS/INS Integration Architectures Differential GPS – Introduction, LADGPS, WADGPS, and WAAS, GEO Uplink Subsystem (GUS), GEO Uplink Subsystem (GUS), Clock Steering Algorithms, GEO Orbit Determination Applications of GNSS - Civil Navigation Marine Navigation-Air Navigation-Land Navigation Applications of GNSS- GNSS in Surveying, Mapping, and Geographical Information Systems, Government and Military Applications

TOTAL : 45

REFERENCE BOOKS

1 Mohinder S.Grewal , Lawrence R.Weill, Angus P.Andrews, "Global positioning systems - Inertial Navigation and Integration", John wily & sons, 2001

2 Kaplan E.D, "Understanding GPS Principles and Applications", Artech House Boston 1996

3 Hoffman B, Wellenhof,H.Lichtenegger and Collins J,"GPS: Theory and Practice ".4th revised edition,Springer,Wein,New york,1997

4 Leick A,"GPS Satelite Surveying",2nd edition,John Wiley & Sons,NewYork,1996

5 Parkinson B, Spilker,J.(Eds),"GPS:Theory and Applications",Vol.I & Vol.II,AIAA,370 L'Enfant

11CO013 MOBILE AD-HOC NETWORKS

3 0 0 3

Objective:

- To gain knowledge about wireless Adhoc networks and its various layer protocols.
- To study various security attacks and QoS in Adhoc networks.
- To have an overview of Energy management and integration of Adhoc networks

MODULE – I **15**

Introduction to Ad Hoc Networks and MAC Protocols: Introduction – Issues in Adhoc wireless networks; Definition, Icharacteristics features, applications. Characteristics of Wireless channel, Adhoc Mobility Models: - entity and group models.

MAC Protocols: design issues, goals and classification. Contention based protocols, reservation based protocols, scheduling algorithms, protocols using directional antennas, other MAC protocols

Introduction to Wireless sensor networks, issues and challenges in designing a sensor networks, applications, comparison with Adhoc wireless networks.

MODULE - II **15**

Transport Layer and Security Protocols for Adhoc wireless networks: Introduction, Transport layer: Issues and goals in designing- Transport layer classification, adhoc transport protocols, TCP over Adhoc wireless networks, other transport layer protocol for Adhoc Wireless networks, Security issues in Adhoc networks: issues and challenges, network security attacks, Key management, secure routing in Adhoc Wireless networks

MODULE – III **15**

QoS, Energy Management and Integration of Adhoc networks: Quality of Service in Adhoc wireless Networks – Introduction, issues and challenges, classification of QoS, MAC layer solution, Network layer solutions, QoS framework for Adhoc wireless networks.

Energy Management – introduction, needs, classification, Battery Management scheme, transmission power management scheme, system power management scheme.

Co-operative networks- Architecture, methods of co-operation, co-operative antennas, Integration of ad hoc network with other wired and wireless networks.

TOTAL : 45

REFERENCE BOOKS

1 Siva Ram Murthy C and Manoj B.S, "Ad hoc Wireless Networks Architectures and protocols", 2nd edition, Pearson Education. 2007.

2 Camp T, Boleng J, and Davies V "A Survey of Mobility Models for Ad Hoc Network Research," Wireless Communication and Mobile Comp., Special Issue on Mobile Ad Hoc Networking Research, Trends and Applications, vol. 2, no. 5, 2002, pp. 483–502.

3 Laneman N, Tse D.N.C, and Wornell, G.W "Cooperative Diversity in Wireless Networks: Efficient Protocols and Outage Behavior," IEEE Trans. Info. Theory, April 2003.

4 Charles E. Perkins, "Ad hoc Networking", Addison – Wesley, 2000

5 Stefano Basagni J, Marco Conti, Silvia Giordano and Ivan Stojmenovic, "Mobile adhoc networking", Wiley-IEEE press, 2004.

11CO014 ADVANCED SOFT COMPUTING TECHNIQUES

3 0 0 3

Objective:

- To learn and analyze different types of neural networks
- To understand various optimization techniques
- To study various real time applications of neuro fuzzy system

MODULE – I **15**

Neural Networks: Introduction to soft Computing-Neural Networks -Supervised Learning Neural Networks – Perceptrons - Adaline – Back propagation Multilayer perceptrons – Radial Basis Function Networks – Unsupervised Learning and Other Neural Networks – Competitive Learning Networks – Kohonen Self – Organizing Networks – Learning Vector Quantization – Hebbian Learning. Data compression using BPN, Character recognition using Kohen network.

MODULE - II **15**

Fuzzy Logic: Fuzzy Sets – Basic Definition and Terminology – Set-theoretic operations – Member Function Formulation and parameterization – Fuzzy Rules and Fuzzy Reasoning - Extension principle and Fuzzy Relations – Fuzzy Inference Systems –Fuzzy Models

Neuro Fuzzy Modelling: Adaptive Neuro-Fuzzy Inference Systems – Architecture – Hybrid Learning Algorithm – learning Methods that Cross-fertilize ANFIS and RBFN – Coactive Neuro-Fuzzy Modeling – Framework – Neuron Functions for Adaptive Networks.

MODULE -III **15**

Genetic Algorithm: Survival of the fittest, schema theorem ,cross over, mutation, reproduction methods, Application

Ant Colony Optimization: Introduction- From real to Artificial Ants , ACO Meta Heuristics

Particle Swarm Optimization: Introduction , Features of PSO , Basic Principles, Canonical PSO Algorithm Foraging Strategies ,Self organization and stigmetry , Comparision with GA- Application

TOTAL : 45

REFERENCE BOOKS

1. Jang, J.S.R., C.T.Sun and E.Mizutani., "Neuro-Fuzzy and Soft Computing", PHI, Pearson Education, 2004.
2 Eberhart, R., Simpson, P. and Dobbins, R.," Computational Intelligence PC Tools", AP Professional, Boston 1996.
3 Goldberg, Davis E., "Genetic Algorithms: Search, Optimization and Machine Learning" Addison Wesley, New York, 1989.
4 Rajasekaran S and Pai, G.A.V., "Neural Networks, Fuzzy Logic and Genetic Algorithms", Prentice Hall of India, New Delhi, 2003.

11CO015 ADVANCED DIGITAL IMAGE PROCESSING TECHNIQUES

3 0 0 3

Objectives:

- To understand various 2D image transformations.
- To analyse image enhancement and restoration techniques.
- To gain knowledge about various techniques of image segmentation and representation.
- To understand various image compression techniques and its standards

MODULE– I **15**

Image Processing Fundamentals: Image Transforms-Fourier Transform, Wlash, ,Hadamad, ,DCT, Haar and KL transforms and their properties.

Image enhancement – Enhancement by point processing, histogram processing-Enhancement in spatial domain and in frequency domain.

MODULE– II **15**

Colour Image Processing: Fundamentals - Image Restoration- ,Models-Pseudo color image processing-Basics, Converting to other color spaces-Transformations-color smoothing and sharpening-color segmentation-Noise-Color noise compression

Image Filtering and Restoration- Degradation model- diagonalization of circulant and block circulant matrices-Algebraic approach to restoration- inverse filtering-LMS restoration-constrained least squares and iterative restoration, Geometric transformations.

MODULE– III **15**

Image Compression: Fundamentals- Compression models-Lossless and Lossy Image compressions-compression standard

Image Segmentation and Edge Detection- Detection of discontinuities – edge linking and boundary detection- region oriented segmentation- use of motion in segmentation- Marr-Hildreth edge detection-Canny detectors

Image processing analysis for remotely sensed data – Radiometric correction-geometric correction-atmospheric and ground effects-spectral analysis and change detection.

TOTAL: 45

REFERENCE BOOKS

1. Gonzalez, Rafel C. and Woods, Richard E., "Digital Image Processing", Second Edition, Prentice Hall, New York, 2006.
2. Jain, Anil K., "Fundamentals of Digital Image Processing", Prentice Hall of India, New Delhi, 2003.
3. Rosenfield, Azriel and Kak, Avinash C., “Digital Picture Processing”, Academic Press Inc, New York, 2001.
4. Jayaraman. S, Esakkirajan. S, and Veerakumar. T, “Digital Image Processing” Tata McGraw-Hill, New Delhi 1st ed 2009
5. Soman K.P. and Ramachandran K.I. “Insight into Wavelets-From Theory to Practice”, Prentice Hall of India, New Delhi, 2005.

11CO016 TELECOMMUNICATION SYSTEM MODELING AND SIMULATION

3 0 0 3

Objectives:

- To understand the channel modeling and characterization.
- To know about Monte Carlo simulation and other advanced simulation methodologies for wireless radio communication.
- To get knowledge about the designing of communication systems for typical specifications

MODULE - I **15**

Simulation Methodology and Fundamental Concepts: Introduction, Aspects of methodology, Performance Estimation; Sampling and Quantization; Lowpass complex envelope for Bandpass Signals, Multicarrier signals, Nonlinear and Time-Varying Systems; Post processing – Basic Graphical Techniques, Estimation, coding

MODULE - II **15**

Random Signal Generation and Monte Carlo Simulation: Stationary and Ergodic Process, Uniform Random number generators, mapping uniform random variables to an arbitrary PDF, correlated and uncorrelated Gaussian random numbers, PN sequence Generators.

Monte Carlo Simulation – fundamental concepts, application to Communication Systems, Monte Carlo integration, Semi-analytic techniques, Case Study: Performance estimation of a wireless system.

MODULE - III **15**

Advanced Models and Simulation Techniques: Modeling and Simulation of Nonlinearities – Memoryless nonlinearities, Nonlinearities with memory; Modeling and simulation of time-varying systems – Models for LTV systems, Random process model, Taped delay line model; Modeling and simulation of waveform channels, Discrete memoryless channel models, Markov model for discrete channels with memory, Tail Extrapolation, PDF estimators, Case study: Simulation of a cellular radio system.

TOTAL : 45

REFERENCE BOOKS

1. William.H.Tranter, K. Sam Shanmugam, Theodore S.Rappaport, Kurt.L.Kosbar, “Principles of Communication Systems Simulation: with wireless applications”, Pearson Education (Singapore) Pvt. Ltd. 2004.
2. Jeruchim M.C, Balaban P and Sam Shanmugam K, “Simulation of Communication Systems: Modeling methodology and Techniques”, Plenum Press, New York, 2001.
3. Averil.M.Law and David Kelton W, “Simulation Modeling and Analysis”, McGraw Hill Inc., 2000.
4. Geoffrey Gorden, “System Simulation”, PHI, 2nd edition, 1992.
5. Jerry Banks and John S.Carson, “Discrete Event System Simulation”, PHI, 3rd edition 2001

11CO017 ADVANCED SATELLITE COMMUNICATION

3 0 0 3

Objectives :

- To understand thoroughly the basics of orbital mechanics.
- To evaluate the link budget for satellite and earth station for C, Ku, K & Ka bands.
- To comprehend the applications of satellite in ATM and TCP/IP based networks.

MODULE - I **15**

Orbital Mechanics: Growth of Satellite Communication - Kepler's laws of motion, Frequency coordination and regulatory services, Orbit Equations, Orbit Description, Locating the Satellite in the Orbit and with Respect to Earth, Orbital Elements-Look Angle Determination and Visibility - Orbital Perturbations, Orbit Determination, Launch Vehicles, Orbital Effects in Communication System - Performance Attitude control; Satellite launch vehicles and propulsion mechanisms - spectrum allocations for satellite systems, Energy Dispersal, propagation characteristics of fixed and mobile satellite links.

MODULE - II 15

Spacecraft Sub Systems And Earth Station: Spacecraft Subsystems, station keeping- Altitude and Orbit Control, stabilization techniques – Telemetry and Tracking, Power, Systems, Communication Subsystems, Transponders, Antennas, Equipment Reliability, atmospheric losses

Earth Stations, antennas, tracking system, terrestrial interface, different types of interference, interference specification and protection ratio.

The Space Link: Satellite Link Design: Satellite uplink - down link power Budget, Basic Transmission Theory, System Noise Temp, G/T Ratio, Noise Figure; Downlink Design - Design of Satellite Links for Specified C/N - Microwave Propagation on Satellite to Earth.

MODULE - III **15**

Satellite Access Techniques And Applications: Single access vs. multiple access (MA). Classical MA techniques: FDMA, TDMA. Single channel per carrier (SCPC) access - Code division multiple access (CDMA). Demand assignment techniques, Mobile satellite network design, ATM via satellite. TCP/IP via satellite - Call control, handover and call set up procedures, Hybrid satellite-terrestrial networks, Fixed and mobile services - Multimedia satellite services. Advanced applications based on satellite platforms - INTELSAT series - INSAT, VSAT.

TOTAL : 45

REFERENCE BOOKS

1. Timothy Pratt and Charles W Bostian, " Satellite Communications", John Wiley and Sons, 2nd Edition 2002
2. Wilbur L.Pritchard, Hendri G.Suyderhood, Robert A.Nelson,"Satellite Communication Systems Engineering", II Edition, Prentice Hall, New Jersey, 1993
3. Dennis Roddy, “Satellite Communications”, Third Edition, Mc Graw Hill International Editions, 2001.
4. Tri T.Ha, "Digital satellite communication", 2nd Edition, McGraw Hill, New york.1990
5. Coolen.M, " Satellite Communication", IEEE Publication, 1999

11CO018 PRINCIPLES OF REMOTE SENSING

Objective: **3 0 0 3**

- To study the concepts of remote sensing, data acquisition in spatial and arial platforms
- To understand about data acquisition using microwave
- To analyze the remote sensing data.

MODULE -I **15**

Physics of Remote Sensing: Introduction of Remote Sensing, Electro Magnetic Spectrum Physics of Remote Sensing – Effects of Atmosphere - Scattering - Different types - Absorption - Atmospheric window - Energy interaction with surface features - Spectral reflectance of vegetation soil and water – Atmospheric influence on spectral response patterns - Multi concept in Remote Sensing

MODULE - II **15**

Data Acquisition (Space and Aerial Platforms): Types of Platforms - Different types of aircrafts - Manned - Unmanned spacecrafts - Sun synchronize - Geo synchronize satellites - Characteristics of different types of platforms - LANDSAT SPOT IRS INSAT IKONOS QUICKBIRD etc.,
Photographic products, B/W - Colour-Colour IR film and their characteristics - Resolving power of lens and film - Opto mechanical electro optical sensors - Across track and Along track scanners – Multi spectral scanners and thermal scanners - Geometric characteristics of scanner imagery calibration thermal scanners.

MODULE - III **15**

Data Acquisition (Microwave) and Data Analysis: Concept of microwave remote sensing - Types of RADARS - SLAR - Resolution - Range and azimuth -Real aperture and synthetic aperture RADARS characteristics of microwave images - topographic effect -Different types of remote sensing platforms - Airborne and space borne sensors - ERS - JERS - RADARSAT - Scatterometer, altimeter.

Resolution - Spatial - Spectral - Radiometric and temporal resolution - Signal to noise ratio – Different types of data products and their characteristics visual and digital interpretation - Basic principles of digital analog geometric correction - Radiometric correction - Image enhancement - different types – Image classification - Different types of classifications - LIDAR aerial laser terrain mapping.

TOTAL: 45

REFERENCE BOOKS

1 Lillesand. T.M. and Kiefer, R.W., “Remote Sensing and Image Interpretation”, 4th Edition,2000
2 Paul Curran, P.J., “Principles of Remote Sensing”, ELBS, 1995.of John Wiley and Sons, 2000.
3 Sabins Jr, F.F., “Remote Sensing Principles and Image interpretation”, W.H. Freeman and Co., 1978.

11CO019 MICROWAVE INTEGRATED CIRCUITS

3 0 0 3

Objective:

- To obtain knowledge on fabrication techniques used in microwave integrated circuits
- To study the active devices, amplifiers and oscillators used in microwave frequencies.
- To realize the features of integrated antennas in microwave circuits.

MODULE - I **15**

Microstrip Components and Design Analysis: Introduction, Fabrication process of MMIC, Hybrid MICs, Propagating modes, Analysis of MIC by conformal transformation, Hybrid mode analysis, losses in Microstrip, Introduction to slot line and coplanar wave guide.

Introduction to coupled Microstrip, Even and odd mode analysis, Directional couplers, branch line couplers, Design and Fabrication of Lumped elements for MICs, Comparison with distributed circuits Ferromagnetic substrates and inserts, Microstrip circulators, Phase shifters, Isolators.

MODULE - II **15**

Active Devices for MICs and Microwave Transistor Circuits: Microwave BJT ,FET, Varactor diodes, Parametric diodes and Amplifiers, PIN diodes, Transferred electron devices, IMPATT, BARITT, Double drift Avalanche diodes, Microwave transistor Amplifier Design, Noise , Broadband and high power design methods circuits, Microwave transistor Oscillator Design.

MODULE - III **15**

Integrated Antennas and Measurement Techniques: Integrated antenna selection, photonic band gap antennas, micro machined antenna, micro electro mechanical system antennas, microwave measurements - test fixture measurements, probe station measurements, thermal and cryogenic measurements, experimental field probing techniques.

TOTAL: 45

REFERENCE BOOKS

1. Ravender Goyal, "Monolithic MIC; Technology & Design", Artech House, 1989.
2. Gupta K.C. and Amarjit Singh, "Microwave Integrated Circuits", John Wiley, New York, 1975.
3. Gentili C, " Microwave Amplifiers and Oscillators", North Oxford Academic, 1986.
4. Annapurna Das and Sisir K Das, " Microwave Engineering", Tata McGraw-Hill Pub. Co. Ltd., 2004.
5. Samuel. Y. Liao, " Microwave Circuit Analysis and Amplifier Design", Prentice Hall. Inc., 1987.
6. Mathew N.O. Sadiku, "Numerical techniques in Electromagnetics", CRC Press, 2001.

11CO020 SPEECH PROCESSING

3 0 0 3

Objective:

- To know the characteristics of voice signals
- To analyze speech signal using linear predictive coding
- To understand the various speech encoding and decoding techniques

MODULE - I **15**

Speech Signal Analysis: The speech signal – process of speech production – acoustic phonetics – the speech chain – anatomy of the ear – sound perception – auditory models; Acoustic theory of speech production – lossless tube models – digital models for sampled speech signals Time domain processing of speech signals: short time energy, magnitude, zero crossing rate, Speech vs silence discrimination - Pitch period estimation using autocorrelation - Short time Fourier analysis- Definition and properties - Design of digital filter banks - Pitch detection - analysis by synthesis- Cepstrum and homomorphic speech processing: short time cepsturm and complex cepstrum – cepstrum analysis of all pole models- cepstrum distance measures.

MODULE - II **15**

Speech Coding: Linear predictive analysis of speech: basics of LP analysis computation of model gain frequency domain interpretation solution of the LP equations prediction error signal properties of the LP polynomial alternative representations of the LP coefficients

MODULE - III **15**

Speech Signal Modelling: Channel Vocoders and Predictive Coding Scalar; Waveform Coders – Scalar Frequency Domain Coders – Code excited linear Prediction Law – Bit rate Speech coders, Speech Recognition – Hidden Markov Models (HMM) – Practical Issues in Using HMMs – HMM Limitations. - Gaussian Mixture model - connected word recognition-Speaker identification/Verification. Acoustic Modeling – Phonetic Modeling – Language Modeling – Speaker Recognition Algorithm – Signal Enhancement for Mismatched Conditions

TOTAL: 45

REFERENCE BOOKS

1. Lawrence Rabiner and Ronals Schafer, “Theory and Applications of Digital Speech Processing”, Prentice Hall, 2011.
2. Quatieri T.F, “Discrete Time Speech Signal Processing”, Prentice Hall, 2002
3. Gold B and Morgan N, “Speech and Audio Signal Processing”, Wiley and Sons, 2000.
4. Schroeder M.R, “Computer Speech – Recognition, Compression, Synthesis”, Springer Series in Information Sciences, 1999.
5. Douglas O Shaughnessy, “Speech Communciations: Human and Machine”, Universities Press, 2001.

11CO021 MULTICARRIER COMMUNICATIONS

3 0 0 3

Objective:

- To study and analyse the digital modulation techniques through vector spaces.
- To understand the constraints followed in OFDM receivers.
- To gain knowledge about multiuser diversity.

MODULE – I **15**

Introduction to Multicarrier Systems: Linear Algebra: Vector Spaces, Linear independence, Subspaces, Projections, Orthogonality, Eigen Decomposition, Quadratic forms, Digital Communication Review: Linear stream modulation, Optimal Detection, ISI channels, Equalization, Multicarrier Fundamentals: Motivation, OFDM, Subcarrier notion, Role of FFT, Parallel channel decomposition and detection, OFDM Transmitter Optimization: Adaptive Modulation, Waterfilling

MODULE - II **15**

Multicarrier Receivers: SNR gap analysis, Bit loading algorithms, Linear precoding, Coded OFDM, OFDM Receiver Algorithms : Synchronization, Sensitivity to timing and frequency errors, Channel Estimation and Equalization, Zero forcing and MMSE algorithms, Training sequence design, Multiuser Systems: OFDMA, SCFDMA, Distributed and localized mapping

MODULE - III **15**

Multicarrier Diversity: Multiuser diversity, Resource allocation algorithms, Applications to cellular systems, MIMO-OFDM:
Fundamental MIMO concepts, Spatial diversity, Spatial Multiplexing, Space Frequency coding

TOTAL : 45

REFERENCE BOOKS

1. Hanzo L and Keller T, OFDM and MCCDMA a primer, John Wiley and Sons, 2006.
2. Proakis G, Digital Communications, New York McGraw Hill, 2001
3. Strang G, Linear Algebra and Applications, New York Academic, 1980.
4. Tse D and Vishwanath P, Fundamentals of wireless communications, Cambridge Press, 2005.
5. Van Nee R and Prasad R, OFDM for Wireless Multimedia Communications , Artech House Publishers, 1999
6. Chiueh T.D and Tsai P.Y, OFDM Baseband Receiver Design for Wireless Communications, Wiley, 2007

11CO022 SPREAD SPECTRUM COMMUNICATIONS

3 0 0 3

Objective:

- To understand the concepts of various codes for communication
- To gain knowledge about various types & generation of spread spectrum signals
- To understand the various applications of spread spectrum

MODULE – I **15**

Introduction to Spread Spectrum Systems: Detection of binary signals in AWGN - Quadrature multiplexed signaling schemes - Signaling through band limited channels - Equalization of digital data transmission system - Realization imperfections - Degradations in performance.

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

MODULE - II **15**

Spreading Code Generation and Synchronization

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

Synchronization of Spread Spectrum Systems: Optimal tracking of wideband signals - Early-late tracking loops - Code tracking loops for FHSS - Optimum synchronization techniques - Multiple dwell and sequential detectors - Synchronization using a matched filter - Synchronization by estimating the received spreading code.

MODULE - III **15**

Performance of Spread Spectrum System: SS Systems communications models - Performance without coding under AWGN and different jamming environments - spread spectrum systems performances with forward error correction - Block coding - Convolutional coding and specific error correcting codes – Interleaving - Random coding bounds.

TOTAL : 45

REFERENCE BOOKS

1. Ziemer R E and Peterson R L, "Digital Communication and Spread Spectrum Systems", Macmillan Publishing Co., 1985.
2. Dixon R C, "Spread Spectrum Systems", Wiley Interscience, 1976.
3. Holms J K, "Coherent Spread Spectrum Systems", Wiley Interscience, 1982..

11CO023 ADVANCED COMMUNICATION NETWORKS

3 0 0 3

Objective:

- To Analyze and study the performance of various Communication protocols
- To understand Traffic Management and Flow/Congestion Control
- To analyse various routing techniques used in communication networks.

MODULE – I **15**

Introduction: Internet history and architecture, OSI layering, MAC and LLC Issues: Techniques for multiple access, Adaptive LLC mechanisms for wireless links, Internet Routing Architecture: Internet Service Providers and Peering.

Flow/Congestion Control: Implementation, modeling, fairness, stability, open-loop vs closed-loop vs hybrid, traffic specification (LBAP, leaky-bucket), window vs rate, hop-by-hop vs end-to-end, implicit vs explicit feedback, aggregate flow control, reliable multicast. TCP variants (Tahoe, Reno, Vegas, New-Reno, SACK)

MODULE - II **15**

Routing : Implementation, stability/convergence, link-state vs distance-vector vs link-vector, conventional routing, Routing Information Protocol (RIP), Open Shortest Path First (OSPF), Multicast OSPF (MOSPF), Distance Vector Multicast Routing Protocol (DVMRP), BGP instability, Fair queuing, TCP congestion control, TCP variants, Random Early Detect, TCP RTT estimation, Fast retransmit, Fast recovery.

IP Next Generation: IP Next Layer (IPNL), IPV6 features, including transition, Mobile IPV6 operation, Models to support(WLAN) network roaming, IPV6 transition methods, Advanced IP routing and multihoming, IP Multicast.

MODULE - III **15**

Traffic Management: Utility function, traffic models (for Internet), self-similarity, traffic classes (BE, GS), service models (DiffServ, IntServ), class-based allocation, controls at different time scales, renegotiation (RCBR), signaling (RSVP, ATM signaling), resource translation/mapping, admission control (worst-case, statistical, measurement-based), pricing, capacity planning, Integrated Services, Resource ReSerVation Protocol (RSVP), Differentiated Services, Wireless TCP, Mobile IP, Multicast routing, Scalable Multicast routing: Core Based Trees (CBT), Protocol Independent Multicast (PIM), Pragmatic General Multicast (PGM), Scalable Reliable Multicast, Overlay Networks, Peer-to-Peer Networks.

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TOTAL : 45

REFERENCE BOOKS

1. Larry Peterson and Bruce Davie, “Computer Networks: A Systems Approach”, Third Edition, Morgan Kaufmann, , 2003.
2. Michael A Gallo and William M Hancock, “Computer Communications and Networking Technologies”, Thomson Learning, 2002.
3. Jim Kurose and Keith Ross., “Computer Networking: A Top-Down Approach Featuring the Internet”, Addison-Wesley, 2004.
4 William Stallings, “Data and Computer Communications”, Seventh Edition, Prentice Hall, , 2003
5 Andrew S Tanenbaum, “Computer Networks”, Fourth Edition, Prentice Hall, 2002.

11CO024 WIRELESS SYSTEMS AND STANDARDS

3 0 0 3

Objective:

- To know about the basic wireless, Cellular concepts.
- To be familiar with mobile channels.
- To know advanced and upcoming wireless standards.

MODULE – I **15**

Wireless Systems: Advanced Mobile Phone Systems (AMPS) – Characteristics – Operation – General Working of AMPS Phone System – Global System for Mobile Communication – Frequency Bands and Channels – Frames – Identity Numbers – Layers, Planes and Interfaces of GSM – International Mobile Telecommunications (IMT-2000) – Spectrum Allocation – Services provided by 3G Cellular Systems – Harmonized 3G Systems – Universal Mobile Telecommunications Systems (UMTS)

MODULE - II **15**

The IEEE 802.11 Standard: Introduction to IEEE 802.11 – General Description – Medium Access Control (MAC) for the IEEE 802.11 Wireless LANs – Physical Layer for IEEE 802.11 Wireless LANs; Radio systems – Physical Layer for IEEE 802.11 Wireless LANs – IR Systems – Conclusions and Applications.

The HIPERLAN Standard: Introduction - Terminology – Physical Layer -HIPERLAN Channel Access Control (CAC) – HIPERLAN Medium Access Control (MAC) – Conclusions on HIPERLAN Type 1 – Future Brand Standards

MODULE - III **15**

Upcoming Standards and Future Trends: The Evolution of HIPERLAN – The Evolution of IEEE 802.11 – Forthcoming IR Standards – Other RF Standards: Digital Enhanced Cordless Technology (DECT) – Bluetooth – Wireless ATM (WATM) – Home RF.

Recent Advances: Introduction – Ultra Wide Band (UWB) Technology – Characteristics – Signal Propagation – Current Status and Applications – Advantages – Disadvantages – Challenges and Future Directions.

TOTAL : 45

REFERENCE BOOKS

1. Assuncion Santamaria, Francisco Lopez-Hernandez, “Wireless LAN Standards and Applications”, Artech House, 2001.
2. Dharma Prakash Agarwal and Qing- An zeng, “Introduction to Wireless and Mobile Systems”, Vikas publishing House, New Delhi, 2004
3. Neeli Prasad and Anand Prasad, “WLAN System & Wireless IP for Next Generation Communications”, Artec House, 2002.

11CO025 RF MEMS FOR WIRELESS COMMUNICATION

3 0 0 3

Objective:

- To gain knowledge about the physical aspects of RF circuit design
- To know RF MEMS circuit elements such as switches, resonators etc.,
- To understand the working and features of RF MEMS circuits in wireless communication systems.

MODULE – I **15**

Wireless Transceiver Architectures: Introduction, spheres of wireless activities, the home and office, the ground fixed/mobile platform, the space platform, wireless standards, systems and architectures, wireless standards, conceptual wireless systems, wireless transceiver architectures, power and bandwidth-efficient wireless systems & challenges, MEMS based wireless appliances enable ubiquitous connectivity.

Physical aspects of RF circuit design, skin effect, transmission lines on thin substrates, self-resonance frequency, quality factor packaging, practical aspects of RF circuit design, dc biasing, impedance mismatch effects in RF MEMS.

MODULE - II **15**

MEM Switches and its Applications: Enabled circuit elements and models - RF/Microwave substrate properties, Micro machined - enhanced elements - capacitors, inductors, varactors, MEM switches - shunt MEM switch, low voltage hinged MEM switch approaches, push-pull series switch, folded - beam - springs suspension series switch, Resonators - transmission line planar resonators, cavity resonators, micromechanical resonators, film bulk acoustic wave resonators, MEMS modeling - mechanical modeling, electromagnetic modeling.

MODULE - III **15**

RF Applications of MEMS: Enabled circuits - reconfigurable circuits - the resonant MEMS switch, Capacitors, inductors, tunable CPW resonator, MEMS microswitch arrays, Reconfigurable circuits - double - stub tuner, Nth - stub tuner, filters, resonator tuning system, massively parallel switchable RF front ends, true time-delay digital phase shifters, Reconfigurable antennas - tunable dipole antennas, tunable microstrip patch-array antenna.

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

TOTAL : 45

REFERENCE BOOKS

1. Hector J. De Los Santos, "RF MEMS Circuit Design for Wireless Communications", Artech House, 2002
2. Vijay K.Varadan, K.J. Vinoy, K.A. Jose., "RF MEMS and their Applications", John Wiley and sons, LTD, 2002
3. Gabriel M. Rebeiz, "RF MEMS Theory, Design & Technology", Wiley Interscience, 2002

11MS204 NETWORK SECURITY

(Common to Computer Science and Engineering, Communication Systems)

3 0 0 3

Objective:

- To know the methods of conventional encryption.
- To understand the concepts of public key encryption and number theory
- To understand authentication and Hash functions.
- To know the network security tools and applications.
- To understand the system level security used.

MODULE – I **15**

Public Key Cryptography : OSI Security Architecture - Classical Encryption techniques – Cipher Principles – Data Encryption Standard – Block Cipher Design Principles and Modes of Operation - Evaluation criteria for AES – AES Cipher – Triple DES – Placement of Encryption Function – Traffic Confidentiality

Key Management - Diffie-Hellman key Exchange – Elliptic Curve Architecture and Cryptography - Introduction to Number Theory – Confidentiality using Symmetric Encryption – Public Key Cryptography and RSA.

MODULE - II **15**

Authentication and Network Security: Authentication requirements – Authentication functions – Message Authentication Codes – Hash Functions – Security of Hash Functions and MACs – MD5 message Digest algorithm - Secure Hash Algorithm – RIPEMD – HMAC Digital Signatures – Authentication Protocols – Digital Signature Standard - Authentication Applications: Kerberos – X.509 Authentication Service.

MODULE- III **15**

Web Security and System Level Security: Electronic Mail Security – PGP – S/MIME - IP Security – Web Security - Intrusion detection – password management – Viruses and related Threats – Virus Counter measures – Firewall Design Principles – Trusted Systems.

TOTAL : 45

REFERENCE BOOKS

1. Stallings, William., “Cryptography And Network Security: Principles and Practices”, Fourth Edition, Prentice Hall of India, New Delhi, 2005.
2. Forouzan, Behrouz A., “Cryptography and Network Security”, Tata McGraw Hill, New Delhi, 2007.
3. Kahate, Atul., “Cryptography and Network Security”, Second Edition, Tata McGraw-Hill, New Delhi, 2003.
4. Schneier, Bruce, “Applied Cryptography”, Second Edition, John Wiley & Sons Inc, New York, 2001.

11AE015 ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY IN SYSTEM DESIGN

(Common to M.E. Applied Electronics , VLSI Design and Communication Systems)

3 0 0 3

PREREQUISITES

Electromagnetic Theory, Circuit Theory

Objective:

- To give basics of Electromagnetic interference
- To introduce the concept of EMI coupling principles
- To impart the knowledge of EMI/EMC standards and measurements
- To design control circuits based on EMI
- To develop the EMC design of PCBs

MODULE- I **15**

EMI Environment: EMI/EMC concepts and definitions, Sources of EMI, conducted and radiated EMI, Transient EMI, Time domain Vs Frequency domain EMI, Units of measurement parameters, Emission and immunity concepts, ESD.

EMI Coupling Principles: Conducted, Radiated and Transient Coupling, Common Impedance Ground Coupling

MODULE- II **15**

EMI Coupling Principles: Radiated Common Mode and Ground Loop Coupling, Radiated Differential Mode Coupling, Near Field Cable to Cable Coupling, Power Mains and Power Supply coupling.

EMI/EMC Standards and Measurements: Civilian standards - FCC, CISPR, IEC,EN, Military standards - MIL STD 461D/462, EMI Test Instruments /Systems, EMI Shielded Chamber, Open Area Test Site, TEM Cell, Sensors/Injectors/Couplers, Test beds for ESD and EFT, Military Test Method and Procedures (462).

MODULE- III **15**

EMI Control Techniques: Shielding, Filtering, Grounding, Bonding, Isolation Transformer, Transient Suppressors, Cable Routing, Signal Control, Component Selection and Mounting

EMC Design of PCBs: PCB Traces Cross Talk, Impedance Control, Power Distribution Decoupling, Zoning, Motherboard Designs and Propagation Delay Performance Models.

TOTAL: 45

REFERENCE BOOKS

1. Ott, Henry W., "Noise Reduction Techniques in Electronic Systems", Second Edition, John Wiley & Sons, New York, 1988.
2. Kodali, V.P., "Engineering EMC Principles, Measurements and Technologies", IEEE Press, London, 1996.
3. Keiser, Bernhard., "Principles of Electromagnetic Compatibility", Third Edition, Artech House, Dedham, 1986
4. Paul, C.R., “Introduction to Electromagnetic Compatibility”, Second Edition, John Wiley & Sons, New York, 2006.
5. Kodali. Prasad., “Engineering Electromagnetic Compatibility: Principles, Measurements, Technologies and computer models”, Second Edition, John Wiley & Sons, New York, 2001.

11CN012 WIRELESS SENSOR NETWORKS

(Common to M.E. Control and Instrumentation, Communication Systems)

3 0 0 3

Objective:

- To learn the basics of networking sensors and various IEEE standard
- To explore the knowledge in infrastructure establishment and sensor network database
- To understand the concepts of sensor network platforms and tools

MODULE – I **15**

Introduction: Overview of sensor networks- Constraints and challenges – Advantages of sensor networks-Applications- Collaborative processing – Tracking scenario –Problem formulation – Distributed representation and interference of states – Tracking multiple objects – sensor models-Performance comparison and metrics.

Networking sensors: Key assumption - Medium access control – S-MAC protocol – IEEE 802.15.4 standard and ZigBee - General Issues - Geographic, Energy -Aware Routing - Attribute based routing.

MODULE - II **15**

Infrastructure establishment: Topology control – Clustering -Time Synchronization – Localization and Localization services-Sensor tasking and control-Task driven sensing – Role of sensor nodes – Information based tasking - Routing and aggregation.

Sensor network database: Sensor Database Challenges – Querying the physical environment – Interfaces-High level database organization- In-network aggregation – Data centric storage – Data indices and range queries – Distributed Hierarchical aggregation – Temporal data.

MODULE- III **15**

Sensor network platforms and tools: Sensor Node Hardware – Sensor network programming challenges – Node level software platforms – Operating system - TinyOS – Node level simulators – State centric programming –Applications and future directions

TOTAL : 45

REFERENCE BOOKS

1. Feng Zhao, Leonidas Guibas, “Wireless sensor networks- an information processing approach”, Mogan Kanufmann publishers, 2004
2. C. Sivaram Moorthy, B.S Manoj, “Ad Hoc Wireless Networks: Architectures and Protocols”, Prentice Hall, 2004

11CN017 NETWORK ROUTING ALGORITHMS

(Common to M.E. Computer and Communication, Communication Systems)

3 0 0 3

Objective:

- To learn the basics of circuit switching and packet switching networks
- To explore the knowledge in high speed and mobile networks
- To understand the basic and routing concepts of MANET

MODULE – I **15**

Circuit switching networks: AT & T's Dynamic Routing Network, Routing in Telephone Network-Dynamic Non Hierarchical Routing- Trunk Status Map Routing-Real Time Network Routing, Dynamic Alternative Routing-Distributed Adaptive Dynamic Routing-Optimized Dynamic Routing

Packet switching networks: Distance vector Routing, Link State Routing, Inter domain Routing-Classless Inter Domain Routing (CIDR), Interior Gateway Routing Protocols (IGRP) - Routing Information Protocol (RIP), Open Shortest Path First (OSPF), Exterior Gateway Routing Protocol (EGRP) - Border Gateway Protocol (BGP), Apple Talk Routing and SNA Routing

MODULE - II **15**

High speed networks: Routing in optical networks-The optical layer, Node Designs, Network design and operation, Optical layer cost tradeoffs, Routing and wavelength assignment, Architectural variations, Routing in ATM networks- ATM address structure, ATM Routing, PNNI protocol, PNNI signaling protocol, Routing in the PLANET network and Deflection Routing.

Mobile networks: Routing in Cellular Mobile Radio Communication networks-Mobile Network Architecture, Mobility management in cellular systems, Connectionless Data service for cellular systems, Mobility and Routing in Cellular Digital Packet Data (CDPD) network, Packet Radio Routing-DARPA packet radio network, Routing algorithms for small, medium and large sized packet radio networks.

MODULE- III **15**

Mobile Adhoc Networks (MANET): Internet based mobile ad-hoc networking, communication strategies, routing algorithms – Table-driven routing - Destination Sequenced Distance Vector (DSDV), Source initiated on-demand routing- Dynamic Source Routing (DSR), Ad-hoc On- demand Distance Vector (AODV), Hierarchical based routing- Cluster head Gateway Switch Routing (CGSR) and Temporally-Ordered Routing Algorithm (TORA), Quality of Service

TOTAL : 45

REFERENCE BOOKS

1. M. Steen strub, "Routing in Communication networks", Prentice Hall International, NewYork, 1995.
2. "Internetworking Technologies Handbook", ILSG CiscoSystems Inc, Fourth Edition, 2003.
3. William Stallings, "ISDN and Broadband ISDN with Frame Relay and ATM", PHI, New Delhi, 2004.
4. Behrouz A Forouzan, "Data Communications and Networking (3/e), TMH, 2004
5. William Stallings, "High Speed Networks TCP/IP and ATM Design Principles", Prentice Hall International, New York, 1998.
6. Mohammad Ilyas, "The Handbook of Ad hoc Wireless Networks" CRC Press, 2002.
7. Vijay K.Garg, "Wireless Network Evolution: 2G to 3G", Pearson Education, New Delhi, India, 2003.

11CN019 MULTIMEDIA COMPRESSION TECHNIQUES

(Common to M.E. Computer and Communication, Communication Systems)

3 0 0 3

Objective:

- To introduce the fundamentals of compression.
- To understand the techniques of text, audio image and video compression

MODULE – I **15**

Introduction: Special features of Multimedia – Graphics and Image Data Representations – Fundamental Concepts in Video and Digital Audio – Storage requirements for multimedia applications -Need for Compression - Taxonomy of compression techniques – Overview of source coding, source models, scalar and vector quantization theory – Evaluation techniques – Error analysis and methodologies

Text compression: Compaction techniques – Huffmann coding – Adaptive Huffmann Coding – Arithmetic coding – Dictionary techniques – LZW family algorithms.

MODULE - II **15**

Audio compression: Audio compression techniques - μ- Law and A-Law companding-Frequency domain and filtering – Basic sub-band coding – Application to speech coding – G.722 – Application to audio coding – MPEG audio, progressive encoding for audio – Silence compression, speech compression techniques – Formant and CELP Vocoders

Image compression: Predictive techniques – DM, PCM, DPCM: Optimal Predictors and Optimal Quantization– Transform Coding – JPEG Standard – Sub-band coding algorithms: Design of Filter banks – Wavelet based compression: Implementation using filters – EZW, SPIHT coders – JPEG 2000 standards.

MODULE- III **15**

Video compression: Video compression techniques and standards – MPEG Video Coding I: MPEG – 1 and 2 – MPEG Video Coding II: MPEG – 4 and 7 – Motion estimation and compensation techniques – H.261 Standard.

TOTAL : 45

REFERENCE BOOKS

1. Morgan Kauffman, and Khalid Sayood, "Introduction to Data Compression", 2nd Edition, Harcourt India, 2000
2. David Salomon , " Data Compression: The Complete Reference", 2nd Edition, Springer Verlag New York Inc, 2001
3. Yun Q.Shi and Huifang Sun, "Image and Video Compression for Multimedia Engineering – Fundamentals: Algorithms & Standards", CRC press, 2003
4. Peter Symes , " Digital Video Compression", McGraw Hill , 2004
5. Mark Nelson , " Data compression", BPB Publishers, New Delhi,1998
6. Mark S.Drew and Ze-Nian Li, "Fundamentals of Multimedia", PHI, 1st Edition, 2003
7. Watkinson, J , "Compression in Video and Audio", Focal press, London, 1995

11CO026 DATA HIDING TEHNIQUES

3 0 0 3

Objective:

- To know the fundamentals of Steganography and its applications
- To study the concepts of various Data Hiding techniques
- To study the attacks and countermeasures against hidden data

MODULE – I **15**

Steganography: Hiding Information, Methods for hiding information – Hiding in text, Hiding in Disk space, Hiding in Network Packets, Hiding in Software and Circuitry, Hiding in audio and images, Hiding information in images – Hiding data in the noise, Compression, Grammars & Mimicry, Bit twiddling, Ordering and Re-ordering, Anonymous Remailers, Secret Broadcasts, Spreading.

Issues in Image Hiding: Level of Visibility, Robustness Vs Payload, Spatial or transform domain, file format dependence, Image modeling.

MODULE - II **15**

Steganography in Transform Domain: Fast Fourier solutions, The fast Fourier Transform, Hiding information with FFTs and DCTs - Tweaking a number of coefficients, removing the original from the detection process, Tempering the wake, wavelets, Lossy and Lossless data hiding, Modifications-Identifying the best areas, Quantize the coefficients to hide information, Hide the information in the phase, Improved LSB algorithm.

Steganographic Software : Examples of Digital Image Steganographic software – StegoDos, White Noise Storm, S – Tools, Ezstego, Hide & Seek, F4 & F5, outguess.

MODULE - III **15**

Steganalysis:

Attacks Against Hidden Data : Detection:Seeing the unseen, Techniques for detecting hidden information- Code words, Typical approaches, Visual attacks- aural attacks, statistical attacks,structural attacks, Examples of detecting signatures in stego images, Distortion:Disabling steganography and watermarks, Techniques for distorting embedded data, examples of distorting embedded information, application of steganalysis:Forensic investigation

Countermeasures to Attacks : Countermeasures to distortion, Stronger watermarks, Recognition based on Image characteristics – fingerprinting images, Affine Transformations and Invariants, Using fingerprints for recognition, Recovering watermarks from Distorted Images – Recovery using Image fingerprints, Refinement using normal flow, Examples of recovering watermarks from images

TOTAL : 45

REFERENCE BOOKS

1 Peter Wayner, 'Disappearing Cryptography', Morgan Kaufmann Publishers, Second Edition, 2002.

2 Neil F. Johnson, Zoran Duric, Sushil Jajodia, 'Information Hiding: Steganography and Watermarking – Attacks and Countermeasures', Kluwer Academic Publishers, 2001.

3 Greg Kipper, 'Investigator's Guide to Steganography', Auerbach Publications, 2004.

4 Bo Yang and Beixing Deng, "Steganography in gray Images Using wavelet", Proceedings of Second International Symposium on Communications Control and Signal Processing, March 2006, Morocco.

5 Ni Rongrong and Ruan Qiuqi, "Embedding Information into Color images using Wavelet," Proc. IEEE TENCON, pp. 598-601, 2002.

6 Siwei Lyu and Hany Farid, "Steganalysis Using Higher-Order Image Statistics," IEEE Trans. Information Forensics and Security, Vol. 1, pp. 111-119, Mar. 2006.

7 Ying wang amd Pierre Moulin, "Optimized Feature Extraction for Learning-Based Image Steganalysis," IEEE Trans. Information Forensics and Security, Vol. 2, pp. 31-45, Mar. 2007.