NOORUL ISLAM CENTRE FOR HIGHER EDUCATION

NOORUL ISLAM UNIVERSITY, KUMARACOIL

M.E. COMMUNICATION SYSTEMS

CURRICULUM & SYLLABUS

SEMESTER I

SL. No.	Course Code	Course Title	L	T	P	C
THEORY						
1	MA1501	Advanced Mathematics	3	1	0	4
2	EC1501	Advanced Radiation Systems	3	0	0	3
3	EC1502	Modern Digital Communication Techniques	3	0	0	3
4	EC1503	Advanced Digital Signal Processing	3	0	0	3
5	EC1504	Optical Communication Networks	3	0	0	3
6	EC15XX	Elective I	3	0	0	3
PRACTICAL						
7	EC1571	Communication System Lab-I	0	1	2	2
TOTAL			18	2	2	21

MA1501 **ADVANCED MATHEMATICS**

L	T	P	C
3	1	0	4

AIM:

To gain a well found knowledge of optimizing a function and variational problems which provide necessary mathematical support and confidence to tackle real life problems.

OBJECTIVE:

The course objective is to extend the ability of the students in the areas of Matrix Theory and Stochastic Processes. This will be applicable in Engineering practices and serve as a pre-requisite for higher studies and research.

UNIT I ADVANCED MATRIX THEORY **9**

Generalised Eigen vectors– Jordan canonical form — Matrix norms – Singular value decomposition – Pseudo inverse – Least square approximations – QR algorithm.

UNIT II SPECIAL FUNCTIONS **9**

Bessel's equation – Bessel function – Recurrence relations - Generating function and orthogonal property for Bessel functions of first kind – Fourier-Bessel expansion.

UNIT III RANDOM PROCESSES **9**

Classification – Stationary random processes – Ergodic process - Auto correlation – Cross correlations – Properties - Power spectral density.

UNIT IV DYNAMIC PROGRAMMING **9**

Bellman’s principle of optimality – Characteristics of the dynamic programming model – The recursive equation approach – Solution of discrete dynamic programming problem.

UNIT V CALCULUS OF VARIATIONS **9**

Euler’s equation – Functional dependent on first and higher order derivatives – Functional dependent on functions of several independent variables -Isoperimetric Problems.

L: 45 + T: 15, TOTAL: 60 PERIODS

REFERENCES:

1. Bronson, R., “Matrix Operations”, Schaum’s Outline Series, McGraw–Hill, New York
2. Gupta, A.S., “Calculus of Variations with Applications”, Prentice-Hall of India, New Delhi.
3. Dr.Venkataraman, M.K., “ Higher Mathematics for Engineering and Science”, National Publishing Company.1992.
4. Taha, H.A., “Operations Research – An Introduction”, Sixth Edition, Prentice-Hall of India, New Delhi.
5. Gupta, P.K. and Hira, D.S., “Operations Research”, S.Chand & Co. New Delhi.
6. Peebles Jr., P.Z., “Probability, Random Variables and Random Signal Principles”, McGraw-Hill Inc..

EC1501 ADVANCED RADIATION SYSTEMS 3 0 0 3

AIM

To enable the student to study the various types of modern antennas and wave propagation techniques.

OBJECTIVES

- To study radiation from a current element.
- To study aperture antennas
- To learn special antennas such as frequency independent and broad band antennas.
- To study radio wave propagation.

UNIT I CONCEPTS OF RADIATION 9

Retarded vector potentials – Heuristic approach and Maxwell's equation approach. The Lorentz gauge condition. Vector potential in Phasor form. Fields radiated by an alternating current element. Total power radiated and radiation resistance. Radiation from Half wave dipole from assumed current distribution. Power radiated in the farfield. Electric vector potential F for a magnetic current source M. Far zone fields due to magnetic source M.

UNIT II ANTENNA ARRAYS 9

N element linear arrays – uniform amplitude and spacing. Phased arrays. Directivity of Broadside and End fire arrays. Three dimensional characteristics. Binomial arrays and Dolph-Tchebycheff arrays. Circular array. Antenna Synthesis- Line source and discretization of continuous sources. Schelkunoff polynomial method. Fourier transform method.

UNIT III APERTURE ANTENNAS 9

Magnetic current – Duality. Electric and Magnetic current sheets as sources. Huyghens source. Radiation through an aperture in an absorbing screen. Fraunhoffer and Fresnel diffraction. Cornu Spiral. Complimentary screens and slot antennas. Slot and dipoles as dual antennas. Babinets principle. Fourier transform in aperture antenna theory.

UNIT IV HORN, MICROSTRIP , REFLECTOR ANTENNAS 9

E and H plane sectoral Horns. Pyramidal horns. Conical and corrugated Horns. Multimode horns. Phase center. Microstrip antennas – feeding methods. Rectangular patch- Transmission line model. Parabolic Reflector antennas – Prime focus and cassegrain reflectors. Equivalent focal length of Cassegrain antennas. Spillover and taper efficiencies. Optimum illumination.

UNIT V ANTENNA POLARIZATION 9

Simple relationship involving spherical triangles. Linear, Elliptical and circular polarization. Development of the Poincare sphere. Representation of the state of polarization in the Poincare sphere. Random polarization – Stokes parameters.

TOTAL: 45 PERIODS

REFERENCES

1. Balanis, C.A., "Antenna Theory" Wiley,2003
2. Jordan, E.C., " Electromagnetic waves and Radiating systems". PHI 2003

3. Krauss, J.D., " Radio Astronomy" McGraw-Hill 1966, for the last unit (reprints available)
4. Krauss, J.D.,, Fleisch,D.A., "Electromagnetics" McGraw-Hill,1999

EC1502 MODERN DIGITAL COMMUNICATION TECHNIQUES 3 0 0 3

AIM

To introduce the concepts of Digital Communication modulation, error control coding and to discuss about the spread spectrum modulation schemes.

OBJECTIVES

- To study communication over memoryless channel
- To learn about spread spectrum communication.
- To learn about various constant envelope modulation schemes and orthogonal frequency division multiplexing.
- To learn error control coding which encompasses techniques for the encoding and decoding of digital data streams for their reliable transmission over noisy channels.

UNIT I 9

COMMUNICATION OVER MEMORYLESS CHANNEL AND SPREAD SPECTRUM TECHNIQUES

Scalar and vector communication over memoryless channel – Detection criteria; Shannon's channel coding theorem; Channel capacity; Spread spectrum overview - PN sequences; DS spread spectrum; Frequency hopping synchronization; jamming considerations; commercial applications-cellular systems.

UNIT II 9

CONSTANT ENVELOPE MODULATION

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

UNIT III 9

OFDM AND EQUALIZATION

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. Equalization - Linear equalization; Decision feedback equalization; Turbo equalization; Viterbi equalization.

UNIT IV 9

BLOCK CODED DIGITAL COMMUNICATION

Architecture and performance – Binary block codes; Orthogonal; Biorthogonal; Transorthogonal; Linear block codes; Hamming; Golay; Cyclic-Systematic; Non-systematic; BCH ; Reed – Solomon codes.

UNIT V **9**

CONVOLUTIONAL CODED DIGITAL COMMUNICATION

Representation of codes using Polynomial, State diagram, Tree diagram, and Trellis diagram – Decoding techniques using Maximum likelihood, Viterbi algorithm, Sequential and Threshold methods; Trellis Coded Modulation; Turbo Coding.

TOTAL: 45 PERIODS

REFERENCES:

1. M.K.Simon, S.M.Hinedi and W.C.Lindsey, Digital communication techniques; Signaling and detection, Prentice Hall India, New Delhi. 1995
2. I.E.Otung, 'Communication Engineering Principles', Palgrave, 2001
3. Richard Van Nee & Ramjee Prasad, 'OFDM for Multimedia Communications' Artech House Publication, 2001
4. Bernard Sklar, 'Digital Communications', second edition, Pearson Education, 2001
5. Theodore S.Rappaport, 'Wireless Communications', 2nd edition, Pearson Education, 2002
6. Simon Haykin, Digital communications, John Wiley and sons, 1998

EC1503 ADVANCED DIGITAL SIGNAL PROCESSING 3 0 0 3

AIM

To introduce the students the various concepts and techniques used in advanced digital signal processing techniques.

OBJECTIVES

- To study the parametric methods for power spectrum estimation.
- To study adaptive filtering techniques using lms algorithm and to study the applications of adaptive filtering.
- To study multirate signal processing fundamentals.
- To study the analysis of speech signals.
- To introduce the student to wavelet transforms.

UNIT I **9**

DISCRETE RANDOM SIGNAL PROCESSING

Discrete Random Processes- Ensemble averages, stationary processes, Autocorrelation and Auto covariance matrices. Parseval's Theorem, Wiener-Khintchine Relation- Power Spectral Density-Periodogram Spectral Factorization, Filtering random processes. Low Pass Filtering of White Noise. Parameter estimation: Bias and consistency.

UNIT II **9**

SPECTRUM ESTIMATION

Estimation of spectra from finite duration signals, Non-Parametric Methods-Correlation Method , Periodogram Estimator, Performance Analysis of Estimators -Unbiased, Consistent Estimators- Modified periodogram, Bartlett and Welch methods, Blackman –Tukey method. Parametric Methods - AR, MA, ARMA model based spectral estimation. Parameter Estimation -Yule-Walker equations, solutions using Durbin's algorithm

UNIT III **9**

WIENER FILTERS AND LINEAR PREDICTION

Linear prediction- Forward and backward predictions, Solutions of the Normal equations-Levinson-Durbin algorithms. Least mean squared error criterion -Wiener filter for filtering and prediction , FIR Wiener filter and Wiener IIR filters ,Discrete Kalman filter

UNIT IV **9**

ADAPTIVE FILTERS

FIR adaptive filters -adaptive filter based on steepest descent method-Widrow-Hoff LMS adaptive algorithm, Normalized LMS. Adaptive channel equalization-Adaptive echo cancellation-Adaptive noise cancellation- Adaptive recursive filters (IIR). RLS adaptive filters-Exponentially weighted RLS-sliding window RLS.

UNIT V **9**

MULTIRATE DIGITAL SIGNAL PROCESSING

Mathematical description of change of sampling rate - Interpolation and Decimation, Decimation by an integer factor - Interpolation by an integer factor, Sampling rate conversion by a rational factor, Filter implementation for sampling rate conversion- direct form FIR structures, Polyphase filter structures, time-variant structures. Multistage implementation of multirate system. Application to sub band coding - Wavelet transform and filter bank implementation of wavelet expansion of signals.

TOTAL: 45 PERIODS

REFERENCES:

1. Monson H.Hayes, Statistical Digital Signal Processing and Modeling, John Wiley and Sons, Inc.,Singapore, 2002.
2. John G. Proakis, Dimitris G.Manolakis, Digital Signal Processing Pearson Education, 2002.
3. John G. Proakis et.al.,'Algorithms for Statistical Signal Processing', Pearson Education, 2002.
4. Dimitris G.Manolakis et.al.,'Statistical and adaptive signal Processing', McGraw Hill, Newyork,2000.
5. Rafael C. Gonzalez, Richard E.Woods, 'Digital Image Processing', Pearson Education, Inc., Second Edition, 2004.(For Wavelet Transform Topic.

EC1504 OPTICAL COMMUNICATION NETWORKS 3 0 0 3

AIM

To study about various optical system components, networks and their use in the optical communication system and also discuss about different network architecture.

OBJECTIVES

- To learn the basic optical system components
- To learn the types of optical network architectures, Wave length Routing Networks, packet switching and Access networks
- To understand the concept of network management

UNIT I OPTICAL SYSTEM COMPONENTS AND NETWORK DESIGN 9

Optical System Components – Couplers, Isolators & Circulators, Multiplexers & Filters, Optical Amplifiers, Switches, Wavelength Converters; Transmission System Engineering – System model, Power penalty - transmitter, receiver, Optical amplifiers, crosstalk, dispersion; Wavelength stabilization ; Overall design considerations.

UNIT II OPTICAL NETWORK ARCHITECTURES 9

Introduction to Optical Networks; SONET / SDH, Metropolitan-Area Networks, Layered Architecture ; Broadcast and Select Networks – Topologies, Media-Access Control Protocols and Testbeds; Wavelength Routing Architecture.

UNIT III WAVELENGTH ROUTING NETWORKS 9

WDM Network Elements; WDM Network Design - Cost tradeoffs, Virtual Topology Design, Routing and wavelength assignment, Statistical Dimensioning Models.

UNIT IV PACKET SWITCHING AND ACCESS NETWORKS 9

Photonic Packet Switching – OTDM, Multiplexing and Demultiplexing, Synchronisation, Header Processing, Buffering, Burst Switching, Testbeds; Access Networks.

UNIT V NETWORK MANAGEMENT AND SURVIVABILITY 9

Control and Management – Network management functions, Configuration management, Performance management, Fault management, Optical safety, Service interface; network Survivability- Protection in SONET / SDH and IP Networks, Optical layer Protection, Interworking between layers.

TOTAL: 45 PERIODS

REFERENCES

1. Rajiv Ramaswami and Kumar N. Sivarajan, “Optical Networks : A Practical Perspective”, Harcourt Asia Pte Ltd., Second Edition 2006.

2. C. Siva Ram Moorthy and Mohan Gurusamy, "WDM Optical Networks : Concept, Design and Algorithms", Prentice Hall of India, Ist Edition, 2002.
3. P.E. Green, Jr., "Fiber Optic Networks", Prentice Hall, NJ, 1993.
4. Biswanath Mukherjee, "Optical WDM Networks", Springer, 2006.

EC1571 COMMUNICATION SYSTEM LAB - I 0 1 2 2

AIM

To have a practical idea about the various experiments used in the field of communication.

OBJECTIVES

- To have a knowledge about the radiation pattern of different antennas
- To study the different modulation techniques used practically
- To have a knowledge about spread spectrum techniques
- To study about the error correcting coding techniques.

1. Antenna Radiation Pattern measurement.
2. Simulation of Adaptive Filters and multistage multirate systems.
3. Performance evaluation of Digital Data Transmission through Fiber Optic Link.
4. Simulation of QMF using Simulation Packages.
5. Implementation of Video Link using Optical Fiber.
6. Implementation of Linear and Cyclic Codes.
7. Power spectral density estimation.
8. Implementation of Pseudorandom noise generator.
9. Spectral analysis of RF oscillators and amplifiers.
10. Measurement of VSWR and return loss in transmission lines.

TOTAL: 45 PERIODS

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M.E. COMMUNICATION SYSTEMS

CURRICULUM & SYLLABUS

SEMESTER II

SL. No.	Course Code	Course Title	L	T	P	C
THEORY						
1	EC1505	Wireless Communication Networks	3	0	0	3
2	EC1506	Multimedia Compression Techniques	3	0	0	3
3	EC1507	Microwave Integrated Circuits	3	0	0	3
4	EC1508	Satellite Communication	3	0	0	3
5	EC1509	Communication Network Security	3	0	0	3
6	EC15XX	Elective II	3	0	0	3
PRACTICAL						
7	EC1572	Communication System Lab-II	0	1	2	2
TOTAL			18	1	2	20

EC1505 WIRELESS COMMUNICATION NETWORKS 3 0 0 3

AIM

To make the students to know about the various modulation techniques, propagation methods, coding and multi access techniques used in the wireless communication. Techniques regarding various wireless network systems and standards are to be introduced.

OBJECTIVES

- It presents different ways to radio propagation models and predict the large – scale effects of radio propagation in many operating environment.
- It provides idea about digital modulation techniques used in wireless communication. It also deals with the different coding and multiple access techniques and diversity concepts.
- It deals with second generation and third generation wireless networks and worldwide wireless standards.

UNIT I: RADIO PROPAGATION CHARACTERISTICS 9

Radio Propagation Characteristics- Models for path loss, shadowing and multipath fading (delay spread, coherence bandwidth, coherence time, Doppler spread), Jakes channel model.

UNIT II: DIGITAL MODULATION 9

Digital modulation for mobile radio, analysis under fading channels - diversity Techniques and RAKE demodulator, channel coding techniques, multiple access techniques used in wireless mobile communications.

UNIT III: WIRELESS NETWORKS 9

Wireless networks, WLAN, bluetooth, cellular concept- frequency reuse, basic theory of hexagonal cell layout, Spectrum efficiency, FDM / TDM cellular systems- Channel allocation schemes, handover analysis, erlang capacity comparison of FDM / TDM systems and cellular CDMA.

UNIT IV: CELLULAR STANDARDS 9

Discussion of GSM and CDMA cellular standards, Signaling and call control, Mobility management, location tracking, wireless data networking, packet error modeling on fading channels, performance analysis of link and transport layer protocols over wireless channels-mobile data networking (Mobile IP), wireless data in GSM, IS, 95 and GPRS, Space Time Wireless Communications.

UNIT V: SECURITY ISSUES IN WIRELESS NETWORKS 9

Security in Wireless Networks, Secure routing, Key Pre-distribution and Management, Encryption and Authentication, Intrusion Detection in Cellular Mobile Networks, WLANS-Cross-Domain Mobility-Adaptive authentication, AAA architecture and Authentication for WLAN Roaming.

TOTAL: 45 PERIODS

REFERENCES:

1. T.S.Rappaport, “Wireless Communications- Principles and Practice”, Second Edition, Prentice Hall, 2002.
2. W. Stallings, "Wireless Communications and Networks", Prentice Hall, 2002.
3. J. G. Proakis, “Digital Communication”, McGraw Hill, 2000
4. G.L. Stuber, “Principles of Mobile Communications”, Kluwer Academic, 1996.
5. J.Schiller,”Mobile Communications", Addison Wesley, 2000.
6. Uyless Black ,”Mobile and Wireless Networks” , Prentice Hall PTR, 1996.
7. Y. Xiao, X. Shen, D. -Z. Du, “Wireless Network Security”, Springer Science, 2007.

EC1506 MULTIMEDIA COMPRESSION TECHNIQUES 3 0 0 3

AIM

To highlight the features of various compression techniques used in multimedia and to compare their performances.

OBJECTIVES

- To learn about the coding techniques based on text
- To understand various audio compression techniques.
- To study the image compression techniques.
- To discuss about the video compression techniques.

UNIT I **9**

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

UNIT II **9**

TEXT COMPRESSION

Compaction techniques – Huffmann coding – Adaptive Huffmann Coding – Arithmetic coding – Shannon-Fano coding – Dictionary techniques – LZW family algorithms.

UNIT III **9**

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

UNIT IV **9**

IMAGE COMPRESSION

Predictive techniques – DM, PCM, DPCM: Optimal Predictors and Optimal Quantization – Contour based compression – Transform Coding – JPEG Standard – Sub-band coding

algorithms: Design of Filter banks – Wavelet based compression: Implementation using filters – EZW, SPIHT coders – JPEG 2000 standards - JBIG, JBIG2 standards.

UNIT V **9**

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, H.263, H.264 Standards – DVI technology – PLV performance – DVI real time compression – Packet Video.

TOTAL: 45 PERIODS

REFERENCES:

1. Khalid Sayood: Introduction to Data Compression, Morgan Kauffman 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 Pub., 2004.
5. Mark Nelson: Data compression, BPB Publishers, New Delhi, 1998.
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.
8. Jan Vozer : Video Compression for Multimedia, AP Profes, New York, 1995

EC1507 MICROWAVE INTEGRATED CIRCUITS 3 0 0 3

AIM

To enable the student to become familiar with fabrication of MMIC and the monolithic & hybrid circuit used in Microwave communication systems.

OBJECTIVES

- To study Fabrication of MMIC
- To study Monolithic circuit and hybrid circuit and its analysis
- To study various components used in MMIC.

UNIT I **9**

TECHNOLOGY OF HYBRID MICS

Dielectric substrates - thick film technology and materials - thin film technology and materials – methods of testing – encapsulation of devices for MICs – mounting of active devices.

UNIT II **9**

TECHNOLOGY OF MONOLITHIC MICS

Processes involved in fabrication – epitaxial growth of semiconductor layer – growth of dielectric layer – diffusion-ion implantation – electron beam technology.

UNIT III **9**

ANALYSIS OF MICROSTRIP LINE

Methods of conformal transformation – numerical method for analysis – hybrid mode analysis – coupled mode analysis- method of images – losses in microstrips.

UNIT IV **9**

COUPLED MICROSTRIPS, SLOT LINE AND COPLANAR VEGUIDES

Coupled microstrips – even and odd mode analysis – microstrip directional couplers – branch line couplers – periodic branch line couplers – synchronous branch line couplers.

UNIT V **9**

LUMPED ELEMENTS AND NON-RECIPROCAL COMPONENTS

Design and fabrication using microstrips – flat resistors – flat inductors – interdigital capacitors – sandwich capacitors – ferromagnetic substrates for non-reciprocal devices – microstrip circulators – latching circulators – isolators – phase shifters.

TOTAL: 45 PERIODS

REFERENCES

1. Samuel Y. Liao – "Microwave Devices and Circuits", Third Edition, Prentice Hall, 1990
2. Annapurna Das and Sisir K. Das – "Microwave Engineering", Second Edition, Tata McGraw Hill, 2010
3. Gupta K.C, and Amarjit Singh – "Microwave Integrated Circuits" – John Wiley and sons – Wiley Eastern Reprint, 1978
4. Hoffmann R.K – "Handbook of Microwave Integrated Circuits" – Artech House, 1987

EC1508 SATELLITE COMMUNICATION 3 0 0 3

AIM

To enable the student to become familiar with satellites and satellite services.

OBJECTIVES

- Overview of satellite systems in relation to other terrestrial systems
- Study of satellite orbits and launching
- Study of earth segment and space segment components
- Study of satellite access by various users.

UNIT I **9**

ORBITAL MECHANICS

Kepler's laws of motion, Orbits, Orbital 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, Orbital Effects in Communications Systems Performance, Satellite launch vehicles, Spectrum allocations for satellite systems

UNIT II **9**

SPACECRAFT SUB SYSTEMS AND EARTH STATION

Spacecraft Subsystems, Altitude and Orbit Control, Telemetry and Tracking, Power Systems,

Communication Subsystems, Transponders, Antennas, Equipment Reliability, Earth Stations, Example of payloads of operating and planned systems

UNIT III **9**

SPACE LINKS

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-Earth Paths. Interference between satellite circuits, Energy Dispersal

UNIT IV **9**

MULTIPLE ACCESS TECHNIQUES AND NETWORK ASPECTS

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. Examples of MA techniques for existing and planned systems, Mobile satellite network design, ATM via satellite. TCP/IP via satellite. Hybrid satellite-terrestrial networks

UNIT V **9**

SERVICES AND APPLICATIONS

Fixed and mobile services - Multimedia satellite services - Advanced applications based on satellite platforms - INTELSAT series, INSAT, VSAT, Remote Sensing, Mobile satellite service: GSM, GPS, INMARSAT, Navigation System, Direct to Home service (DTH), Special services, E-mail, Video conferencing and Internet connectivity.

TOTAL: 45 PERIODS

REFERENCES

1. Timothy Pratt, Charles Bostian, Jeremy Allnutt, “Satellite Communications”, Second edition, John Wiley and sons, 2003
2. Dennis Roddy, “Satellite Communications”, Third Edition, Mc Graw Hill International Editions, 2001
3. Bruce R.Elbert, "The Satellite Communication Applications Hand Book, Artech House Boston,1997
4. Wilbur L.Pritchard, Hendri G.Suyderhood, Robert A.Nelson,"Satellite Communication Systems Engineering", Second Edition, Prentice Hall, New Jersey, 1993
5. Tri T.Ha, "Digital satellite communication", Second Edition, McGraw Hill, New York, 1990

EC1509 COMMUNICATION NETWORK SECURITY 3 0 0 3

AIM

To study about security, different types of algorithms, Integrity, Authentication and Key management.

OBJECTIVES

- To learn the basics of security
- To learn the types of symmetric, asymmetric key algorithms and key management

- To understand the concept of Firewalls, web security and wireless network security

UNIT I INTRODUCTION TO SECURITY 9

Security Goals, Types of Attacks: Passive attack, active attack, attacks on confidentiality, attacks on Integrity and availability. Security services and mechanisms, Techniques: Cryptography, Steganography , Revision on Mathematics for Cryptography(Euclidean Algorithm,Chinese Remainder Theorem,Finite Fields,Modular Arithmetic).

UNIT II SYMMETRIC & ASYMMETRIC KEY ALGORITHMS 9

Substitutional Ciphers, Transposition Ciphers, Stream and Block Ciphers, Data Encryption Standards (DES), Advanced Encryption Standard (AES), RC4, principle of asymmetric key algorithms, RSA Cryptosystem

UNIT III INTEGRITY, AUTHENTICATION AND KEY MANAGEMENT 9

Message Integrity, Hash functions : SHA, Digital signatures : Digital signature standards. Authentication : Entity Authentication: Biometrics, Key management Techniques.

UNIT IV NETWORK SECURIT , FIREWALLS AND WEB SECURITY 9

Introduction on Firewalls, Types of Firewalls, Firewall Configuration and Limitation of Firewall. IP Security Overview, IP security Architecture, authentication Header, Security payload, security associations, Key Management. Web security requirement, secure sockets layer, transport layer security, secure electronic transaction, dual signature

UNIT V WIRELESS NETWORK SECURITY 9

Security Attack issues specific to Wireless systems: Worm hole, Tunneling, DoS. WEP for Wi-Fi network, Security for 4G networks: Secure Ad hoc Network, Secure Sensor Network

TOTAL: 45 PERIODS

REFERENCES

1. Behrouz A. Fourcuzan ," Cryptography and Network security" Tata McGraw- Hill, 2008
2. William Stallings,"Cryptography and Network security: principles and practice",2nd Edition,Prentice Hall of India,New Delhi,2002
3. Atul Kahate ," Cryptography and Network security", 2nd Edition, Tata McGraw- Hill, 2008
4. R.K.Nichols and P.C. Lekkas ," Wireless Security"
5. H. Yang et al., Security in Mobile Ad Hoc Networks: Challenges and Solution, IEEE Wireless Communications, Feb. 2004.
6. Securing Ad Hoc Networks," IEEE Network Magazine, vol. 13, no. 6, pp. 24-30, December 1999.
7. "Security of Wireless Ad Hoc Networks," http://www.cs.umd.edu/~aram/wireless/survey.pdf.
8. David Boel et.al (Jan 2008) "Securing Wireless Sensor Networks – Security Architecture " Journal of networks , Vol.3. No. 1. pp. 65 -76.
9. Perrig, A., Stankovic, J., Wagner, D. (2004), "Security in Wireless Sensor Networks", Communications of the ACM, 47(6), 53-57.

EC1572 COMMUNICATION SYSTEM LAB – II 0 1 2 2

AIM

To have a practical idea about the advanced experiments used in the field of communication.

OBJECTIVES

- To have an idea about the different compression techniques
- To study about the micro strip antennas
- To study about the Global Positioning Systems.

1. Simulation of Audio and speech compression algorithms.
2. Simulation of EZW / SPIHT Image coding algorithm.
3. Simulation of Microstrip Antennas.
4. S-parameter estimation of Microwave devices.
5. Study of Global Positioning System.
6. Performance evaluation of simulated CDMA System.
7. Design and testing of a Microstrip coupler.
8. Characteristics of λ/4 and λ/2 transmission lines.
9. Simulation of Direct Sequence Spread Spectrum.
10. Simulation of digital communication in AWGN and fading channels.

TOTAL: 45 PERIODS

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M.E. COMMUNICATION SYSTEMS

CURRICULUM & SYLLABUS

SEMESTER – III

SL. NO.	SUBJECT CODE	SUBJECT	L	T	P	C
THEORY						
1.	XX2E3	Elective III	3	0	0	3
2.	XX2E4	Elective IV	3	0	0	3
3.	XX2E5	Elective V	3	0	0	3
PRACTICAL						
4.	EC1573	Simulation and Analysis Lab	0	1	2	2
5.	EC15P1	Project Work Phase – I	0	0	12	6
Total			9	1	14	17

EC1573 SIMULATION AND ANALYSIS LAB 0 1 2 2

Use appropriate simulation tools for the following experiments:

1. Channel equalizer design (LMS, RLS)
2. Communication over fading channels – Rayleigh fading & Rician fading channels
3. OFDM transceiver design
4. Simulation of MIMO systems
5. Determination of Maximum bit rate of a digital fiber optic link
6. Signal transmission and reception using WDM and spectral characterization
7. Spatial Filtering Techniques
8. Frequency Domain Filtering
9. Two Dimensional Transforms
10. Wiener Filtering
11. Denoising Techniques
12. Basic Morphological Operation

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NOORUL ISLAM UNIVERSITY, KUMARACOIL

M.E. COMMUNICATION SYSTEMS

CURRICULUM & SYLLABUS

SEMESTER – IV

SL. NO.	SUBJECT CODE	SUBJECT	L	T	P	C
PROJECT						
1.	EC15P5	Project Work Phase – II	0	0	38	16
Total			0	0	38	16

NOORUL ISLAM CENTRE FOR HIGHER EDUCATION

NOORUL ISLAM UNIVERSITY, KUMARACOIL

M.E. COMMUNICATION SYSTEMS

LIST OF ELECTIVES

SL. No.	Course Code	Course Title	L	T	P	C
1.	EC15A1	Digital Image Processing	3	0	0	3
2.	EC15A2	Wavelets and Multiresolution Processing	3	0	0	3
3.	EC15A3	Digital Communication Receivers	3	0	0	3
4.	EC15A4	Soft Computing Techniques	3	0	0	3
5.	EC15A5	Simulation of Communication Systems and Networks	3	0	0	3
6.	EC15A6	Global Positioning Systems	3	0	0	3
7.	EC15A7	High Performance Communication Networks	3	0	0	3
8.	EC15A8	High Speed Switching Architecture	3	0	0	3
9.	EC15A9	RF System Design	3	0	0	3
10.	EC15B1	Multimedia Networking	3	0	0	3
11.	EC15B2	Geographic Information System	3	0	0	3
12.	EC15B3	Advanced Embedded System Design	3	0	0	3
13.	EC15B4	Network Management	3	0	0	3
14.	EC15B5	Wireless Sensor Networks	3	0	0	3
15.	EC15B6	Pattern Recognition	3	0	0	3
16.	EC15B7	Optical Switching Architectures	3	0	0	3
17.	EC15B8	Advances in Wireless Communication	3	0	0	3
18.	EC15B9	Micro Electromechanical System (MEMS)	3	0	0	3
19.	EC15C1	4G Wireless Networks	3	0	0	3

EC15A1 DIGITAL IMAGE PROCESSING 3 0 0 3

PREREQUISITE: Signals and Systems, Digital Signal Processing

AIM

To introduce the student to various image processing techniques such as enhancements, segmentation, compression etc.

OBJECTIVES

- To study the image fundamentals and mathematical transforms necessary for image processing.
- To study the image enhancement techniques
- To study image restoration procedures.
- To study the image compression procedures.
- To study the image segmentation and representation techniques.

UNIT I **9**

DIGITAL IMAGE FUNDAMENTALS:

Elements of digital image processing systems, Elements of visual perception, psycho visual model, brightness, contrast, hue, saturation, mach band effect, Color image fundamentals - RGB,HSI models, Image sampling, Quantization, dither, Two-dimensional mathematical preliminaries.

UNIT II **9**

IMAGE TRANSFORMS:

1D DFT, 2D transforms – DFT, DCT, Discrete Sine, Walsh, Hadamard, Slant, Haar, KLT, SVD, Wavelet Transform.

UNIT III **9**

IMAGE ENHANCEMENT AND RESTORATION:

Histogram modification and specification techniques, Noise distributions, Spatial averaging, Directional Smoothing, Median, Geometric mean, Harmonic mean, Contraharmonic and Yp mean filters, Homomorphic filtering, Color image enhancement. Image Restoration – degradation model, Unconstrained and Constrained restoration, Inverse filtering – removal of blur caused by uniform linear motion, Wiener filtering, Geometric transformations – spatial transformations, Gray-Level interpolation.

UNIT IV **9**

IMAGE SEGMENTATION AND RECOGNITION:

Edge detection. Image segmentation by region growing, region splitting and merging, edge linking.. Image Recognition – Patterns and pattern classes, Matching by minimum distance classifier, Matching by correlation, Back Propagation Neural Network, Neural Network applications in Image Processing.

UNIT V **9**

IMAGE COMPRESSION:

Need for data compression, Huffman,. Run Length Encoding, Shift codes, Arithmetic coding, Vector Quantization, Block Truncation Coding. Transform Coding – DCT and Wavelet. JPEG, MPEG. Standards, Concepts of Context based Compression.

TOTAL: 45 PERIODS

REFERENCES:

1. Rafael C. Gonzalez, Richard E.Woods, 'Digital Image Processing', Pearson Education, Inc., Second Edition, 2004.
2. Anil K. Jain, 'Fundamentals of Digital Image Processing', Prentice Hall of India, 2002.
3. David Salomon : Data Compression – The Complete Reference, Springer Verlag New York Inc., 2nd Edition, 2001
4. Rafael C. Gonzalez, Richard E.Woods, Steven Eddins, ' Digital Image Processing using MATLAB', Pearson Education, Inc., 2004.
5. William K.Pratt, ' Digital Image Processing', John Wiley, NewYork, 2002.
6. Milman Sonka, Vaclav Hlavac, Roger Boyle, 'Image Processing, Analysis, and Machine Vision', Brooks/Cole, Vikas Publishing House, II ed., 1999.
7. Sid Ahmed, M.A., 'Image Processing Theory, Algorithms and Architectures', McGrawHill, 1995.

EC15A2 WAVELETS AND MULTIRESOLUTION PROCESSING 3 0 0 3

PREREQUISITE: Linear Algebra, Digital Filter Design

AIM

To study in detail about wavelets and various multiresolution techniques used in image processing.

OBJECTIVES

- To introduce preliminary knowledge required for wavelets.
- To study in detail about multiresolution analysis.
- To learn about continuous wavelet transform.
- To discuss about discrete wavelet transform.
- To give an idea about the application area of this subject to students

UNIT I **9**

INTRODUCTION

Vector Spaces - properties - dot product - basis - dimension, orthogonality and orthonormality - relationship between vectors and signals - Signal spaces - concept of Convergence - Hilbert spaces for energy signals - Generalised Fourier Expansion.

UNIT II **9**

MULTI RESOLUTION ANALYSIS

Definition of Multi Resolution Analysis (MRA) – Haar basis - Construction of general orthonormal MRA-Wavelet basis for MRA – Continuous time MRA interpretation for the DTWT – Discrete time MRA- Basis functions for the DTWT – PRQMF filter banks

UNIT III **9**

CONTINUOUS WAVELET TRANSFORM

Wavelet Transform - definition and properties - concept of scale and its relation with frequency - Continuous Wavelet Transform (CWT) - Scaling function and wavelet functions (Daubechies, Coiflet, Mexican Hat, Sinc, Gaussian, Bi-Orthogonal) - Tiling of time -scale plane for CWT.

UNIT IV **9**

DISCRETE WAVELET TRANSFORM

Filter Bank and sub band coding principles - Wavelet Filters - Inverse DWT computation by Filter banks -Basic Properties of Filter coefficients - Choice of wavelet function coefficients - Derivations of Daubechies Wavelets -Mallat's algorithm for DWT – Multi-band Wavelet transforms.

Lifting Scheme: Wavelet Transform using Polyphase matrix Factorization - Geometrical foundations of lifting scheme - Lifting scheme in Z -domain

UNIT V **9**

APPLICATIONS

Signal Compression – Image Compression techniques: EZW-SPHIT Coding - Image denoising techniques: Noise estimation - Shrinkage rules -. Shrinkage Functions - Edge detection and object Isolation, Image Fusion, and Object Detection. Curve and Surface Editing- Variational modeling and finite element method using wavelets.

TOTAL: 45 PERIODS

REFERENCES

1. Rao .R.M and A.S.Bopardikar, "Wavelet Transforms: Introduction to theory and Applications", Pearson Education Asia Pte. Ltd., 2000.
2. K.P.Soman and K.I.Ramachandran," Insight into Wavelets – From Theory to practice", Prentice- Hall, 2004.
3. Strang G, Nguyen T, "Wavelets and Filter Banks," Wellesley Cambridge Press, 1996
4. Vetterli M, Kovacevic J., "Wavelets and Sub-band Coding," Prentice Hall, 1995
5. Mallat S., "Wavelet Signal Processing", Academic Press, 1996

EC15A3 DIGITAL COMMUNICATION RECEIVERS 3 0 0 3

PREREQUISITE: Digital Communication, Communication Theory

AIM

To discuss about the features of different digital communication receivers used in the field of communication.

OBJECTIVES

- To have an introduction about the various digital communication techniques.
- To study about the optimum receivers for AWGN channel.
- To discuss about the receivers for fading channel.
- To study in detail about various synchronization techniques.
- To study about different types of adaptive equalization techniques.

UNIT I **9**

REVIEW OF DIGITAL COMMUNICATION TECHNIQUES

Base band and band pass communication, signal space representation, linear and non- linear modulation techniques, and spectral characteristics of digital modulation.

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 CHANNELS

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

UNIT IV **9**

SYNCHRONIZATION TECHNIQUES

Carrier and symbol 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

Zero forcing algorithm, LMS algorithm, Adaptive decision – feedback equalizer, and equalization of Trellis-coded signals, Kalman algorithm, blind equalizers, and stochastic gradient algorithm, Echo cancellation

TOTAL: 45 PERIODS

REFERENCES
1. Heinrich Meyer, Mare Moeneclacy and Stefan.A. Fechtel, “Digital Communication Receivers”, Vol I & II, John Wiley, New York, 1997
2. John. G. Proakis, “Digital Communication”, 4th ed., McGraw Hill, New York, 2001
3. E.A. Lee and D.G. Messerschmitt, “Digital Communication”, 2nd edition, Allied Publishers, New Delhi, 1994
4. Simon Marvin, “Digital Communication Over Fading channel; An unified approach to performance Analysis”, John Wiley, New York, 2000
5. Bernard Sklar, “Digital Communication Fundamentals and Applications, Prentice Hall, 1998

EC15A4 SOFT COMPUTING TECHNIQUES 3 0 0 3

PREREQUISITE: Digital Logic

AIM

To introduce the techniques of soft computing and adaptive neuro-fuzzy inferencing systems which differ from conventional AI and computing in terms of its tolerance to imprecision and uncertainty.

OBJECTIVES

- To introduce the ideas of fuzzy sets, fuzzy logic and use of heuristics based on human experience
- To become familiar with neural networks that can learn from available examples and generalize to form appropriate rules for inferencing systems
- To provide the mathematical background for carrying out the optimization associated with neural network learning
- To familiarize with genetic algorithms and other random search procedures useful while seeking global optimum in self-learning situations

UNIT I **9**

ARTIFICIAL NEURAL NETWORKS

Basic concepts-single layer perceptron-Multi layer perceptron-Adaline-Madaline-Learning rules-Supervised learning-Back propagation networks-Training algorithm, Practical difficulties, Advanced algorithms-Adaptive network- Radial basis network-modular network-Applications

UNIT II **9**

UNSUPERVISED NETWORKS

Introduction- unsupervised learning -Competitive learning networks-Kohonen self organising networks-Learning vector quantisation - Hebbian learning - Hopfield network-Content addressable nature, Binary Hopfield network, Continuous Hopfield network Travelling Salesperson problem - Adaptive resonance theory –Bidirectional Associative Memory-Principle component Analysis

UNIT III **9**

FUZZY SYSTEMS

Fuzzy sets-Fuzzy rules: Extension principle, Fuzzy relation- fuzzy reasoning – fuzzy inference

systems: Mamdani model, Sugeno model. Tsukamoto model -Fuzzy decision making-Multiobjective Decision Making,-Fuzzy classification-Fuzzy control methods -Application

UNIT IV **9**

NEURO-FUZZY MODELLING

Adaptive Neuro Fuzzy based inference systems – classification and regression trees: decision tress, Cart algorithm – Data clustering algorithms: K means clustering, Fuzzy C means clustering, Mountain clustering, Subtractive clustering – rule base structure identification – Neuro fuzzy control: Feedback Control Systems, Expert Control, Inverse Learning, Specialized Learning, Back propagation through Real –Time Recurrent Learning.

UNIT V **9**

GENETIC ALGORITHM

Fundamentals of genetic algorithm-Mathematical foundations-Genetic modeling-Survival of the fittest-crossover-Inversion and Deletion-mutation-reproduction-Generational cycle-rank method-rank space method- Other derivative free optimization-simulated annealing, Random search, Downhill simplex search-Application.

TOTAL: 45 PERIODS

REFERENCES

1. Jang J.S.R.,Sun C.T and Mizutani E – “Neuro Fuzzy and Soft computing”, Pearson education (Singapore) 2004
2. David E.Goldberg : “Genetic Algorithms in Search, Optimization, and Machine Learning”, Pearson Education, Asia, 1996
3. Laurene Fauseett:”Fundamentals of Neural Networks”, Prentice Hall India, New Delhi, 1994.
4. Timothy J.Ross:”Fuzzy Logic Engineering Applications”, McGraw Hill, NewYork, 1997.
5. S.Rajasekaran and G.A.Vijayalakshmi Pai “Neural networks,Fuzzy logics,and Genetic algorithms”, Prentice Hall of India, 2003
6. George J.Klir and Bo Yuan,”Fuzzy Sets and Fuzzy Logic”,Prentice Hall Inc., New Jersey, 1995

EC15A5 SIMULATION OF COMMUNICATION SYSTEMS & NETWORKS 3 0 0 3

PREREQUISITE: Random process, Communication System

AIM

To model the random variables and random process applied to telecommunication system and to learn the methods of system simulation and performance evaluation.

OBJECTIVES

- To learn simulation of random variables and random process
- To learn modeling of radio communication channels

- To understand various simulation techniques
- To understand simulation methodologies and performance evaluation
- To analyse some digital communication optical communication and satellite communication techniques as case studies through simulation.

UNIT I **9**

MODELLING OF COMMUNICATION SYSTEM

Model of speech and picture signals, Pseudo noise sequences, Non-linear sequences, Analog channel model, Noise and fading, Digital channel model-Gilbert model of bursty channels, HF, Troposcatter and satellite channels, Switched telephone channels, Analog and Digital communication system models, Light wave system models.

UNIT II **9**

SIMULATION OF RANDOM VARIABLES AND RANDOM PROCESS

Univariate and multivariate models, Transformation of random variables, Bounds and approximation, Random process models-Markov and ARMA Sequences, Sampling rate for simulation, Computer generation and testing of random numbers

UNIT III **9**

ESTIMATION OF PERFORMANCE MEASURES

Quality of an estimator, estimator for SNR, Probability density functions of analog communication system, BER of digital communication systems, Monte Carlo method and Importance of sampling method, estimation of power spectral density

UNIT IV **9**

COMMUNICATION NETWORKS

Queuing models, M/M/I and M/M/I/N queues, Little formula, Burke's theorem ,M/G/I queue, Embedded Markov chain analysis of TDM systems, Polling, Random access systems

UNIT V **9**

NETWORK OF QUEUES

Queues in tandem, store and forward communication networks, capacity allocation, Congestion and flow chart, Routing model, Network layout and Reliability

TOTAL: 45 PERIODS

REFERENCES

1. M.C.Jeruchim,Philip Balaban and K.Sam Shanmugam, "Simulation of communication systems", Plenum Press, New York,1992
2. A.M.Law and W.David Kelton, "Simulation Modelling and analysis", Mc Graw Hill Inc., New York ,1991
3. J.F.Hayes, “Modelling and Analysis of Computer Communication networks”, Plenum Press, New York,1984
4. Jerry Banks and John S.Carson, “Discrete-event System Simulation”, Prentice Hall Inc., New Jersey,1984

EC15A6 GLOBAL POSITIONING SYSTEMS 3 0 0 3

PREREQUISITE: Sattellite Communication, Antennas

AIM

To introduce the various concepts and theories, propagation media and coding techniques used in global positioning system.

OBJECTIVES

- To have an idea about the basics and concepts of various global techniques
- To have a knowledge of different laws of planetary motion.
- To study about the different coding techniques used.
- To discuss about the different atmospheric effects on GPS.

UNIT I **9**

History of GPS – BC-4 System – HIRAN – NNSS – NAVSTAR GLONASS and GNSS Systems – GPS Constellation – Space Segment – Control Segment – User Segment – Single and Dual Frequency – Point – Relative – Differential GPS – Static and Kinematic Positioning – 2D and 3D – reporting Anti Spoofing (AS); Selective Availability (SA) – DOP Factors.

UNIT II **9**

Coordinate Systems – Geo Centric Coordinate System – Conventional Terrestrial Reference System – Orbit Description – Keplerian Orbit – Kepler Elements – Satellite Visibility – Topocentric Motion – Disturbed Satellite Motion – Perturbed Motion – Disturbing Accelerations - Perturbed Orbit – Time Systems – Astronomical Time System – Atomic Time – GPS Time – Need for Coordination – Link to Earth Rotation – Time and Earth Motion Services.

UNIT III **9**

C/A code; P-code; Y-code; L1, L2 Carrier frequencies – Code Pseudo Ranges – Carries Phases – Pseudo Ranges – Satellite Signal Signature – Navigation Messages and Formats – Undifferenced and Differenced Range Models – Delta Ranges – Signal Processing and Processing Techniques – Tracking Networks – Ephemerides – Data Combination: Narrow Lane; Wide Lane – OTF Ambiguity.

UNIT IV **9**

Propagation Media – Multipath – Antenna Phase Centre – Atmosphere in brief – Elements of Wave Propagation – Ionospheric Effects on GPS Observations – Code Delay – Phase Advances – Integer Bias – Clock Error – Cycle Slip – Noise-Bias – Blunders – Tropospheric Effects on GPS Oberservables – Multipath Effect – Antenna Phase Centre Problems and Correction.

UNIT V **9**

Inter Disciplinary Applications – Crystal Dynamics – Gravity Field Mapping – Atmospheric Occulation – Surveying – Geophysics – Air borne GPS – Ground Transportation – Space borne GPS – Metrological and Climate Research using GPS.

TOTAL: 45 PERIODS

REFERENCES

1. B.Hoffman - Wellenhof, H.Lichtenegger and J.Collins, "GPS: Theory and Practice", 4th revised edition, Springer, Wein, New york,1997
2. A.Leick, "GPS Satellites Surveying", 2nd edition, John Wiley & Sons,NewYork,1995
3. B.Parkinson, J.Spilker, Jr.(Eds), "GPS: Theory and Applications", Vol.I & Vol.II, AIAA, 370 L'Enfant Promenade SW, Washington, DC 20024, 1996
4. A.Kleusberg and P.Teunisen(Eds), “GPS for Geodesy”, Springer-Verlag, Berlin,1996
5. L.Adams, "The GPS - A Shared National Asset”, Chair, National Academy Press, Washington, DC, 1995

Websites:

6. http://www.auslig.gov.au
7. http://igscb.jpl.nasa.gov
8. http://gibs.leipzig.ifag.de
9. http://www.navcen.uscg.mil

EC15A7 HIGH PERFORMANCE COMMUNICATION NETWORKS 3 0 0 3

PREREQUISITE: Computer Networks.

AIM

To study some fundamental concepts in wireless networks.

OBJECTIVES

- To understand physical and wireless MAC layer alternatives techniques.
- To learn planning and operation of wireless networks.
- To study various wireless LAN and WAN concepts.
- To understand WPAN and geo-location systems.

UNIT I **9**

PACKET SWITCHED NETWORKS

OSI and IP models, Ethernet (IEEE 802.3), Token ring (IEEE 802.5), Wireless LAN (IEEE 802.11) FDDI, DQDB, SMDS: Internetworking with SMDS

UNIT II **9**

ISDN AND BROADBAND ISDN

ISDN - overview, interfaces and functions, Layers and services - Signaling System 7 (SS7) - Broadband ISDN architecture and Protocols.

UNIT III **9**

ATM AND FRAME RELAY

ATM: Main features-addressing, signaling and routing, ATM header structure-adaptation layer, management and control, ATM switching and transmission. Frame Relay: Protocols and services, Congestion control

UNIT IV **9**

ADVANCED NETWORK ARCHITECTURE

IP forwarding architectures overlay model, Multi Protocol Label Switching (MPLS), integrated services in the Internet, Resource Reservation Protocol (RSVP), Differentiated services

UNIT V **9**

BLUE TOOTH TECHNOLOGY

The Blue tooth module-Protocol stack Part I: Antennas, Radio interface, Base band, The Link controller, Audio, The Link Manager, The Host controller interface; The Blue tooth module-Protocol stack Part I: Logical link control and adaptation protocol, RFCOMM, Service discovery protocol, Wireless access protocol, Telephony control protocol.

TOTAL: 45 PERIODS

REFERENCES

1. William Stallings, "ISDN and Broadband ISDN with Frame Relay and ATM", 4th edition, Pearson education Asia, 2002.
2. Leon Gracia, Widjaja, "Communication networks ", Tata McGraw-Hill, New Delhi, 2000.
3. Jennifer Bray and Charles F.Sturman, "Blue Tooth" Pearson education Asia, 2001.
4. Sumit Kasera, Pankaj Sethi, "ATM Networks ", Tata McGraw-Hill, New Delhi, 2000.
5. Rainer Handel, Manfred N.Huber and Stefan Schroder ,"ATM Networks",3rd edition, Pearson education asia, 2002.
6. Jean Walrand and Pravin varaiya ,"High Performance Communication networks",2nd edition, Harcourt and Morgan Kauffman,London,2000.
7. William Stallings, "High-speed Networks and Internets", 2nd edition, Pearson education Asia, 2003.
8. Behrouz A. Forouzan, "Data Communication and Networking", 5th Edition, McGraw-Hill Higher Education, 2012

EC15A8 HIGH SPEED SWITCHING ARCHITECTURE 3 0 0 3

PREREQUISITE: Computer Networks, Switching Techniques.

AIM

To highlight the features of different technologies involved in High Speed Networking and their performance.

OBJECTIVES

- Students will get an introduction about various high speed networks.
- Students will be provided with an up-to-date survey of developments in High Speed Networks.
- Enable the students to know techniques involved in LAN switching and ATM switching.
- Students will get an introduction about various Queuing techniques involved in high speed networks

UNIT I **9**

HIGH SPEED NETWORK:

Introduction- LAN, WAN, Network evolution through ISDN to B-ISDN, Transfer mode and control of B-ISDN, SDH multiplexing structure, ATM standard, ATM adaptation layers.

UNIT II **9**

LAN SWITCHING TECHNOLOGY:

Switching Concepts, switch forwarding techniques, switch path control, LAN Switching, cut through forwarding, store and forward, virtual LANs

UNIT III **9**

ATM SWITCHING ARCHITECTURE

Switch model, Blocking networks - basic - and- enhanced banyan networks, sorting networks - merge sorting, re-arrangable networks - full-and- partial connection networks, non blocking networks - Recursive network construction, comparison of non-blocking network, Switching with deflection routing - shuffle switch, tandem banyan

UNIT IV **9**

QUEUES IN ATM SWITCHES

Internal Queueing -Input, output and shared queueing, multiple queueing networks – combined Input, output and shared queueing - performance analysis of Queued switches.

UNIT V **9**

IP SWITCHING

Addressing model, IP Switching types - flow driven and topology driven solutions, IP Over ATM address and next hop resolution, multicasting, Ipv6 over ATM.

TOTAL: 45 PERIODS

REFERENCES

1. Achille Pattavina, Switching Theory: Architectures and performance in Broadband ATM networks "John Wiley & Sons Ltd, New York. 1998
2. Christopher Y Metz, Switching protocols & Architectures, McGraw - Hill Professional Publishing, NewYork.1998.
3. Rainer Handel, Manfred N Huber, Stefan Schroder, ATM Networks - Concepts Protocols, Applications III Edition, Addison Wesley, New York. 1999.
4. John A.Chiong: Internetworking ATM for the internet and enterprise networks. McGraw Hill, New York, 1998.

EC15A9 **RF SYSTEM DESIGN** **3 0 0 3**

PREREQUISITE: Electronic devices, Communication systems

AIM

To design the various elements used in the radio frequency communication environment

OBJECTIVES

- To have a basics of RF design
- To get an idea about the filter designed for RF communication.
- To discuss about the various active and components and their applications
- To study about the RF amplifier design.

UNIT I **9**

RF ISSUES

Importance of RF design, Electromagnetic Spectrum, RF behaviour of passive components, Chip components and Circuit Board considerations, Scattering Parameters, Smith Chart and applications.

UNIT II **9**

RF FILTER DESIGN

Overview , Basic resonator and filter configuration, Special filter realizations, Filter implementations, Coupled filter.

UNIT III **9**

ACTIVE RF COMPONENTS & APPLICATIONS

RF diodes, BJT, RF FETs, High electron mobility transistors; Matching and Biasing Networks – Impedance matching using discrete components, Microstripline matching networks, Amplifier classes of operation and biasing networks.

UNIT IV **9**

RF AMPLIFIER DESIGNS

Characteristics, Amplifier power relations, Stability considerations, Constant gain circles, Constant VSWR circles, Low Noise circuits, Broadband , high power and multistage amplifiers.

UNIT V **9**

OSCILLATORS, MIXERS & APPLICATIONS

Basic Oscillator model, High frequency oscillator configuration, Basic characteristics of Mixers; Phase Locked Loops; RF directional couplers and hybrid couplers; Detector and demodulator circuits.

TOTAL: 45 PERIODS

REFERENCES:

1. Reinhold Ludwig and Powel Bretchko, RF Circuit Design – Theory and Applications, Pearson Education Asia, First Edition, 2001.
2. Joseph . J. Carr, Secrets of RF Circuit Design , McGraw Hill Publishers, Third Edition, 2000.
3. Mathew M. Radmanesh, Radio Frequency & Microwave Electronics, Pearson Education Asia, Second Edition, 2002.
4. Ulrich L. Rohde and David P. NewKirk, RF / Microwave Circuit Design, John Wiley & Sons USA 2000.
5. Roland E. Best, Phase - Locked Loops : Design, simulation and applications,

McGraw Hill Publishers 5TH edition 2003.

EC15B1 MULTIMEDIA NETWORKING 3 0 0 3

PREREQUISITE: Multimedia, Computer networks

AIM

To introduce the various multimedia networking techniques used in the internet fields and to give an idea about different networking protocols.

OBJECTIVES

- To study about the different types of data used in internet.
- To discuss in detail about the different broad band technologies.
- To study about the different types of protocols used.
- To have an idea about the multimedia standards.

UNIT I **9**

MULTIMEDIA NETWORKING

Digital sound, video and graphics, basic multimedia networking, multimedia characteristics, evolution of Internet services model, network requirements for audio/ video transform, multimedia coding and compression for text, image, audio and video.

UNIT II **9**

BROAD BAND NETWORK TECHNOLOGY

Broadband services, ATM and IP, IPV6, High speed switching, resource reservation, Buffer management, traffic shaping, caching, scheduling, and policing, throughput, delay and jitter performance. Storage and media services, voice and video over IP, MPEG-2 over ATM/IP, indexing synchronization of requests, recording and remote control.

UNIT III **9**

RELIABLE TRANSPORT PROTOCOL AND APPLICATIONS

Multicast over shared media network, multicast routing and addressing, scaling multicast and NBMA networks, Reliable transport protocols, TCP adaptation algorithm, RTP, RTCP. MIME, Peer- to-Peer computing, shared application, video conferencing, centralized and distributed conference control, distributed virtual reality, light weight session philosophy.

UNIT IV **9**

MULTIMEDIA COMMUNICATION STANDARDS

Objective of MPEG- 7 standard, Functionalities and systems of MPEG-7, MPEG-21 Multimedia Framework Architecture, - Content representation, Content Management and usage, Intellectual property management, Audio visual system- H322: Guaranteed QOS LAN systems; MPEG_4 video Transport across internet.

UNIT V **9**

MULTIMEDIA COMMUNICATION ACROSS NETWORKS

Packet Audio/video in the network environment, video transport across Generic networks- Layered video coding, error Resilient video coding techniques, Scalable Rate control, Streaming video across Internet, Multimedia transport across ATM networks and IP network, Multimedia across wireless networks.

TOTAL: 45 PERIODS

REFERENCES

1. Jon Crowcroft, Mark Handley, Ian Wakeman, Internetworking Multimedia, Harcourt Asia Pvt. Ltd. Singapore, 1998.
2. B.O. Szuprowicz, Multimedia Networking, McGraw Hill, Newyork. 1995
3. Tay Vaughan, Multimedia - Making it to work, 4ed, Tata McGraw Hill , NewDelhi, 2000.
4. K.R.Rao, Zoran S. Bojkovic and Dragorad A. Milovanovic, Multimedia Communication systems, PHI , 2003

EC15B2 GEOGRAPHIC INFORMATION SYSTEM 3 0 0 3

AIM:

To provide understanding of geographic information system and modeling of data.

OBJECTIVE:

To provide exposure to data models and data structure used in GIS and to introduce various Raster and Vector Analysis capabilities of GIS also expose the concept of quality and errors in GIS.

UNIT I BASICS 9

Maps: Types – Characteristics – Coordinate systems – Map projections – Definition of GIS – Evolution – Components of GIS – Data : Spatial and Non-spatial – Spatial Data: Point, Line, Polygon/Area and Surface – Non-Spatial Data: Levels of measurement – Database Structures.

UNIT II DATA MODEL AND INPUT 9

Raster Data Model – Grid – Tessellations – Geometry of Tessellations –– Data Compression – Vector Data Model – Topology – Topological consistency – Vector data input– Raster Vs. Vector comparison – File Formats for Raster and Vector – Vector to Raster conversion- raster formats

UNIT III DATA ANALYSIS AND OUTPUT 9

Raster Data Analysis: Local, Neighborhood and Regional Operations – Map Algebra – Vector Data Analysis: Non-topological analysis, Topological Analysis, Point-in-Polygon, Line-in-polygon, Polygon-in-polygon – Network Analysis – buffering – ODBC – Map Compilation.

UNIT IV SPATIAL MODELING 9

Modeling in GIS – types – Digital Elevation Models: Generation, Representation, Applications – ALTM.

UNIT V DATA QUALITY AND MISCELLANEOUS TOPICS 9

Data quality analysis – Sources of Error – Components of Data Quality – Meta Data – Open GIS consortium – Customisation in GIS – Object Oriented GIS – WebGIS-GIS system evaluation and bench marking.

TOTAL: 45 PERIODS

REFERENCES:

1. Lo. C P and Yeung, Albert K W, "Concepts and Techniques of Geographic Information Systems", Prentice Hall of India, 2002.
2. Robert Laurini and Derek Thompson, "Fundamentals of Spatial Information Systems", Academic Press, 1996.
3. Peter A Burrough, Rachael A Mc.Donnell, "Principles of GIS", Oxford University Press, 2000.
4. Allan Brimicombe, GIS Environmental Modeling and Engineering, Taylor & Francis, 2003.

EC15B3 ADVANCED EMBEDDED SYSTEM DESIGN 3 0 0 3

AIM:

To provide understanding of design and development of embedded system.

OBJECTIVES:

- To provide exposure to embedded hardware, software and peripherals
- To gain knowledge of real time operating system
- To provide understanding of memory and interfacing
- To provide understanding of concurrent process models and hardware-software co-design.

UNIT – I INTRODUCTION AND REVIEW OF EMBEDDED HARDWARE 9

Terminology – Gates – Timing diagram – Memory – Microprocessor buses – Direct memory access – Interrupts – Built interrupts – Interrupts basis – Shared data problems – Interrupt latency - Embedded system evolution trends – Round-Robin – Round Robin with interrupt function – Rescheduling architecture – algorithm.

UNIT - II REAL TIME OPERATING SYSTEM 9

Task and Task states – Task and data – Semaphore and shared data operating system services – Message queues timing functions – Events – Memory management – Interrupt routines in an RTOS environment – Basic design using RTOS.

UNIT – III EMBEDDED HARDWARE, SOFTWARE AND PERIPHERALS 9

Custom single purpose processors: Hardware – Combination Sequence – Processor design –RT level design – optimising software: Basic Architecture – Operation – Programmers view – Development Environment – ASIP – Processor Design – Peripherals – Timers, counters and watch dog timers – UART – Pulse width modulator – LCD controllers – Key pad controllers – Stepper motor controllers – A/D converters – Real time clock.

UNIT – IV MEMORY AND INTERFACING 9

Memory: Memory write ability and storage performance – Memory types – composing memory – Advance RAM interfacing communication basic – Microprocessor interfacing I/O addressing – Interrupts – Direct memory access – Arbitration multilevel bus architecture – Serial protocol – Parallel protocols – Wireless protocols – Digital camera example.

UNIT – V CONCURRENT PROCESS MODELS AND HARDWARE SOFTWARE CO-DESIGN 9

Modes of operation – Finite state machines – Models – HCFSL and state charts language –state machine models – Concurrent process model – Concurrent process – Communication among process –Synchronization among process – Implementation – Data Flow model. Design technology; Automation synthesis – Hardware software co-simulation – IP cores – Design Process Model.

TOTAL: 45 PERIODS

REFERENCES:

1. David. E.Simon "An Embedded Software Primer", Pearson Education, 2001.
2. Frank Vahid and Tony Gwargie "Embedded System Design", John Wiley & sons, 2002.
3. Steve Heath, "Embedded System Design", Elserien, Second Edition, 2004.

EC15B4 NETWORK MANAGEMENT 3 0 0 3

AIM

To understand the concepts, terminologies and technologies of network management.

OBJECTIVES

The objectives of this course are to

- To understand the need for interoperable network management
- To learn to the concepts and architecture behind standards based network management
- To understand the concepts and terminology associated with SNMP and TMN
- To understand network management as a typical distributed application
- To study the current trends in network management technologies.

UNIT I FUNDAMENTALS OF COMPUTER NETWORK TEHNOLOGY 9

Network Topology, LAN, Network node components- Hubs, Bridges, Routers, Gateways, Switches, WAN, ISDN Transmission Technology, Communications protocols and Standards

UNIT II OSI NETWORK MANAGEMENT 9

OSI Network management model-Organizational model-Information model, communication model. Abstract Syntax Notation - Encoding structure, Macros Functional model CMIP/CMIS

UNIT III INTERNET MANAGEMENT (SNMP) 9

SNMP-Organizational model-System Overview, The information model, communication model-Functional model, SNMP proxy server, Management information, protocol remote monitoring

UNIT IV BROADBAND NETWORK MANAGEMENT 9

Broadband network s and services, ATM Technology-VP,VC,ATM Packet, Integrated service, ATMLAN emulation, Virtual LAN. ATM Network Management-ATM Network reference model, integrated local management Interface. ATM Management Information base, Role of SNMD and ILMI in ATM Management, M1, M2, M3, M4 Interface. ATM Digital Exchange Interface Management

UNIT V NETWORK MANAGEMENT APPLICATIONS 9

Configuration management, Fault management, performance management, Event Correlation Techniques security Management, Accounting management, Report Management, Policy Based Management Service Level Management.

TOTAL: 45 PERIODS

REFERENCES

1. Mani Subramanian, "Network Management Principles and practice ", Addison Wesly New York, 2000.
2. Salah Aiidarous, Thomas Plevayk, "Telecommunications Network Management Technologies and Implementations ", eastern Economy Edition IEEE press, New Delhi, 1998.
3. Lakshmi G. Raman, "Fundamentals of Telecommunication Network Management ", Eastern Economy Edition IEEE Press, New Delhi, 1999.

EC15B5 WIRELESS SENSOR NETWORKS 3 0 0 3

AIM

To enable the students to become familiar with wireless sensor networks.

OBJECTIVES

The objectives of this course are to

- To provide the understanding of concepts of wireless sensor networks
- To provide the knowledge of various layers of wireless sensor networks
- To provide a case study in the understanding of practical implementation.

UNIT I INTRODUCTION 9

Challenges for wireless sensor networks, Comparison of sensor network with ad hoc network, Single node architecture –Hardware components, energy consumption of sensor nodes, Network architecture – Sensor network scenarios, types of sources and sinks, single hop versus multi-hop networks, multiple sinks and sources, design principles, Development of wireless sensor networks– WINS ,µAMPS Underwater Acoustic and Deep space networks.

UNIT II PHYSICAL LAYER 9

Introduction wireless channel and communication fundamentals – frequency allocation, modulation and demodulation, wave propagation effects and noise, channels models, spread spectrum communication , packet transmission and synchronization, quality of wireless channels and measures for improvement, physical layer and transceiver design consideration in wireless sensor networks, Energy usage profile, choice of modulation, Power Management.

UNIT III DATA LINK LAYER 9

MAC protocols –fundamentals of wireless MAC protocols, low duty cycle protocols and wakeup concepts, contention-based protocols, Schedule-based protocols, Link Layer protocols – fundamentals task and requirements, error control, framing, link management

UNIT IV NETWORK LAYER 9

Gossiping and agent-based uni cast forwarding , Energy-efficient unicast, Broadcast and multicast, geographic routing , mobile nodes, Data –centric and content-based networking – Data –centric routing, Data aggregation, Data-centric storage, Higher layer design issues

UNIT V CASE STUDY 9

Target detection tracking, Habitat monitoring, Environmental disaster monitoring, Practical implementation issues, IEEE 802.15.4 low rate WPAN, Sensor Network Platforms and tools-Sensor node hardware, Node-level software platforms, node – level simulators.

REFERENCES

1. Wireless Sensor Networks: an information processing approach – Feng zhao, Leonidas guibas, Elsivier publication, 2004.
2. Wireless Sensor Networks–C.S.Raghavendra Krishna, M.Sivalingam and Tarib znati, Springer publication, 2004.
3. Wireless Sensor Networks: Architecture and protocol –Edgar H .Callaway, CRC press.
4. Protocol and Architecture for Wireless Sensor Networks –Holger Karl , Andreas willig ,John Wiley publication, Jan 2006.
5. Wireless Sensor Networks: First European workshop, EWSN 2004, Berlion, Germany, January 2004 proceedings –Holger Karl, Andreas willig, Adam holisz, Springer publication.
6. .I.F. Akyildiz, W. Su, Sankarasubramaniam, E. Cayirci, "Wireless sensor networks: a survey", computer networks, Elsevier, 2002, 394 - 422.
7. Jamal N. Al-karaki, Ahmed E. Kamal", Routing Techniques in Wireless sensor networks: A survey", IEEE wireless communication, December 2004, 6 – 28.

EC15B6 PATTERN RECOGNITION 3 0 0 3

AIM

To provide an introduction to the theory and practice of pattern recognition.

OBJECTIVES

The objectives of this course are to

- Provide a set of unifying concepts and theory for standard pattern recognition methods and problems
- Study of the pattern classification
- Study of unsupervised classification
- Study of pattern recognition
- Study of feature extraction and selection

UNIT I PATTERN CLASSIFIER 10

Overview of pattern recognition – Discriminant functions – Supervised learning – Parametric estimation – Maximum likelihood estimation – Bayesian parameter estimation – Perceptron algorithm – LMSE algorithm – Problems with Bayes approach – Pattern classification by distance functions – Minimum distance pattern classifier.

UNIT II UNSUPERVISED CLASSIFICATION 8

Clustering for unsupervised learning and classification – Clustering concept – Cmeans algorithm – Hierarchical clustering procedures – Graph theoretic approach to pattern clustering – Validity of clustering solutions.

UNIT III STRUCTURAL PATTERN RECOGNITION 8

Elements of formal grammars – String generation as pattern description – Recognition of syntactic description – Parsing – Stochastic grammars and applications – Graph based structural representation.

UNIT IV FEATURE EXTRACTION AND SELECTION 9

Entropy minimization – Karhunen – Loeve transformation – Feature selection through functions approximation – Binary feature selection.

UNIT V RECENT ADVANCES 10

Neural network structures for Pattern Recognition – Neural network based Pattern associators – Unsupervised learning in neural Pattern Recognition – Self-organizing networks – Fuzzy logic – Fuzzy pattern classifiers – Pattern classification using Genetic Algorithms.

TOTAL: 45 PERIODS

REFERENCES

1. Robert J.Schalkoff, Pattern Recognition Statistical, Structural and Neural Approaches, John Wiley & Sons Inc., New York, 1992.
2. Tou and Gonzales, Pattern Recognition Principles, Wesley Publication Company, London, 1974.
3. Duda R.O., and Har P.E., Pattern Classification and Scene Analysis, Wiley, New York, 1973.
4. Morton Nadier and Eric Smith P., Pattern Recognition Engineering, John Wiley & Sons, New York, 1993.

EC15B7 OPTICAL SWITCHING ARCHITECTURES 3 0 0 3

AIM

To study the concepts of optical switching and networks.

OBJECTIVES

The objectives of this course are to

- To introduce the aspects of access networks
- To study about the design of virtual topology

- To study about internet using optical networks
- To study about optical switching
- To study about convertible networks.

UNIT I ACCESS NETWORKS 9

Network architecture overview - today's access networks - future Access networks - optical access network architecture - application area – Passive optical networks- Broadcast Select PON – WRPON - Case study – SUCCESS HPON- Network topology – Media access control protocol – Scheduling algorithm- Ethernet based passive optical networks –QoS.

UNIT II VIRTUAL TOPOLOGY DESIGN 9

Design problem – design heuristics – topology reconfiguration due to traffic changes- Network management- Protection concepts in Ring Networks, Mesh Networks- Handling node failures- Combined SONET/WDM network design – Regular virtual topologies – Shuffle net – Implementation in broadcast select network

UNIT III OPTICAL INTERNET NETWORKS 9

Optical Circuit switching- Optical Burst switching- Optical packet switching – MPLS in WDM Networks -Types MPLS Nodes – Multi protocol lambda switching – MPLS and Optical TE similarities – IP, MPLS and Optical control planes –LSP routing.

UNIT IV OPTICAL SWITCHING 9

Free-space optical switching – multistage optical interconnection networks- back plane optical interconnects, optical memory for switching – logic functionality – nonlinear fiber couplers, photonic switch architectures based on TDM, WDM, OCX, ATM.

UNIT V WAVELENGTH- CONVERTIBLE NETWORKS 9

Routing in convertible networks – Performance Evaluation – Network with sparse wavelength conversion – Converter Placement problem – Converter problem – Rerouting - Benefits and Issues, Light path Migration, Rerouting Schemes, Algorithms- AG, MWPG.

TOTAL: 45 PERIODS

REFERENCES

1 C. Siva Rama Murthy and Mohan Gurusamy, " WDM Optical Networks – Concepts, Design and Algorithms", Prentice Hall of India Pvt. Ltd, New Delhi – 2002.

2 Uyless Black, "Optical Network: Third Generation Transport System", Pearson Education, 1st edition, 2002.

3 Hussein T.Mouftah and Jaafar M.H.Elmirghani, "Photonic Switching Technology – Systems and Networks", IEEE Press, New York -10016-5997,ISBN – 0-7803- 4707-2.

4 Rajiv Ramaswamy and Kumar N.Sivarajan, "Optical Networks – A Practical Perspective", Morgan Kauffman, 2004

5 Bahaa E.A. Saleh, Malvin Carl Teich, "Fundamentals of Photonics" Wiley Interscience; 1st edition, 2002.

6 http://www.wdm.stanford.edu/ snrc-access/

EC15B8 ADVANCES IN WIRELESS COMMUNICATION 3 0 0 3

AIM

To study about the concepts of wireless channels and modeling.

OBJECTIVES

The objectives of this course are to

- To introduce the aspects of point to point communication and wireless channel
- To study about multiple access and interference management in cellular systems
- To study about multiuser capacity in AWGN and fading channels
- To study about MIMO channel modeling and multiplexing.

UNIT I WIRELESS CHANNEL AND POINT TO POINT COMMUNICATION 9

Wireless systems- Physical modeling for wireless channels- Input /output model of the wireless channel- Time and frequency coherence-Statistical channel models Detection in a Rayleigh fading channel- Time diversity-Antenna diversity-frequency diversity-impact of channel uncertainty

UNIT II CELLULAR SYSTEMS DESIGN-MULTIPLE ACCESS AND INTERFERENCE MANAGEMENT 9

Narrow band cellular system- GSM system-Wide band systems-CDMA-uplink-CDMA down link- OFDM-Allocation design principles-Hopping pattern-receiver design - sectorization

UNIT III MULTI USER CAPACITY OF WIRELESS CHANNELS AND OPPORTUNISTIC COMMUNICATION 9

AWGN channel capacity-resources of the AWGN channel-Linear time –invariant Gaussian channels-capacity of fading channels-Uplink AWGN channel-Down link AWGN channel-uplink fading channel-down link fading channel-Frequency selective fading channel-Multi user diversity

UNIT IV MIMO CHANNEL MODELING -CAPACITY AND ARCHITECTURES 9

Multiplexing capability of deterministic MIMO channels- Physical modeling of MIMO channels- Modeling of MIMO fading channels-The V-BLAST architecture-fast fading MIMO channel-receiver architectures- slow fading MIMO channel- D-BLAST outage optimal architecture

UNIT V MIMO DIVERSITY MULTIPLEXING-MULTI USER COMMUNICATION 9

Diversity–multiplexing tradeoff-universal code design for optimal diversity-Uplink with multiple receive antennas-MIMO uplink-Down link with multiple transmit antennas- MIMO down link

TOTAL: 45 PERIODS

TEXT BOOK

1. David Tse, Pramod Viswanath, “Fundamentals of Wireless Communication”, Cambridge University Press, 2005

REFERENCES

1. Paulraj, Rohit Nabar, Dhananjay Gore, “Introduction to Space Time Wireless Communication Systems”, Cambridge University Press, 2003.
2. Sergio Verdu “ Multi User Detection” Cambridge University Press, 1998

EC15B9 MICRO ELECTROMECHANICAL SYSTEM (MEMS) 3 0 0 3

AIM

To introduce the students about micro electromechanical systems.

OBJECTIVES

The objectives of this course are to

- To understand the basic concepts of MEMS sensors, actuators, accelerometers etc
- To have understanding of MEMS and electrostatic designs
- To study about the issues encountered in MEMS systems
- To study about optical MEMS.

UNIT I INTRODUCTION TO MEMS 9

MEMS and Microsystems Micro sensors, micro actuation, MEMS with micro actuators, Micro accelerometers, Micro fluidics, MEMS materials, fabrication process – bulk micromachining, surface micromachining, LIGA.

UNIT II MECHANICS FOR MEMS DESIGN 9

Elasticity, Stress, Strain and material properties, Bending of thin plates, Spring configurations, Thermo mechanics – actuators, force and response time, Fracture and Thin film mechanics.

UNIT III ELECTRO STATIC DESIGN 9

Electrostatics: Basic theory, electrostatic instability, gap and finger pull up, electrostatic actuators, Comb generators, electromagnetic actuators, bistable actuators, Actuator Modeling.

UNIT IV CIRCUIT AND SYSTEM ISSUES 9

Electronic interfaces, MOSFET, Op-Amp, Charge measuring circuits, Feedback systems, Noise, Capacitive accelerometer, Peizo electric pressure sensor, Modeling of MEMS systems.

UNIT V OPTICAL MEMS 9

Optical MEMS - System design basics, Design examples: Optical Switching fabrics, Variable attenuators, Tunable optical sources.

TOTAL: 45 PERIODS

REFERENCES

1. Stephen Santeria, “Microsystems Design”, Kluwer publishers, 2000.
2. P. Rai-Choudhury , "MEMS and MOEMS Technology and Applications", SPIE—the International Society for Optical Engineering, 2000.
3. Chang Liu, “Foundations of MEMS,” Pearson Prentice Hall, 2006.

EC15C1 4G WIRELESS NETWORKS 3 0 0 3

AIM

To have understanding of cellular systems in general and 4G wireless networks in particular.

OBJECTIVES

The objectives of this course are to

- To understand introduce the existing wireless systems
- To study the concepts of 4G wireless system including MAC, routing, mobility management, TCP and QoS.

UNIT I WIRELESS SYSTEMS 9

Cellular concept – cellular architecture. Cellular systems – 1G, 2G, 3G. Wireless in Local Loop, Wireless ATM. Broadband Wireless Access – UWB, IEEE802.11a/b (Wi-Fi), IEEE802.16 (WiMAX) – HIPERACCESS, IEEE802.20 (MobileFi), IEEE802.21 (MIHS) and IEEE802.22 (WRAN). Optical wireless networks.

UNIT II 4G – MAC 9

Introduction – 4G systems. Hybrid 4G network protocols, Channel modeling for 4G MIMO and UWB. Adaptive and Reconfigurable Link layer, adaptive MAC-AMC, HARQ, CDMA, TDMA/OFDMA. Software radio-DAB, DVB.

UNIT III 4G – ROUTING 9

Network overlay in 4G, Network synchronization and Power optimal routing. Adaptive network layer-routing with topology aggregation. Adaptive resource management, Network deployment and management.

UNIT IV 4G – MOBILITY MANAGEMENT 9

Mobility management – Concept, requirements and operations. Mobility support for LAN/MAN. Mobility management models – Macro mobility and Micro mobility. Mobile IP-MIPv6, HMIP, cellular IP, HAWAII and IDMP. Context-aware mobility management.

UNIT V 4G – TCP AND QoS 9

Adaptive TCP and cross layer optimization. Positioning in wireless networks. QoS – Issues. Classifications of QoS approaches – MAC and Network layer solutions. QoS framework – QoS models, QoS Resource reservation signaling, INSIGNIA, INORA, SWAN and proactive RTMAC.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Savo G.Glisic, “Advanced Wireless Networks: 4G Technologies”, Kindle Editions, 2006.
2. Savo G.Glisic, “Advanced Wireless Communications: 4G Technologies”, Kindle Editions, 2006.
3. C.Siva Ram Murthy and B.S. Manoj, “Ad-Hoc Wireless Networks-Architectures and

Protocols", Pearson Education, 2004.

REFERENCES

1. Hendrik Bernt, "Towards 4G Technologies: Services with Initiate", Kindle Editions, 2006.
2. www.3gpp.org