KONGU ENGINEERING COLLEGE, PERUNDURAI, ERODE – 638 052
(Autonomous)

M.E. DEGREE IN COMMUNICATION SYSTEMS (FULL TIME)
CURRICULUM
(For the candidates admitted from academic year 2014-15 onwards)

SEMESTER – I

Course Code	Course Title	Hours/ Week			Credit	Maximum Marks		
		L	T	P		CA	ESE	Total
	THEORY							
14AMT16	Applied Mathematics for Communication Engineers	3	1	0	4	40	60	100
14COT11	Statistical Signal Processing	3	1	0	4	40	60	100
14COT12	Antenna Systems	3	1	0	4	40	60	100
14COT13	Digital Communication Techniques	3	0	0	3	40	60	100
14COT14	Optical Networks	3	0	0	3	40	60	100
14COT15	Transform Techniques	3	1	0	4	40	60	100
	PRACTICAL							
14COL11	Communication System Design Laboratory	0	0	3	1	100	0	100
				Total	**23**			

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 2014-15onwards)

SEMESTER – II

Course Code	Course Title	Hours/ Week			Credit	Maximum Marks		
		L	T	P		CA	ESE	Total
	THEORY							
14COT21	Wireless Communication Networks	3	0	0	3	40	60	100
14COT22	RF System Design	3	0	0	3	40	60	100
14COT23	Digital Communication Receivers	3	1	0	4	40	60	100
14COT24	Microwave Communication Systems	3	1	0	4	40	60	100
	Elective-I (Professional)	3	0	0	3	40	60	100
	Elective-II (Professional)	3	0	0	3	40	60	100
	PRACTICAL							
14COL21	RF Communication Systems Laboratory	0	0	3	1	100	0	100
14COL22	Wireless Communication and Network Systems Laboratory	0	0	3	1	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 2014-15onwards)

SEMESTER – III

Course Code	Course Title	Hours/ Week			Credit	Maximum Marks		
		L	T	P		CA	ESE	Total
	THEORY							
	Elective - III (Professional)	3	0	0	3	40	60	100
	Elective – IV (Professional)	3	0	0	3	40	60	100
	Elective - V (Open)	3	0	0	3	40	60	100
	PRACTICAL							
14COP31	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							
14COP41	Project Work – Phase- II	0	0	24	12	100	100	200
				Total	**12**			

CA – Continuous Assessment, ESE – End Semester Examination

Total Credits: 72

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M.E. DEGREE IN COMMUNICATION SYSTEMS (PART TIME)
CURRICULUM

(For the candidates admitted from academic year 2014-15onwards)

SEMESTER – I

Course Code	Course Title	Hours/ Week			Credit	Maximum Marks		
		L	T	P		CA	ESE	Total
	THEORY							
14AMT16	Applied Mathematics for Communication Engineers	3	1	0	4	40	60	100
14COT11	Statistical Signal Processing	3	1	0	4	40	60	100
14COT13	Digital Communication Techniques	3	0	0	3	40	60	100
	PRACTICAL							
14COL11	Communication System Design Laboratory	0	0	3	1	100	0	100
				Total	**12**			

CA – Continuous Assessment, ESE – End Semester Examination

SEMESTER – II

Course Code	Course Title	Hours/ Week			Credit	Maximum Marks		
		L	T	P		CA	ESE	Total
	THEORY							
14COT21	Wireless Communication Networks	3	0	0	3	40	60	100
14COT22	RF System Design	3	0	0	3	40	60	100
14COT23	Digital Communication Receivers	3	1	0	4	40	60	100
	PRACTICAL							
14COL21	RF Communication Systems Laboratory	0	0	3	1	100	0	100
				Total	**11**			

CA – Continuous Assessment, ESE – End Semester Examination

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(Autonomous)

M.E. DEGREE IN COMMUNICATION SYSTEMS (PART TIME)
CURRICULUM

(For the candidates admitted from academic year 2014-15onwards)

SEMESTER – III

Course Code	Course Title	Hours/ Week			Credit	Maximum Marks		
		L	T	P		CA	ESE	Total
	THEORY							
14COT12	Antenna Systems	3	1	0	4	40	60	100
14COT14	Optical Networks	3	0	0	3	40	60	100
14COT15	Transform Techniques	3	1	0	4	40	60	100
				Total	**11**			

CA – Continuous Assessment, ESE – End Semester Examination

SEMESTER – IV

Course Code	Course Title	Hours/ Week			Credit	Maximum Marks		
		L	T	P		CA	ESE	Total
	THEORY							
14COT24	Microwave Communication Systems	3	1	0	4	40	60	100
	Elective-I (Professional)	3	0	0	3	40	60	100
	Elective-II (Professional)	3	0	0	3	40	60	100
	PRACTICAL							
14COT22	Wireless Communication and Network System Laboratory	0	0	3	1	100	0	100
				Total	**11**			

CA – Continuous Assessment, ESE – End Semester Examination

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(Autonomous)

M.E. DEGREE IN COMMUNICATION SYSTEMS (PART TIME)
CURRICULUM

(For the candidates admitted from academic year 2014-15onwards)

SEMESTER – V

Course Code	Course Title	Hours/ Week			Credit	Maximum Marks		
		L	T	P		CA	ESE	Total
	THEORY							
	Elective - III (Professional)	3	0	0	3	40	60	100
	Elective – IV (Professional)	3	0	0	3	40	60	100
	Elective - V (Open)	3	0	0	3	40	60	100
	PRACTICAL							
14COP31	Project Work – Phase –I	0	0	12	6	50	50	100
				Total	**15**			

CA – Continuous Assessment, ESE – End Semester Examination

SEMESTER – VI

Course Code	Course Title	Hours/ Week			Credit	Maximum Marks		
		L	T	P		CA	ESE	Total
	PRACTICAL							
14COP41	Project Work – Phase –II	0	0	24	12	100	100	200
				Total	**12**			

CA – Continuous Assessment, ESE – End Semester Examination

Total Credits: 72

LIST OF ELECTIVES					
Course Code	**Course Title**	**Hours/Week**			**Credit**
		L	**T**	**P**	
14COE01	CDMA Engineering	3	0	0	3
14COE02	Industrial Communication Protocol	3	0	0	3
14COE03	Mobile Ad-Hoc Networks	3	0	0	3
14COE04	Vehicular Ad-Hoc Networks	3	0	0	3
14COE05	Digital Image Processing and Multi Resolution Analysis *	3	0	0	3
14COE06	Satellite Communication System *	3	0	0	3
14COE07	Green Communication	3	0	0	3
14COE08	Microwave Integrated Circuits	3	0	0	3
14COE09	Speech Processing	3	0	0	3
14COE10	Multicarrier Communication	3	0	0	3
14COE11	Spread Spectrum Communication	3	0	0	3
14COE12	TCP/IP Networks	3	0	0	3
14COE13	Wireless Systems and Standards	3	0	0	3
14COE14	RF MEMS for Wireless Communication	3	0	0	3
14COE15	Network Security Algorithms	3	0	0	3
14CNE02	Wireless Sensor Networks	3	0	0	3
14CNT14	Multimedia Compression Techniques	3	0	0	3
14COE16	Electromagnetic Interference and Compatibility	3	0	0	3
14ESE02	Soft Computing and Optimization Techniques	3	0	0	3
14VLE12	DSP Processor Architecture and Programming	3	0	0	3

*- Open Elective

14AMT16 APPLIED MATHEMATICS FOR COMMUNICATION ENGINEERS

(Common to Communication Systems & Computer and Communication Engineering)

3 1 0 4

UNIT – I **9**

Vector Spaces: Definition – Subspaces – Span – Linear dependence and independence – Basis and dimension – Row space, Column space and Null Space – Rank and nullity.

UNIT – II **9**

Inner Product Spaces: Inner products – Angle and Orthogonality in inner product spaces – Orthonormal Bases – Gram-Schmidt Process – QR-Decomposition – Orthogonal Projection – Least square technique – Orthogonal matrices.

UNIT – III **9**

Linear Programming: Formulation – Graphical solution – Simplex method – Two phase method - Transportation Model – Initial Basic Feasible Solution – North west corner rule – Vogel's approximation method – Optimum solution by MODI method – Assignment problems – Hungarian method

UNIT – IV **9**

Stochastic Processes: Introduction – Classification of Stochastic Processes – Markov Chain: Introduction -Transition Probability Matrices – Chapman Kolmogorov equations - Classification of States – Continuous Time Markov Chains – Poisson Process - Birth and Death Processes.

UNIT - V **9**

Queuing Theory: Markovian queues – Single and Multi-server Models – Little's formula – Machine Interference Model - Non- Markovian Queues – Pollaczek Khintchine Formula.

Lecture: 45, Tutorial: 15, TOTAL: 60

REFERENCE BOOKS:

1. Howard Anton, Chris Rorres, "Elementary Linear Algebra" John Wiley & Sons, 2010.
2. David C Lay, "Linear Algebra and Its Applications", Pearson Education, 2009.
3. Taha, H.A., "Operations Research, An introduction", 7th edition, Pearson Education Editions, Asia, New Delhi, 2002.
4. Roy D.Yates and David J Goodman, "Probability and Stochastic Processes – A friendly Introduction for Electrical and Computer Engineers", John Wiley & Sons, 2005.
5. Donald Gross and Carl M. Harris, "Fundamentals of Queuing theory", 2nd edition, John Wiley and Sons, New York (1985).

Course Outcomes:

On completion of the course the students will be able to

- handle problems in linear algebra
- solve linear programming problems
- process information using random process
- use queuing theory in communication

14COT11 STATISTICAL SIGNAL PROCESSING

(Common to Communication Systems, VLSI Design, Embedded Systems & Computer and Communication Engineering)

3 1 0 4

Pre-requisites: Digital Signal Processing

UNIT – I **9**

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

UNIT – II **9**

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

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

UNIT – III **9**

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.

UNIT – IV **9**

Adaptive Filter: Concepts of adaptive filter – FIR adaptive filters – LMS algorithm – Applications: Noise cancellation-Adaptive recursive filers– AR lattice structure and ARMA process, lattice – ladder filters.

UNIT – V **9**

Overview of speech processing : Speech Fundamentals: Articulatory Phonetics – Production and Classification of Speech Sounds; Acoustic Phonetics – acoustics of speech production; Short time Homomorphic Filtering of Speech; Linear Prediction (LP) analysis: Basis and development, LPC spectrum.

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.

Course Outcomes:

On completion of the course the students will be able to

- demonstrate the concepts of discrete random signal processing in real time applications
- estimate and analyze the spectrum using parametric and non-parametric approach
- design an adaptive filter and various error minimization algorithm for speech quality improvement

14COT12 ANTENNA SYSTEMS

3 1 0 4

Pre-requisites: Transmission Lines and Waveguides **,** Antennas and Wave Propagation

UNIT – I **9**

Antenna Fundamentals: Antenna fundamental parameters; Radiation integrals, Radiation from surface and line current distributions – dipole, monopole; 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.

UNIT – II **9**

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

UNIT – III **9**

Radiation From Apertures: 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

UNIT – IV **9**

Microstrip Antennas: Microstrip dipole; Patch ,Rectangular patch, Circular patch, and Ring antenna – radiation analysis from cavity model; input impedance of rectangular and circular patch antenna

UNIT – V **9**

Array Antenna and Advanced Antennas: Two dimensional uniform array; Phased array, beam scanning, grating lobe, feed network,; Linear array synthesis techniques – Binomial and Chebyshev distributions, smart antennas and fractal antennas

Lecture: 45, Tutorial: 15, TOTAL: 60

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

Course Outcomes:

On completion of the course the students will be able to

- analyze the modern techniques in antenna technologies
- measure antenna parameters
- design the various types of antenna

14COT13 DIGITAL COMMUNICATION TECHNIQUES

3 0 0 3

Pre-requisites: Digital Communication

UNIT – I **9**

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

UNIT – II **9**

Trellis Coded Modulation: 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.

UNIT – III **9**

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.

UNIT – IV **9**

Turbo 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.

UNIT – V **9**

Space-Time Coding : 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.

TOTAL : 45

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.
6. L.Hanzo, T.H.Liew, B.L.Yeap and R.Y.S.Tee, "Turbo Coding , Turbo equalization and space time coding", John Wiley & sons,2002.

Course Outcomes:

On completion of the course the students will be able to

- realize the state-of-art in digital communication techniques
- evaluate and interrelate the various blocks of digital communication system
- design and evaluate the performance of various modulation and coding techniques

14COT14 OPTICAL NETWORKS

(Common to Communication Systems & Computer and Communication Engineering)

3 0 0 3

Pre-requisites: Optical Communication

UNIT – I **9**

Optical System Components: Optical System Components – Couplers, Isolators Circulators, Multiplexers- Filters: Bragg Gratings,Fabry perot, Mach Zehnder Interfero meter, Optical Amplifiers, Transmitters, Detectors, Switches, Wavelength converters

UNIT – II **9**

Network Design And Management: Transmission System Engineering – System Model, Power Penalty, Transmitter, Receiver, Optical amplifiers, Crosstalk, Dispersion, Fiber Non-linearity, Wavelength Stabilization.

Control and Management – Network management functions, Configuration management, Performance and Fault management, Optical safety.

UNIT – III **9**

Optical Network Architecture and Survivability: Introduction to Optical Networks; SONET / SDH, Layered Architecture, Broadcast and Select Networks, IP, MAC Protocols and Test beds.

Network Survivability – Protection in SONET / SDH and IP Networks, Optical Layer Protection, Internetworking between layers.

UNIT – IV **9**

Wavelength Routing: WDM Network Elements; WDM Network Design – Cost trade-offs, LTD and RWA, Dimensioning Wavelength-Routing Network, Statistical Dimensioning models.

UNIT – V **9**

Packet Switching: Photonic Packet Switching – OTDM, Synchronization, Header Processing, Buffering, Burst Switching, 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.

Course Outcomes:

On completion of the course the students will be able to

- design and evaluate the performance of various optical network architectures and wavelength routing models
- analyze and assess the future trends in optical network architecture

14COT15 TRANSFORM TECHNIQUES

(Common to Communication Systems & Computer and Communication Engineering)

3 1 0 4

Pre-requisites: Signals and Systems, Digital Signal Processing

UNIT – I **9**

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.

UNIT – II **9**

Two Dimensional Transforms and its Applications I: Concept of two dimensional Fourier transforms – properties & their significance, energy & power spectral density functions- Walsh transforms, Hadamard transform, Haar Transform.

UNIT – III **9**

Two Dimensional Transforms And Its Applications II: Transform based lossy and lossless compression, Slant Transform, Discrete Cosine Transform,KL Transform, Hough Transform, Radon Transform. Short time Fourier transform & properties of STFT

UNIT – IV **9**

Wavelet Transforms: CWT - inverse CWT, Introduction to Discrete Wavelet Transform ,Multi-resolution analysis (MRA),Relationship to filter banks, orthogonal wavelets-Types & their applications

UNIT – V **9**

Multi Scale Transforms: Contourlet, Bandlet,, Curvelet, Ridgelet transforms-Properties & their applications

Lecture: 45, Tutorial: 15, TOTAL: 60

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.
6. S.Jayaraman,S.Essakirajan,T.Veerakumar,"Digital Image Processing" Tata McGraw-Hill Education, 2011.
7. K.P Soman,K.I Ramachandran,"Insight into wavelets From Theory to practice" 2/e, PHI learning private limited,2010

Course Outcomes:

On completion of the course the students will be able to

- analyze the various applications of transform techniques in communication systems
- solve various problems in the design of a new communication system

14COL11 COMMUNICATION SYSTEM DESIGN LABORATORY

0 0 3 1

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. Fiber optic communication characterization using OTDR
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
12. Simulation of speech processing algorithm using Code composer studio.

TOTAL: 45

REFERENCES / MANUALS / SOFTWARE:

- MATLAB
- Code composer studio
- Light Runner

Course Outcomes:

On completion of the course the students will be able to

- analyze and simulate the baseband coding techniques in digital communication systems
- apply communication engineering principles and design tools for various baseband signal conditioning methods
- analyze and interpret the various compression algorithms of speech signals

14COT21 WIRELESS COMMUNICATION NETWORKS

(Common to Communication Systems & Computer and Communication Engineering)

3 0 0 3

Pre-requisites: Wireless Networks

UNIT – I **9**

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.

UNIT – II **9**

Medium Access Alternatives: Fixed assignment for voice oriented networks, Random Access for data oriented networks, Integration of voice and data traffic.

UNIT – III **9**

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

UNIT – IV **9**

Wireless WANs: Communication in the infrastructure, GSM, CDMA, IMT 2000, GPRS and High data rates, Short message service in GSM, Mobile Application Protocols.

UNIT – V **9**

Wireless LANs and Adhoc Networks: Introduction to wireless LANs - IEEE 802.11 WLANs - Physical Layer- MAC sublayer- MAC Management Sublayer- HIPERLAN1 - HIPERLAN-2, IEEE 802.15 WPAN – Home RF, Bluetooth, Zigbee, Wireless Geolocation system 4G features and challenges, 4G technologies

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.

Course Outcomes:

On completion of the course the students will be able to

- apply the concepts of wireless MANs, LANs and PANs in wireless communication networks
- provide technological solution towards Physical and MAC Layer problems of Cellular, PAN and WLAN Networks

14COT22 RF SYSTEM DESIGN

3 0 0 3

Pre-requisites: Control systems , Analog Electronics, Transmission Lines and Waveguides

UNIT – I **9**

CMOS physics, transceiver specifications and architectures: CMOS: Introduction to MOSFET Physics – Noise: Thermal, shot, flicker, popcorn noise transceviver 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 up conversion

UNIT – II **9**

Impedance matching and amplifiers: S- parameters with Smith chart, Passive IC components - Impedance matching networks, 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 LNAs – Terminated with Resistors and Source Degeneration LNAs.

UNIT – III **9**

Feedback systems and power amplifiers: Feedback Systems: Stability of feedback systems: Gain and phase margin, Root-locus techniques – Time and Frequency domain considerations Compensation Techniques- Power Amplifiers: General model – Class A, AB, B, C, D, E and F amplifiers – ACPR metric

UNIT – IV **9**

PLL and frequency synthesizers: PLL: Linearised Model – Noise properties – Phase detectors – Loop filters and Charge pumps Frequency Synthesizers: Integer-N frequency synthesizers – Direct Digital Frequency synthesizers

UNIT – V **9**

Mixer: characteristics – Non-linear based mixers: Quadratic mixers – Multiplier based mixers: Single balanced and double balanced mixers – subsampling mixers, Oscillators: Describing Functions, Colpitts oscillators – Resonators – Tuned Oscillators – Negative resistance oscillators – Phase noise

Total : 45

REFERENCE BOOKS:

1. Lee T.H, “Design of CMOS RF Integrated Circuits”, Second Edition, Cambridge University Press, 2004
2. Razavi B., “RF Microelectronics”, Pearson Education, 1997.
3. Jan Crols, and Michiel Steyaert, “CMOS Wireless Transceiver Design”, Kluwer Academic Publishers, 2003
4. Razavi B., “Design of Analog CMOS Integrated Circuits”, McGraw Hill, 2001.
5. Reinhold Ludwig, and Pavel Bretchko, “RF Circuit Design,” Pearson Education, New Delhi, 2008.

Course Outcomes:

On completion of the course the students will be able to

- realize the practical aspects of RF system design
- analyze the stability and gain of an RF power amplifiers and oscillators
- identify a suitable architecture and design a system, component to meet desired needs within realistic constraints for the user requirements
- design various RF oscillators and mixers

14COT23 DIGITAL COMMUNICATION RECEIVERS

3 1 0 4

Pre-requisites: Digital Communication

UNIT – I **9**

Review of Digital modulation techniques : Base band and band pass communication -Signal space representation, Linear and nonlinear modulation techniques, M-ary modulation techniques-Spectral characteristics of digital modulation, Spread spectrum modulation techniques.

UNIT – II **9**

Optimum Receivers for AWGN Channel : Correlation demodulator, matched filter , maximum likelihood sequence detector,optimum receiver for CPM signals, M-ary orthogonal signals, envelope detectors for M-ary and correlated binary signals.

UNIT – III **9**

Receivers for Fading channel: Characterization of fading multiple channels, statistical models, flat and frequency selective fading, diversity technique, Optimal receivers for data detection and synchronization parameter estimation, coded waveform for fading channel.

UNIT – IV **9**

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

UNIT – V **9**

Adaptive Equalization: Optimum ML receiver for band limited channels, MSE equalizer, optimum demodulation of digital signals in the presence of ISI and AWGN, Zero forcing algorithm, LMS algorithm, adaptive decision-feedback equalizer and Equalization of Trellis-coded signals. Kalman algorithm, Blind equalizers and Stochastic gradient algorithm

Lecture: 45, Tutorial: 15, TOTAL: 60

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.

Course Outcomes:

On completion of the course the students will be able to

- evaluate the performance of various synchronization techniques
- formulate and interpret the representation and processing of fading channels in receiver systems

14COT24 MICROWAVE COMMUNICATION SYSTEMS

3 1 0 4

Pre-requisites: Microwave Communication

UNIT – I **9**

Microwave Components: Scattering matrix, Theory and Design of Ferromagnetic components: Basic properties of Ferromagnetic materials, Plane wave propagation in a Ferrite medium, Ferrite Isolators, Ferrite Phase Shifters, Ferrite Circulators,

UNIT – II **9**

Power dividers and Impedance Matching Power Dividers: Basic properties of Dividers and Couplers – T junction power divider,

Impedance Matching: Impedance Matching And Tuning**:** Matching with Lumped Elements, Single-stub Tuning, Double-stub Tuning and the Quarter-wave Transformer.

UNIT – III **9**

Microwave Resonators and Filters: Microwave Resonators: Series and Parallel Resonant Circuits, Transmission Line Resonators. Microwave filters: Periodic Structures, Filter Design by the Insertion Loss Methods, Filter transformation and Coupled line filters

UNIT – IV **9**

Microwave Systems: System aspects of antennas, Wireless communication systems, Microwave propagation, Radiometer system and other applications

UNIT – V **9**

Radar Systems: 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

Lecture: 45, Tutorial: 15, TOTAL: 60

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

Course Outcomes:

On completion of the course the students will be able to

- design and evaluate a microwave system considering the path losses and fading characteristics
- design and analyze impedance matching circuits for any real time systems

14COL21 RF COMMUNICATION SYSTEMS LABORATORY

0 0 3 1

LIST OF EXPERIMENTS:

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

TOTAL: 45

REFERENCES / MANUALS / SOFTWARE:

- MATLAB
- HFSS

Course Outcomes:

On completion of the course the students will be able to

- analyze and design various types of antennas
- evaluate the spectral characteristics of various modulation techniques
- analyze the S- parameter of a newly designed high frequency RF components and antennas using vector network analyzer

14COL22 WIRELESS COMMUNICATION AND NETWORK SYSTEMS LABORATORY

(Common to Communication Systems & Computer and Communication Engineering)

0 0 3 1

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 NS2
7. Simulation and performance evaluation of Ad-hoc routing protocols using NS2
8. Simulation and performance evaluation of Wireless MAC protocols using NS2
9. Simulation and performance evaluation of Wi –Fi LAN
10. Simulation and performance evaluation of Wi max

TOTAL: 45

REFERENCES / MANUALS / SOFTWARE:

- NS2
- EXATA Emulator

Course Outcomes:

On completion of the course the students will be able to

- model radio signal propagation issues and analyze their impact on communication system performance
- simulate various routing protocols in Ad-hoc Mode
- emulate Video streaming under wireless test bed on WLAN, Wired and PAN

14COE01 CDMA ENGINEERING

(Common to Communication Systems & Computer and Communication Engineering)

3 0 0 3

Pre-requisites: Digital Communication

UNIT – I **9**

Principles of Code Division Multiple Access: Spread spectrum technique – Direct sequence and frequency hopping spread spectrum communication system – PN codes and Walsh codes – Rake receiver – Capacity – Effects of loading, sectorization and voice activity – Power control – Hand off – Link structure – Forward link – Pilot, synchronization, paging and traffic channels – Reverse Link – access and traffic channel

UNIT – II **9**

Call Processing and Traffic: Call processing states – Initialization, idle, access and traffic states – Forward link and Reverse link analysis - Calculation of E_c/I_o and E_b/N_o – Traffic intensity – Grade of Service – Erlang-B and C models

UNIT – III **9**

WCDMA Basics: Protocol architecture, principles of physical layer, Spreading codes and modulation- Introduction- channelization codes- Scrambling codes-modulation- uplink , downlink spreading and modulation

UNIT – IV **9**

OFDMA and MC-CDMA: OFDM principles , Frequency hopping in OFDMA - OFDMA system description – Channel coding, modulation, time and frequency synchronization, Combination of OFDM and CDMA - MC-CDMA, MT-CDMA and MC-DS CDMA systems - Difference between OFDMA and MC-CDMA

UNIT – V **9**

Optical CDMA: Families of Prime Codes- Prime code, Generalized and Extended Prime Codes, Experimental demonstration of Optical CDMA, Synchronization of Optical CDMA networks-Cross-correlation properties, Application, Temporal-Spatial CDMA Optical Network, Multiwavelength Optical CDMA networks

TOTAL : 45

REFERENCE BOOKS:

1. Samuel C Yang, "CDMA RF System Engineering", Artech House, 1998.
2. Richard Van Nee and Ramjee Prasad, "OFDM for wireless Multimedia Communication", Artech House, 2000.
3. Andrew Richardson ,"WCDMA Design Handbook", Cambridge university press, 2005.
4. Khaled Fazal and Stephen Kaiser, "Multicarrier and Spread Spectrum Systems," 2008
5. Guu-Chang Yang, "Prime Codes with Application to Optical and Wireless Networks", Artech House, Inc., 2002.

Course Outcomes:

On completion of the course the students will be able to

- demonstrate basic spread spectrum techniques and different CDMA techniques
- apply his knowledge on basic principles behind radio resource management techniques such as power control, channel allocation and handoffs in different CDMA techniques
- identify the suitable modulation techniques for the given channel environment

14COE02 INDUSTRIAL COMMUNICATION PROTOCOL

3 0 0 3

Pre-requisites: Computer Communication Networks, Wireless Networks

UNIT – I **9**

Modbus: Modbus-Overview, protocol structure, Modbus troubleshooting – common problems-detailed troubleshooting: Modbus plus-protocol overview, common problems/faults-detailed troubleshooting. Modbus II-protocol architecture.

UNIT – II **9**

DNP 3 and IEC 60870-5: DNP 3-Overview, physical layer, data link layer, transport layer, application layer; IEC 60870-5 – standard-protocol architecture, physical layer, data link layer, application layer

UNIT – III **9**

Industrial Ethernet: 10Mbps Ethernet-Medium-access-control,-signaling,-Frame-format, transmission,reception.802.2LLC-100Mbps-Media-access,-Autonegotiation-Industrial-Ethernet troubleshooting

UNIT – IV **9**

AS-Interface & Devicenet: As-interface-overview, physical layer, data link layer-Device Net-physical layer, data link layer, application layer.

UNIT – V **9**

Data Highway Plus and HART: Data highway plus (DH 485)-overview; HART-protocol overview, physical layer, data link layer and application layer

Total : 45

REFERENCE BOOKS:

1. Deon Reynders, Steve Mackay and Edvin Wright, Practical Industrial data communication: Best practice technique, Elsevier-2005
2. Deon Reynders, Steve Mackay and Edvin, Practical Industrial data network design and installation: Best practice technique , Elsvier-2005

Course Outcomes:

On completion of the course the student will be able to

- utilize the concepts of Modbus used in modern data communication
- design and assess a industry standard communication protocol for various conditioning methods

14COE03 MOBILE AD-HOC NETWORKS

3 0 0 3

Pre-requisites: Wireless Networks

UNIT – I **9**

Introduction to Ad Hoc Networks: Introduction – Issues in Adhoc wireless networks; Definition, characteristics - features, applications. Adhoc Mobility Models: - entity and group models.

UNIT – II **9**

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.

UNIT – III **9**

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

UNIT – IV **9**

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.

UNIT – V **9**

Energy Management & Co-operative 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

Course Outcomes:

On completion of the course the students will be able to

- use wireless Adhoc networks and its various layer protocols for real time application
- identify a suitable security attack and QoS in Adhoc networks for the given channel model

14COE04 VEHICULAR AD-HOC NETWORKS

3 0 0 3

Pre-requisites: Mobile Ad-Hoc Networks, Computer Communication Networks

UNIT – I **9**

VANETS- Standards and Regulations: Protocol stack for DSRC , DSRC Regulations - United States , Europe , DSRC Physical Layer Standard , OFDM - PMD function , PLCP function, DSRC Data Link Layer Standard (MAC and LLC) , DSRC Middle Layers, MAC extension for multi channel operation

UNIT – II **9**

VANETS Architecture: Auto Net domain communication architecture, Auto Net Generic Reference Protocol Stack, IEEE WAVE Architecture - IEEE802.11p and IEEE1609.x Standards, C2C-CC, ISO TC204 CALM, EN 302 655, Vehicle Architecture, Roadside Architecture, Infrastructure Architecture, Mobile Device Architecture

UNIT – III **9**

Networking: Networking Principles in the Auto Net Generic Reference Protocol Stack, Network Layer Functionality in Auto Nets, Network Protocol Data Units, Auto Net Ad-Hoc Networking, Auto Net Ad-Hoc Network Characteristics, Auto Net Ad-Hoc Network Addressing and Routing, Beaconing, Network Utility Maximization in Auto Nets, Auto Net Cellular Networking - Communication Architecture, Interactions and Cross-Layer Optimization IPv6 and Mobility Extensions , IPv6 - Mobility Extensions, Deployment Issues.

UNIT – IV **9**

Transport Layer: Transport Layer Integration in the Auto Net Generic Reference Protocol Stack, Auto Net Transport- TCP, UDP, TCP in Auto Nets, Congestion Control in TCP, Impact of Auto Nets, Enhancements of TCP and Technical Requirements for Auto Net Scenarios, The MOCCA Transport Protocol.

UNIT – V **9**

Applications: Vehicle-to-Infrastructure Safety Applications - Intersection Crashes , Cooperative Intersection Collision Avoidance System for Violations- CICAS-V Design , CICAS-V Development , CICAS-V Testing , Integrated Safety Demonstration , Vehicle-to-Vehicle Safety Applications, System Implementation , System Testing

Total : 45

REFERENCE BOOKS:

1. "Automotive Inter-networking", Timo Kosch, Christoph Schroth, Markus Strassberger, Marc Bechler, Wiley-2012
2. Vehicle Safety Communications: Protocols, Security, and Privacy, Tao Zhang, Luca Delgrossi, Wiley.
3. "VANET Vehicular Applications and Inter-Networking Technologies", Hannes Hartenstein, Kenneth Laberteaux, Wiley-2010.
4. "Vehicular Networks: Models and Algorithms", André-Luc Beylot, Houda Labiod, Wiley-2013

Course Outcomes:

On completion of the course the students will be able to

- use VANET networks and its various layer protocols for real time applications.
- design and assess an appropriate architecture for a given user requirement

14COE05 DIGITAL IMAGE PROCESSING AND MULTI RESOLUTION ANALYSIS

(Common to Communication Systems, VLSI Design, Embedded Systems, Computer and Communication Engineering & Mechatronics)

3 0 0 3

Pre-requisites: Digital Signal Processing

UNIT – I **9**

Image Transforms: Orthogonal transforms – FT,DST,DCT, Hartley, Walsh hadamard, Haar, Radon, Slant Wavelet, KL, SVD and their properties

UNIT – II **9**

Image Enhancement and Restoration: Image enhancement - Point operations - contrast stretching - clipping and thresholding - digital negative intensity level slicing - bit extraction. Histogram processing - histogram equalisation -modification. Spatial operations – smoothing spatial filters, sharpening spatial filters. Transform operations. Color image enhancement. Image Restoration – degradation model, Noise models, Unconstrained and Constrained restoration, Inverse filtering – removal of blur caused by uniform linear motion, Wiener filtering, Restoration by SVD and Homomorphic filtering

UNIT – III **9**

Image Compression: Image Compression – Need for data compression – Run length encoding – Huffman coding – Arithmetic coding – predictive coding- transform based compression, - vector quantization – block truncation coding.

Image Segmentation: Point, Edge and line detection -thresholding-Region based approach

Image Representation: boundary based – region based and intensity based description

UNIT – IV **9**

Registration and Multi valued image Processing: Registration – geometric transformation – registration by mutual information

Mutivalued image processing – colour image processing – colour image enhancement- satellite image processing- radiometric correction – other errors- multi spectral image enhancement- medical image processing – image fusion

UNIT – V **9**

Wavelets And Multiresolution Processing : Image Pyramids – Subband coding – The Haar Transform – Multiresolution Expansion – Series Expansion – Scaling Function – Wavelet Function – Wavelet Transform in One Dimension- The Wavelet Series Expansion – The Discrete Wavelet Transform – The Continuous Wavelet Transform – The Fast Wavelet Transform – Wavelet transform in two dimensions– Applications in image denoising and compression

Total : 45

REFERENCE BOOKS:

1. Chanda B, Dutta Majumder D., “Digital Image Processing and analysis”, 2nd Edition, PHI learning, 2011
2. Gonzalez, Rafel C. and Woods, Richard E., "Digital Image Processing", 2nd Edition, Prentice Hall, New York, 2006.
3. Jain, Anil K., "Fundamentals of Digital Image Processing", Prentice Hall of India, New Delhi, 2003.
4. Rosenfield, Azriel and Kak, Avinash C., “Digital Picture Processing”, Academic Press Inc, New York, 1982.

5. Jayaraman. S, Esakkirajan. S, and Veerakumar. T, "Digital Image Processing" Tata McGraw-Hill, New Delhi, 2009

Course Outcomes:

On completion of the course the students will be able to

- analyze and process digital images and color images in various domains
- apply concepts of wavelets in image processing for various applications

14COE06 SATELLITE COMMUNICATION SYSTEM

3 0 0 3

Pre-requisites: Satellite Communication

UNIT – I **9**

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.

UNIT – II **9**

Spacecraft Sub Systems: 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.

UNIT – III **9**

Earth Station:

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.

UNIT – IV **9**

Satellite Access Techniques: 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.

UNIT – V **9**

Applications of Satellite Access Techniques

ATM via satellite. TCP/IP via satellite - INTELSAT series - INSAT, VSAT Systems, LEO and Non Geostationary satellite systems.

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

Course Outcomes :

On completion of the course the students will be able to

- realize the concepts involved in satellite communication systems
- evaluate the performance of the satellites in their orbits
- use various access techniques for designing real time applications

14COE07 GREEN COMMUNICATION

3 0 0 3

UNIT – I **9**

Green communication Energy Management and Modulation : Energy Management for Location-Based Services on Mobile Devices, Energy Efficient Supply of Mobile Devices, Green Radio network - PHY and MAC layer optimization for energy-harvesting wireless networks - Green modulation and coding schemes in energy-constrained wireless networks

UNIT – II **9**

Energy conservation on various applications : QoE-Based Energy Conservation for VoIP Applications in WLAN, Minimum Energy Multi-criteria Relay Selection in Mobile Ad Hoc Networks; Energy Optimization Techniques for Wireless Sensor Networks

UNIT – III **9**

Energy Harvesting systems :Design Issues in EM Energy Harvesting Systems, Energy Scavenging for Magnetically Coupled Communication Devices-Case study

UNIT – IV **9**

Techniques on energy harvesting systems : Mixed-Signal, Low-Power Techniques in Energy Harvesting Systems, Toward Modeling Support for Low-Power and Harvesting Wireless Sensors for Realistic Simulation of Intelligent Energy-Aware Middleware

UNIT – V **9**

Energy harvesting and management on WSNs : Energy Consumption Profile for Energy Harvested WSNs, Radio Frequency Energy Harvesting and Management for Wireless Sensor Networks

Total : 45

REFERENCE BOOKS:

1. Green Mobile Devices and Networks: Energy Optimization and Scavenging Techniques, H. Venkataraman, Gabriel-miro Muntean- CRC Press 2012.
2. Green Radio Communication Networks, Ekram Hossain, Vijay K. Bhargava, Gerhard P. Fettweis
   Cambridge University Press, 30-Jun-2012
3. Green Communications: Theoretical Fundamentals, Algorithms and Applications, Jinsong Wu, Sundeep Rangan , Honggang Zhang- September 20, 2012 by CRC Press
4. Green Communications and Networking, F. Richard Yu, Xi Zhang, Victor C.M. Leung - December 7, 2012 by CRC Press
5. Green IT Strategies and Applications: Using Environmental Intelligence, Bhuvan Unhelkar, June 22, 2011 by CRC Press

Course Outcomes:

On completion of the course the students will be able to

- implement different concepts and basic principles of green communication strategies
- design a future architecture for green communication and networking
- implement green communication by overcoming technical challenges and in measurement of energy gain for future opportunities

14COE08 MICROWAVE INTEGRATED CIRCUITS

3 0 0 3

Pre-requisites: Microwave Communication

UNIT – I **9**

Microstrip Components : Introduction, Fabrication process of MMIC, Hybrid MICs, Propagating modes, Directional couplers, branch line couplers, Microstrip circulators, Phase shifters, Isolators. Introduction to slot line and coplanar wave guide, Introduction to coupled Microstrip

UNIT – II **9**

Microstrip design Analysis: Analysis of MIC by conformal transformation, Hybrid mode analysis, losses in Microstrip, Introduction to slot line and coplanar wave guide., Even and odd mode analysis, Design and Fabrication of Lumped elements for MICs, Comparison with distributed circuits Ferromagnetic substrates and inserts.

UNIT– III **9**

Amplifiers : Stability & gain analysis, matching techniques, reactively matched amplifier design, Power amplifier,LNA.

UNIT– IV **9**

Oscillators : Design principles, active device CAD techniques for large signal oscillators design, phase noise, MMIC_VCO, mixers-Analysis of mixer circuits-Diode mixers-Active FET Mixers.

UNIT – V **9**

Integrated Antennas & Microwave 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. I.D.Robertson & S.Lucyszyn,"RFIC and MMIC design and Technology"Institution of Electrical Engineers, 2001
3. Gupta K.C. and Amarjit Singh, "Microwave Integrated Circuits", John Wiley, New York, 1975
4. Gentili C, " Microwave Amplifiers and Oscillators", North Oxford Academic, 1986
5. Annapurna Das and Sisir K Das, " Microwave Engineering", Tata McGraw-Hill Pub. Co. Ltd., 2004.
6. Samuel. Y. Liao, " Microwave Circuit Analysis and Amplifier Design", Prentice Hall. Inc., 1987
7. Mathew N.O. Sadiku, "Numerical techniques in Electromagnetics", CRC Press, 2001.

Course Outcomes:

On completion of the course the students will be able to

- implement the fundamentals to recent techniques in microwave integrated circuit technology
- design and assess the performance of various planar configurations

14COE09 SPEECH PROCESSING

3 0 0 3

Pre-requisites: Digital Signal Processing

UNIT – I **9**

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.

UNIT – II **9**

Speech Properties: 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.

UNIT – III **9**

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

UNIT – IV **9**

Speech Signal Recognition: 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.

UNIT – V **9**

Speech Signal Modelling: 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. Gold B and Morgan N, “Speech and Audio Signal Processing”, Wiley and Sons, 2000.
3. Quatieri T.F, “Discrete Time Speech Signal Processing”, Prentice Hall, 2002
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

Course Outcomes:

On completion of the course the students will be able to

- characterize the real time speech signals on different channel environments
- apply his knowledge on speech signal modeling, recognition and coding techniques for various channel impairment

14COE10 MULTICARRIER COMMUNICATION

(Common to Communication Systems & Computer and Communication Engineering)

3 0 0 3

Pre-requisites: Digital Communication, Cellular and Mobile Communication

UNIT – I **9**

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

UNIT – II **9**

Multicarrier Fundamentals: Motivation, OFDM, Subcarrier notion, Role of FFT, Parallel channel decomposition and detection, OFDM Transmitter Optimization: Adaptive Modulation, Waterfilling

UNIT – III **9**

Multicarrier Receivers: SNR gap analysis, Bit loading algorithms, Linear precoding, Coded OFDM, OFDM Receiver Algorithms : Synchronization, Sensitivity to timing and frequency errors

UNIT – IV **9**

Channel Estimation and Equalization: Zero forcing and MMSE algorithms, Training sequence design, Multiuser Systems: OFDMA, SCFDMA, Distributed and localized mapping.

UNIT – V **9**

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

Course Outcomes:

On completion of the course the students will be able to

- demonstrate the trade-offs involved in the design of modulation coding techniques
- design the baseband signaling waveforms for a particular user requirement and type of channel over which the system has to function

14COE11 SPREAD SPECTRUM COMMUNICATION

(Common to Communication Systems & Computer and Communication Engineering)

3 0 0 3

Pre-requisites: Digital Communication

UNIT – I **9**

Performance characterization of digital data transmission: Detection of binary signals in AWGN - Quadrature multiplexed signaling schemes - Equalization of digital data transmission system - Communication in the presence of pulse noise jamming - Low probability detection scheme

UNIT – II **9**

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

UNIT – III **9**

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.

UNIT – IV **9**

Synchronization of spread spectrum systems: Optimal tracking of wideband signals - Code tracking loops for FHSS - Optimum synchronization techniques - Synchronization using a matched filter - Synchronization by estimating the received spreading code.

UNIT – V **9**

Performance of Spread Spectrum System: SS Systems communications models - Performance without coding under AWGN - 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, Peterson R L and David E. Borth, "Introduction to Spread Spectrum Communications", Published by Pearson Education Pte. Ltd., 2005
2. Dixon R C, "Spread Spectrum Systems", Wiley Interscience, 1976
3. Holms J K, "Coherent Spread Spectrum Systems", Wiley Interscience, 1982.

Course Outcomes:

On completion of the course the students will be able to

- utilize the concept of digital data transmission from fundamental to recent technology
- evaluate the performance of spectral characterization of spread spectrum system on different transmission medium

14COE12 TCP/IP NETWORKS

3 0 0 3

Pre-requisites: Computer Communication Networks

UNIT – I **9**

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

UNIT – II **9**

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)

UNIT – III **9**

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

UNIT – IV **9**

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. **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.

UNIT – V **9**

Traffic Management: 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

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

Course Outcomes:

On completion of the course the students will be able to

- design and analyze the specific TCP/IP protocol for the given channel
- realize the Traffic Management and Flow/Congestion Control for next generation technology
- analyze various routing techniques used in communication networks

14COE13 WIRELESS SYSTEMS AND STANDARDS

3 0 0 3

Pre-requisites: Cellular and Mobile Communication, Wireless Networks

UNIT – I **9**

Wireless Systems: 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 .

UNIT – II **9**

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

UNIT – III **9**

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

UNIT – IV **9**

Future Standard & 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.

UNIT – V **9**

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

Course Outcomes:

On completion of the course the students will be able to

- design and analyze the baseband signaling schemes from fundamental to recent wireless system standards
- apply knowledge on the future standard and trends in wireless system

14COE14 RF MEMS FOR WIRELESS COMMUNICATION

3 0 0 3

Pre-requisites: Microwave Engineering ,Transmission Lines and Waveguides

UNIT – I **9**

Introduction to RF MEMS: 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.

UNIT – II **9**

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

UNIT – III **9**

Resonators & enabled circuits : Transmission line planar resonators, cavity resonators, micromechanical resonators, film bulk acoustic wave resonators, MEMS modeling – mechanical modeling, electromagnetic modeling. Enabled circuits – reconfigurable circuits – the resonant MEMS switch, Capacitors, inductors, tunable CPW resonator, MEMS microswitch arrays.

UNIT – IV **9**

Reconfigurable circuits : Double – stub tuner, N^{th} – 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

UNIT – V **9**

Filters & oscillators: Film bulk acoustic wave filters – FBAR filter fundamentals, FBAR filter for PCS applications, RF MEMS filters – Ka-Band millimeter-wave Micromachined tunable filter, High-Q 8-MHz MEM Resonator filter, RF MEMS Oscillators – fundamentals, 14-GHz MEM Oscillator, Ka- Band Micromachined cavity oscillator, 2.4 GHz MEMS based voltage controlled oscillator

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.
4. Marc Madou, "Fundamentals of Microfabrication", CRC press 1997.
5. Stephen D. Senturia," Micro system Design", Kluwer Academic Publishers, 2001

6. Tai Ran Hsu ,"MEMS and Microsystems Design and Manufacture" , Tata Mcraw Hill, 2002.
7. Chang Liu, "Foundations of MEMS", Pearson education India limited, 2006
8. Sergey Edward Lyshevski, "MEMS and NEMS: Systems, Devices, and Structures" CRC Press, 2002

Course Outcomes:

On completion of the course the students will be able to

- demonstrate the various aspects of micro/nano system design
- design tools on fabrication of various RF MEMS circuits

14COE15 NETWORK SECURITY ALGORITHMS

3 0 0 3

Pre-requisites: Computer Communication Networks

UNIT – I **9**

Public Key Cryptography : OSI Security Architecture - Classical Encryption techniques – symmentric cipher model, substitution techniques, Transposition techniques– Cipher Principles – Data Encryption Standard, Strength of DES, AES Cipher – Triple DES – Placement of Encryption Function – Traffic Confidentiality

UNIT – II **9**

Security Key Management: Introduction to Number theory-format's & Euler's Theorems, Testing for primality, Chinese Remaindar Theorem-Public key cryptography-RSA-Key Management - Diffie-Hellman key Exchange – Elliptic Curve Cryptography

UNIT – III **9**

Authentication: Authentication requirements – Authentication functions – Message Authentication Codes – Hash Functions – Security of Hash Functions and MACs – SHA-512-HMAC

UNIT – IV **9**

Digital signature & authentication Applications: Digital Signatures – Authentication Protocols – Digital Signature Standard - Authentication Applications: Kerberos – X.509 Authentication Service. Electronic mail security: PGP.

UNIT – V **9**

Web Security and System Level Security: IP Security Overview, Architecture- Key management – 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.

Course Outcomes:

On completion of the course the students will be able to

- design and assess information security risks that concern integrity of data and availability of systems
- demonstrate the ways in which communication network security may get compromised and the basic principles of security algorithm design

14CNE02 WIRELESS SENSOR NETWORKS

(Common to Computer and Communication Engineering, Communication Systems & Control and Instrumentation Engineering)

3 0 0 3

Pre-requisites: Wireless Networks

UNIT – I **9**

Overview of Wireless Networks: Challenges for Wireless Sensor Networks - Characteristics requirements-required mechanisms, Difference between mobile ad-hoc and sensor networks, Applications of sensor networks -case study, Enabling Technologies for Wireless Sensor Networks.

UNIT – II **9**

Architectures : Single-Node Architecture -Hardware Components, Energy Consumption of Sensor Nodes, Operating Systems and Execution Environments, Network Architecture -Sensor Network Scenarios, Optimization Goals and Figures of Merit, Gateway Concepts. Physical Layer and Transceiver Design Consideration

UNIT – III **9**

MAC and Routing: MAC Protocols for Wireless Sensor Networks, IEEE 802.15.4, Zigbee, Low Duty Cycle Protocols And Wakeup Concepts -S-MAC, The Mediation Device Protocol, Wakeup Radio Concepts, Address and Name Management, Assignment of MAC Addresses, Routing Protocols -Energy-Efficient Routing, Geographic Routing.

UNIT – IV **9**

Infrastructure Establishment: Topology Control, Clustering, Time Synchronization, Localization and Positioning, Sensor Tasking and Control.

UNIT – V **9**

Data Management and Security : Data management in WSN, Storage and indexing in sensor networks, Query processing in sensor, Data aggregation, Directed diffusion, Tiny aggregation, greedy aggregation, security in WSN.

TOTAL : 45

REFERENCE BOOKS:

1. Ian F. Akyildiz, Mehmet Can Vuran, " Wireless Sensor Networks" John Wiley, 2010
2. Yingshu Li, My T. Thai,Weili Wu, " Wireless Sensor Networks and Applications", Springer, 2008
3. Holger Karl & Andreas Willig, " Protocols And Architectures for Wireless Sensor Networks" , John Wiley, 2005.
4. Feng Zhao & Leonidas J. Guibas, "Wireless Sensor Networks-An Information Processing Approach", Elsevier, 2007.
5. Kazem Sohraby, Daniel Minoli, & Taieb Znati, "Wireless Sensor Networks Technology, Protocols and applications", John Wiley, 2007.
6. Anna Hac, "Wireless Sensor Network Designs", John Wiley, 2003.
7. Bhaskar Krishnamachari, "Networking Wireless Sensors", Cambridge Press, 2005.
8. Mohammad Ilyas and Imad Mahgaob, "Handbook of Sensor Networks : Compact Wireless And Wired Sensing Systems", CRC Press, 2005.

9. Wayne Tomasi, “Introduction to Data Communication and Networking”, Pearson Education, 2007

Course Outcomes:

On completion of the course the students will be able to

- appreciate the need for designing energy efficient sensor nodes and protocols for prolonging network lifetime
- demonstrate an understanding of the different implementation challenges and the solutions approaches.

14CNT14 MULTIMEDIA COMPRESSION TECHNIQUES

(Common to Computer and Communication Engineering & Communication Systems)

3 0 0 3

UNIT – I **9**

Introduction : Special features of Multimedia – Graphics and Image Data Representations – Popular File formats - Fundamental Concepts in Video - Digital Audio – Storage requirements for multimedia applications -Need for Compression - Lossy & Lossless compression techniques– Overview of Source Models - Source coding - Scalar and Vector quantization

UNIT – II **9**

Text Compression: Compression techniques: Shannon- Fano coding -Huffman coding – Adaptive Huffman Coding – Arithmetic coding – Dictionary techniques : LZW algorithm.

UNIT– III **9**

Audio Compression: Audio compression techniques - μ- Law and A-Law companding-Frequency domain and filtering – Differential Encoding –DPCM- ADPCM – DM – Optimal Predictors and Optimal Quantization -Application to speech coding: G.722 – Application to audio coding : MPEG audio, Silence compression- Speech compression techniques : Formants and CELP Vocoders

UNIT– IV **9**

Image Compression : Transform Coding: JPEG Standard – Sub band coding algorithms - Design of Filter banks – Implementation using filters- Wavelet based compression: EZW- SPIHT coders – JPEG 2000 standards- JBIG- JBIG2 standards

UNIT – V **9**

Video Compression : Video compression Based on Motion Compensation – Search for Motion Vectors - H.261 - MPEG Video Coding I: MPEG – 1 and 2 – MPEG Video Coding II: MPEG – 4: Object Based Visual Coding –Synthetic Object Coding –Object types-Profiles and Levels – MPEG 7.

TOTAL : 45

REFERENCE BOOKS:

1. Morgan Kauffman, Khalid Sayood, “Introduction to Data Compression”, Harcourt India, 2nd Edition, 2000
2. David Salomon , “ Data Compression – The Complete Reference”, Springer Verlag New York Inc, 2nd Edition, 2001
3. Yun Q.Shi, 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,2000
6. Mark S.Drew, Ze-Nian Li, “Fundamentals of Multimedia”, PHI, 1st Edition, 2003
7. Watkinson J , “Compression in Video and Audio”, Focal press, London,1995

Course Outcomes:

On completion of the course the students will be able to

- perform text and audio compression
- acquire the knowledge of various compression techniques in image and video
- apply the above knowledge and skills to compress various types of media

14COE16 ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY

(Common to Communication Systems, VLSI Design, Applied Electronics & Control and Instrumentation Engineering)

3 0 0 3

Pre-requisites: Microwave Communication

UNIT – I **9**

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

UNIT – II **9**

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

UNIT – III **9**

EMI/EMC standards and measurements : Civilian standards - FCC, CISPR,I EC, 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).

UNIT – IV **9**

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

UNIT – V **9**

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", John Wiley & Sons, New York, 1988
2. Paul, C.R., “Introduction to Electromagnetic Compatibility”, John Wiley & Sons, New York, 1992
3. Kodali, V.P., "Engineering EMC Principles, Measurements and Technologies", IEEE Press, London, 1996.
4. Keiser, Bernhard., "Principles of Electromagnetic Compatibility", Third Edition, Artech House, Dedham, 1986.

Course Outcomes:

On completion of the course the students will be able to

- formulate the various aspects EMI/EMC coupling
- identify a suitable EMI testing and controlling techniques
- develop the EMC design of PCBs

14ESE02 SOFT COMPUTING AND OPTIMIZATION TECHNIQUES

(Common to Embedded Systems & Communication Systems)

3 0 0 3

Pre-requisites: Soft Computing

UNIT – I **9**

Neural Networks: Introduction to soft Computing-Neural Networks -Supervised Learning Neural Networks – Perceptrons - Back propagation Multilayer perceptrons – Radial Basis Function Networks – Support Vector Machine – Extreme Learning Machine

UNIT – II **9**

Fuzzy Logic: Fuzzy Sets – Basic Definition and Terminology - Fuzzy Rules and Fuzzy Reasoning - Extension principle and Fuzzy Relations – Fuzzy Inference Systems –Fuzzy Models – De-fuzzification methods

Neuro Fuzzy Modelling: Adaptive Neuro-Fuzzy Inference Systems – Architecture – Hybrid Learning Algorithm

UNIT – III **9**

Hybrid Systems-Integration of Neural Networks and Fuzzy Logic : Sequential hybrid stystems-Auxillary hybrid systems-embedded hybrid systems-neuro-fuzzy hybids- Fuzzy back propagation networks- simplified fuzzy ARTMAP- Fuzzy Associative memory

UNIT – IV **9**

Genetic Algorithm: Fundamentals of genetic algorithm- encoding- fitness function – reproduction- Genetic Modeling – Inheritance operators - cross over, mutation, inversion, deletion, bit wise operators – generation cycle – schema theorem - Application

UNIT – V **9**

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

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

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. Rajasekaran S and Pai, G.A.V., "Neural Networks, Fuzzy Logic and Genetic Algorithms", Prentice Hall of India, New Delhi, 2003
3. Eberhart, R., Simpson, P. and Dobbins, R.," Computational Intelligence PC Tools", AP Professional, Boston 1996.
4. Goldberg, Davis E., "Genetic Algorithms: Search, Optimization and Machine Learning" Addison Wesley, New York, 1989
5. Ross Timothy J., " Fuzzy Logic Engineering Applications" John Wiley and Sons, 2004

Course Outcomes:

On completion of the course the students will be able to

- utilize the soft computing techniques and their role in building intelligent machines
- interpret the working of fuzzy systems
- solve optimization problems

14VLE12 DSP PROCESSOR ARCHITECTURE AND PROGRAMMING

(Common to VLSI Design & Communication Systems)

3 0 0 3

Pre-requisites: Digital Signal Processing.

UNIT – I **9**

Fundamentals of programmable DSPs: Multiplier and Multiplier accumulator (MAC) – Modified Bus Structures and Memory access in Programmable DSPs – Multiple access memory – Multi-port memory – VLIW architecture- Pipelining – Special Addressing modes in P-DSPs – On chip Peripherals

UNIT – II **9**

TMS320C54XX: Fundamentals of Programmable DSPs - Architecture of TMS320C54X-54X Buses-Memory organization-Computational Units-Pipeline operation-On-chip peripherals –Address Generation Units- Addressing modes and instruction set- assembly language instructions -Introduction to Code Composer studio

UNIT – III **9**

TMS320C6X : Architecture of TMS320C6X – Computational units-Addressing modes –Memory architecture- pipeline operation- instruction set- assembly language instructions

UNIT – IV **9**

Blackfin Processor(BF537): Architecture of BF537- Computational units - Internal Memory organization- System interrupts – Direct Memory Access- on-chip peripherals-ALU-MAC-DAG Units-Addressing modes-Assembly language instructions- Timers –Interrupts-Serial ports-UART-Simple programs

UNIT – V **9**

Applications Using TMS320C54X/C6X/BF537: Program development - Software Development Tools- The Assembler and the Assembly Source File Filter design- Linker and Memory Allocation - DSP Software Development Steps- Speech Digitization-Encoding & Decoding-Image compression-Restoration-Adaptive Echo cancellation-Modulation

TOTAL: 45

REFERENCE BOOKS::

1. Venkataramani, B. and Bhaskar, M., “Digital Signal Processors: Architecture, Programming and Applications”, Tata McGraw–Hill, New Delhi, 2003
2. Texas Instrumentation, “User guides: Analog Devices”, Motorola Inc, Arizona, 2003
3. Sen.M.Kuo, Woon–Seng S.Gan, “Digital Signal Processors: Architecture, Implementation and Applications”, Prentice Hall, 2005
4. www.analogdevices.com.

Course Outcomes:

On completion of the course the students will be able to

- utilize the architecture of various DSP processor
- design various applications using DSP processors