SNS COLLEGE OF TECHNOLOGY, COIMBATORE – 641035

(AN AUTONOMOUS INSTITUTION)

REGULATION – 2016

CHOICE BASED CREDIT SYSTEM

SUGGESTED CURRICULA I – IV SEMESTERS AND

SYLLABI I – IV SEMESTERS

M. E. COMMUNICATION SYSTEMS

SEMESTER I

S.NO.	COURSE CODE	COURSE TITLE	CAT	CONTACT PERIODS	L	T	P	C	PRE-REQUISITES
THEORY									
1.	16MA602	Applied Mathematics for Communication Engineers	FC	4	3	1	0	4	-
2.	16CM601	Advanced Digital Signal Processing	PC	4	3	1	0	4	-
3.	16CM602	Advanced Radiation Systems	PC	4	3	1	0	4	-
4.	16CM603	Optical Communication Networks	PC	3	3	0	0	3	-
5.	16CM604	Microwave Integrated Circuits	PC	3	3	0	0	3	-
6.		Elective-I	PE	3	3	0	0	3	-
PRACTICAL									
7.	16CM605	Communication Systems Lab – I	PC	2	0	0	2	1	-
8.	16CM606	Industrial Training-I	EEC	2	0	0	2	1	-
			TOTAL	**25**	**18**	**3**	**4**	**23**	

SEMESTER II

S.NO.	COURSE CODE	COURSE TITLE	CAT	CONTACT PERIODS	L	T	P	C	PRE-REQUISITES
THEORY									
1	16CM607	Multimedia Compression Techniques	PC	4	3	1	0	4	-
2	16CM608	Modern Digital Communication Techniques	PC	4	3	1	0	4	-
3	16CM609	High Performance Communication Networks	PC	3	3	0	0	3	
4		Elective –II	PE	3	3	0	0	3	-
5		Elective –III	PE	3	3	0	0	3	-
PRACTICAL									
6	16CM610	Communication Systems Lab –II	PC	2	0	0	2	1	-
7	16CM611	Industrial Training-II	EEC	2	0	0	2	1	-
			Total	**21**	**15**	**2**	**4**	**19**	

SEMESTER III

S.NO.	COURSE CODE	COURSE TITLE	CAT	CONTACT PERIODS	L	T	P	C	PRE-REQUISITES
THEORY									
1		Elective-IV	PE	3	3	0	0	3	-
2		Elective-V	PE	3	3	0	0	3	-
3		Open Elective	OE	3	3	0	0	3	-
PRACTICAL									
4	16CM701	Technical Seminar & Research Methodology	EEC	2	0	0	2	1	-
5	16CM702	Project Phase-I	EEC	12	0	0	12	6	-
			TOTAL	**23**	**9**	**0**	**14**	**16**	

SEMESTER IV

S.NO.	COURSE CODE	COURSE TITLE	CAT	CONTACT PERIODS	L	T	P	C	PRE-REQUISITES
THEORY									
1.	16CM703	Project Phase-II	EEC	24	0	0	24	12	-
			TOTAL	**24**	**0**	**0**	**24**	**12**	

TOTAL CREDITS OF THE PROGRAMME: 70

FOUNDATION COURSE (FC)

S.NO.	COURSE CODE	COURSE TITLE	CONTACT PERIODS	L	T	P	C	PRE-REQUISITES
1.	16MA602	Applied Mathematics for Communication Engineers	4	3	1	0	4	-

PROFESSIONAL CORE (PC)

S.NO.	COURSE CODE	COURSE TITLE	CONTACT PERIODS	L	T	P	C	PRE-REQUISITES
1	16CM601	Advanced Digital Signal Processing	4	3	1	0	4	-
2	16CM602	Advanced Radiation Systems	4	3	1	0	4	-
3	16CM603	Optical Communication Networks	3	3	0	0	3	-
4	16CM604	Microwave Integrated Circuits	3	3	0	0	3	-
5	16CM607	Multimedia Compression Techniques	4	3	1	0	4	-
6	16CM608	Modern Digital Communication Techniques	4	3	1	0	4	-
7	16CM609	High Performance Communication Networks	3	3	0	0	3	-
Practical								
8	16CM605	Communication Systems Lab –I	2	0	0	2	1	-
9	16CM610	Communication Systems Lab –II	2	0	0	2	1	-
			Total	21	4	4	27	

PROFESSIONAL ELECTIVES

S.NO.	COURSE CODE	COURSE TITLE	CONTACT PERIODS	L	T	P	C	PRE-REQUISITES
1.	16CM612	High Speed Switching Architecture	3	3	0	0	3	-
2.	16CM613	Advanced Fiber Optic Technologies	3	3	0	0	3	-
3.	16CM614	Cognitive Radio Networks	3	3	0	0	3	-
4.	16CM615	Communication Network Design	3	3	0	0	3	-
5.	16CM616	Digital Communication Receivers	3	3	0	0	3	-
6.	16CM617	Ultra Wideband Communication	3	3	0	0	3	-
7.	16CM618	Network Routing Algorithms	3	3	0	0	3	-
8.	16CM619	Speech and Audio Signal Processing	3	3	0	0	3	-
9.	16CM620	Advanced Wireless Communication Techniques	3	3	0	0	3	-
10.	16CM621	Multiuser Detection in Wireless Communication	3	3	0	0	3	-
11.	16CM622	Advanced Digital Image Processing	3	3	0	0	3	-
12.	16CM704	Medical Systems and Signal Processing	3	3	0	0	3	-
13.	16CM705	Communication Network Security	3	3	0	0	3	-
14.	16CM706	Embedded and Real Time systems	3	3	0	0	3	-
15.	16CM707	Smart Antennas	3	3	0	0	3	-
16.	16CM708	Information Theory and Coding	3	3	0	0	3	-
17.	16CM709	Advanced Microwave Communication	3	3	0	0	3	-

18.	16CM710	Multirate Signal Processing	3	3	0	0	3	-
19.	16CM711	Telecommunication System Modeling and Simulation	3	3	0	0	3	-
20.	16CM712	Advanced Processor Architecture	3	3	0	0	3	
			TOTAL	60	0	0	60	

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

S.NO.	COURSE CODE	COURSE TITLE	CONTACT PERIODS	L	T	P	C	PRE-REQUISITES
1.	16CM606	Industrial Training- I	2	0	0	2	1	-
2.	16CM611	Industrial Training- II	2	0	0	2	1	-
3.	16CM701	Technical Seminar & Research Methodology	2	0	0	2	1	-
4.	16CM702	Project Phase-I	12	0	0	12	6	-
5.	16CM703	Project Phase-II	24	0	0	24	12	-
			TOTAL	0	0	42	21	

OPEN ELECTIVE OFFERED TO OTHER PG PROGRAMMES

S.NO.	COURSE CODE	COURSE TITLE	CONTACT PERIODS	L	T	P	C	PRE-REQUISITES
1.	16CM001	3D Image and Video Processing	3	3	0	0	3	-
2.	16CM002	Wireless Systems and Standards	3	3	0	0	3	-
3.	16CM003	Artificial Intelligence and Optimization Techniques	3	3	0	0	3	-
4.	16CM004	Network Management	3	3	0	0	3	-
5	16CM005	Mobile and Pervasive Computing	3	3	0	0	3	-
6	16VL002	Bluetooth Technology	3	3	0	0	3	-
			Total	18	0	0	18	

S.NO.	SUBJECT AREA	CREDITS PER SEMESTER				TOTAL CREDITS
		I	II	III	IV	
1	**FC**	4				4
2	**PC**	15	12			27
3	**PE**	3	6	6		15
4	**OE**			3		3
5	**EEC**	1	1	7	12	21
	TOTAL	**23**	**19**	**16**	**12**	**70**

FOUNDATION COURSE (FC)

16MA 602	APPLIED MATHEMATICS FOR COMMUNICATION ENGINEERS	L	T	P	C
		3	1	0	4

UNIT-I	SPECIAL FUNCTIONS	9+3

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

UNIT-II	MATRIX THEORY	9+3

Some important matrix factorizations – The Cholesky decomposition – QR factorization – Least squares method – Singular value decomposition - Toeplitz matrices and some applications.

UNIT-III	ONE DIMENSIONAL RANDOM VARIABLES	9+3

Random variables - Probability function – moments – moment generating functions and their properties – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions – Function of a Random Variable.

UNIT-IV	TWO DIMENSIONAL RANDOM VARIABLES	9+3

Joint distributions – Marginal and Conditional distributions – Functions of two dimensional random variables – Regression Curve – Correlation**.**

UNIT-V	QUEUEING MODELS	9+3

Poisson Process – Markovian queues – Single and Multi-server Models – Little's formula - Machine Interference Model – Steady State analysis – Self Service queue.

L:45	T:15	T: 60 PERIODS

REFERENCES

1. Grewal, B.S., Numerical methods in Engineering and Science, 40th edition, Khanna Publishers, 2007.
2. Moon, T.K., Sterling, W.C., Mathematical methods and algorithms for signal Processing, Pearson Education, 2000.
3. Richard Johnson, Miller & Freund, Probability and Statistics for Engineers, 7th Edition, Prentice – Hall of India, Private Ltd., New Delhi (2007).
4. Taha, H.A., Operations Research, An introduction, 7th edition, Pearson education Editions, Asia, New Delhi, 2002.
5. Donald Gross and Carl M. Harris, Fundamentals of Queuing theory, 2nd edition, John Wiley and Sons, New York (1985)

16CM 601	ADVANCED DIGITAL SIGNAL PROCESSING	L	T	P	C
		3	1	0	4

UNIT-I	DISCRETE RANDOM SIGNAL PROCESSING	9+3

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	SPECTRUM ESTIMATION	9+3

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	LINEAR ESTIMATION AND PREDICTION	9+3

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.

UNIT-IV	ADAPTIVE FILTERS	9+3
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).		

UNIT-V	MULTIRATE DIGITAL SIGNAL PROCESSING	9+3
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.		

L:45	T:15	T: 60 PERIODS

REFERENCES

1. Monson H.Hayes, Statistical Digital Signal Processing and Modeling, John Wiley and Sons,Inc., Singapore, 2002. [Unit I - V]
2. John G. Proakis, Dimitris G.Manolakis, Digital Signal Processing Pearson Education, [Unit I, II, III ,V]
3. John G. Proakis et.al.'Algorithms for Statistical Signal Processing', Pearson Education, 2002. [Unit II, III, IV]
4. Dimitris G.Manolakis et.al.' Statistical and adaptive signal Processing', Artech House Inc., 2005. [Unit I - IV]

16CM 602	ADVANCED RADIATION SYSTEMS	L	T	P	C
		3	1	0	4

UNIT-I	ANTENNA FUNDAMENTALS	9+3
Antenna fundamental parameters, Radiation integrals ,Radiation from surface and line current distributions – dipole, monopole, loop antenna; Mobile phone antenna- base station, hand set antenna; Image; Induction ,reciprocity theorem, Broadband antennas and matching techniques, Balance to unbalance transformer, Introduction to numerical techniques.		
UNIT-II	**RADIATION FROM APERTURES**	**9+3**
Field equivalence principle, Radiation from Rectangular and Circular apertures, Uniform aperture distribution on an infinite ground plane; Slot antenna; Horn antenna; Reflector antenna, aperture blockage, and design consideration.		

UNIT-III	ARRAY ANTENNA	9+3

Linear array –uniform array, end fire and broad side array, gain, beam width, side lobe level; Two dimensional uniform array; Phased array, beam scanning, grating lobe, feed network,; Linear array synthesis techniques – Binomial and Chebyshev distributions.

UNIT-IV	MICRO STRIP ANTENNA	9+3

Radiation Mechanism from patch; Excitation techniques; Microstrip dipole; Rectangular patch, Circular patch, and Ring antenna – radiation analysis from cavity model; input impedance of rectangular and circular patch antenna; Microstrip array and feed network; Application of microstrip array antenna.

UNIT-V	EMC ANTENNA AND ANTENNA MEASUREMENTS	9+3

Concept of EMC measuring antenna; Rx and Tx antenna factors; Log periodic dipole, Biconical, Ridge guide, Multi turn loop; Antenna measurement and instrumentation – Gain, Impedance and antenna factor measurement; Antenna test range Design.

L:45	T:15	T: 60 PERIODS

REFERENCES

1. Balanis.A, “Antenna Theory Analysis and Design”, John Wiley and Sons, New York, 1982. [Unit I – V]
2. Krauss.J.D, “Antennas”, II edition, John Wiley and sons, New York, 1997. [Unit II&III]
3. Edward .C. Jordan and Keith .G.Balmain, “Electromagnetic Waves and Radiating Systems”, second edition, Prentice Hall of India Pvt., Ltd., New Delhi, 2006
4. I.J. Bahl and P. Bhartia,” Microstrip Antennas”,Artech House,Inc.,1980
5. W.L.Stutzman and G.A.Thiele,”Antenna Theory and Design”, 2nd edition, John Wiley& Sons Inc., 1998.

16CM 603	OPTICAL COMMUNICATION NETWORKS	L	T	P	C
		3	0	0	3

UNIT-I	OPTICAL SYSTEM COMPONENTS	9

Light propagation in optical fibers – Loss & bandwidth, System limitations, Non-Linear effects; Solitons; Optical Network Components – Couplers, Isolators & Circulators, Multiplexers & Filters, Optical Amplifiers, Switches, Wavelength Converters.

UNIT-II	OPTICAL NETWORK ARCHITECTURES	9

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

UNIT-III	WAVELENGTH ROUTING NETWORKS	9

The optical layer, Node Designs, Optical layer cost tradeoff, Routing and wavelength assignment, Virtual topology design, Wavelength Routing Testbeds, Architectural variations.

UNIT-IV	PACKET SWITCHING AND ACCESS NETWORKS	9

Photonic Packet Switching – OTDM, Multiplexing and Demultiplexing, Synchronization, Broadcast OTDM networks, Switch-based networks; Access Networks – Network Architecture overview, Future Access Networks, Optical Access Network Architectures; and OTDM networks.

UNIT-V	NETWORK DESIGN AND MANAGEMENT	9

Transmission System Engineering – System model, Power penalty - transmitter, receiver, Optical amplifiers, crosstalk, dispersion; Wavelength stabilization ; Overall design considerations; Control and Management – Network management functions, Configuration management, Performance management, Fault management, Optical safety, Service interface.

L:45	T:0	T: 45 PERIODS

REFERENCES

1. M Rajiv Ramaswami and Kumar N. Sivarajan, "Optical Networks : A Practical Perspective", Harcourt Asia PVT Ltd., Second Edition 2004. [Unit I - V]
2. C. Siva Ram Moorthy and Mohan Gurusamy, "WDM Optical Networks : Concept, Design and Algorithms", Prentice Hall of India, I Edition, 2002. [Unit III]
3. P.E. Green, Jr., "Fiber Optic Networks", Prentice Hall, NJ, 1993. [Unit I-IV]

16CM 604	MICROWAVE INTEGRATED CIRCUITS	L	T	P	C
		3	0	0	3

UNIT-I	INTRODUCTION TO MICROWAVE INTEGRATED CIRCUITS	9

MMIC- technology, advantages and applications, Active device technologies, design approaches, multichip module technology, substrates.

UNIT-II	PASSIVE COMPONENTS	9

Inductors, capacitors, resistors, micro strip components, coplanar circuits, multilayer techniques, micro machined passive components, switches & attenuators, filter design.

UNIT-III	AMPLIFIERS	9

Stability & gain analysis, matching techniques, reactively matched amplifier design, LNA

UNIT-IV	OSCILLATORS	9

Design principles, active device CAD techniques for large signal oscillators design, phase noise, MMIC_VCO, Mixers-Mixer analysis, Diode Mixers.

UNIT-V	INTEGRATED ANTENNAS AND MEASUREMENT TECHNIQUES	9

Integrates antenna selection, photonic band gap antennas, micro machined antenna, micro electro mechanical system antennas, test fixture measurements, probe station measurements, thermal and cryogenic measurements.

L:45	T:15	T: 60 PERIODS

REFERENCES

1. Ravender Goyal, "Monolithic MIC; Technology & Design", Artech House, 1989.
2. Gupta K.C. and Amarjit Singh, "Microwave Integrated Circuits", John Wiley, New York, 1975. [Unit I]
3. Hoffman R.K. "Handbook of Microwave Integrated Circuits", Artech House, Boston, 1987. [Unit I]
4. Ulrich L. Rohde and David P.N., "RF / Microwave Circuit Design for Wireless Applications", John Wiley, 2000.
5. C. Gentili, "Microwave Amplifiers and Oscillators", North Oxford Academic, 1986. [Unit III,IV]
6. Annapurna Das and Sisir K Das, "Microwave Engineering", Tata McGraw-Hill Pub. Co. Ltd., 2004. [Unit II]
7. Samuel. Y. Liao, "Microwave Circuit Analysis and Amplifier Design", Prentice Hall. Inc., 1987. [Unit III]
8. RF and MMIC Design e-book edited by I.D.Robertson and S.Lucyszyn . [Unit I – V]

16CM 607	MULTIMEDIA COMPRESSION TECHNIQUES	L	T	P	C
		4	1	0	4

UNIT-I	INTRODUCTION	9+3

Overview of Information Theory, Redundancy, Entropy -Overview of Human audio, Visual systems-Need for Compression - Taxonomy of compression techniques – Overview of source coding, source models, scalar and vector quantization theory – Evaluation techniques – Error analysis and methodologies.

UNIT-II	TEXT COMPRESSION	9+3

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

UNIT-III	AUDIO COMPRESSION	9+3

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	IMAGE COMPRESSION	9+3

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 standard.

UNIT-V	VIDEO COMPRESSION	9+3

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 – .261 Standard – DVI technology – PLV performance – DVI real time compression – Packet Video.

L:45	T:15	T: 60 PERIODS

REFERENCES

1. Khalid Sayood : Introduction to Data Compression, Morgan Kauffman Harcourt India, 3rd Edition, 2006. [Unit I - V]
2. David Salomon : Data Compression – The Complete Reference, Springer Verlag New York Inc., 4th Edition, 2011. [Unit III - V]
3. Mark Nelson : Data compression, BPB Publishers, New Delhi,2010. [Unit II]
4. Mark S.Drew, Ze-Nian Li : Fundamentals of Multimedia, PHI, 1st Edition, 2004. [Unit I –V].
5. Yun Q.Shi, Huifang Sun : Image and Video Compression for Multimedia Engineering - Fundamentals, Algorithms & Standards, CRC press, 2003. [Unit IV,V]
6. Peter Symes : Digital Video Compression, McGraw Hill Pub., 2004. [Unit V]
7. Watkinson,J : Compression in Video and Audio, Focal press,London.1995. [Unit III,V]
8. Jan Vozer : Video Compression for Multimedia, AP Profes, NewYork, 1995[Unit V]

16CM 608	MODERN DIGITAL COMMUNICATION TECHNIQUES	L	T	P	C
		4	1	0	4

UNIT-I	CONSTANT ENVELOPE MODULATION	9+3

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

UNIT-II	OFDM	9+3

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-III	BLOCK CODED DIGITAL COMMUNICATION	9+3

Architecture and performance – Binary block codes; Orthogonal; Biorthogonal; Transorthogonal – Shannon's channel coding theorem; Channel capacity; Matched filter; Concepts of Spread spectrum communication – Linear block codes; Hammning; Golay; Cyclic; BCH ; Reed – Solomon codes.

UNIT-IV	CONVOLUTIONAL CODED DIGITAL COMMUNICATION	9+3

Representation of codes using Polynomial, State diagram, Tree diagram, and Trellis diagram – Decoding techniques using Maximum likelihood, Viterbi algorithm, Turbo Coding.

UNIT-V	EQUALIZATION TECHNIQUES	9+3

Band Limited Channels- ISI – Nyquist Criterion- Controlled ISI-Partial Response signals- Equalization algorithms – Linear equalizer – Decision feedback equalization – Adaptive Equalization algorithms.

L:45	T:15	T: 60 PERIODS

REFERENCES

1. M.K.Simon, S.M.Hinedi and W.C.Lindsey, Digital communication techniques; Signalling and detection, Prentice Hall India, New Delhi. 1995. [Unit I – IV].

2. Simon Haykin, Digital communications, John Wiley and sons, 2006 [Unit I – III].
3. Bernard Sklar., 'Digital Communications', second edition, Pearson Education,2001. [Unit IV].
4. John G. Proakis., 'Digital Communication', 4th edition, Mc Graw Hill Publication,2001. [Unit V].
5. Theodore S.Rappaport., 'Wireless Communications', 2nd edition, PearsonEducation, 2002. [Unit V].
6. Stephen G. Wilson., 'Digital Modulation and Coding', First Indian Reprint [Unit I].
7. Richard Van Nee, Ramjee Prasad, ' OFDM for multimedia communications' , Artech House Publications, 2001 [Unit II].

16CM 609	HIGH PERFORMANCE COMMUNICATION NETWORKS	L	T	P	C
		3	0	0	3

UNIT-I	BASICS OF NETWORKS	9

Telephone, computer, Cable television and Wireless network, networking principles, Digitalization: Service integration, network services and layered architecture, traffic characterization and QOS.

UNIT-II	PACKET SWITCHED NETWORKS	9

OSI and IP models: Ethernet (IEEE 802.3); token ring (I EEE 802.5), FDDI, DQDB, frame relay, SMDS; Internetworking with SMDS.

UNIT-III	INTERNET AND TCP/IP NETWORKS	9

Overview; internet protocol; TCP and VDP; performance of TCP/IP networks circuit, Switched networks: SONET; DWDM, Fiber to home, DSL. Intelligent networks, CATV

UNIT-IV	ATM AND WIRELESS NETWORKS	9

Main features- addressing, signaling and routing; ATM header structure-adaptation layer, management and control ;BISDN ;Interworking with ATM ,Wireless channel, link level design, channel access; Network design and wireless networks.

UNIT-V	OPTICAL NETWORKS AND SWITCHING	9
Optical links- WDM systems cross-connects, optical LAN's, optical paths and networks; TDS and SDS: modular switch designs-Packet switching, distributed, shared, input and output buffers.		

L:45	T:0	T: 45 PERIODS

REFERENCES

1. Jean warland and Pravin Varaiya, "High Performance Communication Networks ", 2nd Edition, Harcourt and Morgan Kauffman, London, 2000. [Unit I – V]
2. Leon Gracia, Widjaja, "Communication networks ", Tata McGraw-Hill, New Delhi, 2000. [Unit I,II]
3. Sumit Kasera, Pankaj Sethi, "ATM Networks ", Tata McGraw-Hill, New Delhi, 2000. [Unit IV]
4. Behrouz.A. Forouzan, "Data Communication and Networking ", Tata McGraw-Hill, New Delhi,2000 [Unit I,II]

16CM 605	COMMUNICATION SYSTEMS LAB-I	L	T	P	C
		0	0	2	1

LIST OF EXPERIMENTS

1. Channel equalizer design using MATLAB (LMS, RLS)
2. Multi rate filters
3. ADPCM.
4. Transform based compression techniques.
5. Antenna Radiation Pattern measurement.
6. Performance Evaluation of digital modulation schemes
7. Implementation of Linear and Cyclic Codes.
8. OFDM transceiver design using MATLAB
9. Performance evaluation of Digital Data Transmission through Fiber Optic Link

P:30	T:0	T: 30 PERIODS

16CM 610	COMMUNICATION SYSTEM LAB II	L	T	P	C
		0	0	2	1

LIST OF EXPERIMENTS

1. Simulation of Audio and speech compression algorithms
2. Simulation of EZW / SPIHT Image coding algorithm.
3. Simulation of Micro strip 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 $\lambda/4$ and $\lambda/2$ transmission lines.

P:30	T:0	T: 30 PERIODS

PROFESSIONAL ELECTIVES (PE)

16CM 612	HIGH SPEED SWITCHING ARCHITECTURES	L	T	P	C
		3	0	0	3

UNIT-I	LAN SWITCHING TECHNOLOGY	9

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

UNIT-II	ATM SWITCHING ARCHITECTURE	9

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 switch.

UNIT-III	QUEUES IN ATM SWITCHES	9

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

UNIT-IV	PACKET SWITCHING ARCHITECTURES	9

Architectures of Internet Switches and Routers- Bufferless and buffered Crossbar switches, Multi-stage switching, Optical Packet switching; switching fabric on a chip; Internally buffered Crossbars.

UNIT-V	IP SWITCHING	9

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

L:45	T:0	T: 45 PERIODS

REFERENCES

1.Achille Pattavina, "Switching Theory: Architectures and performance in Broadband ATM networks ",John Wiley & Sons Ltd, New York. [Unit II, III]

1. Elhanany M. Hamdi, "High Performance Packet Switching architectures", Springer Publications, 2007. [Unit IV]

3.Christopher Y Metz, "Switching protocols & Architectures", McGraw – Hill Professional Publishing, NewYork.1998. [Unit V]

4. Rainer Handel, Manfred N Huber, Stefan Schroder, "ATM Networks – Concepts Protocols, Applications", 3rd Edition, Addison Wesley, New York. 1999. [Unit I,IV]

5.H. Jonathan Chao, Cheuk.H.Lam, "Broadband Packet Switching Technologies: A practical guide to ATM switches and IP Routers", John wiley & sons, 2001. [Unit II]

16CM 613	ADVANCED FIBER OPTIC TECHNOLOGIES	L	T	P	C
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UNIT-I	OPTICAL SYSTEM COMPONENTS AND NETWORK DESIGN	9

Optical System Components – MZIM, Multiplexers; filters; switches; wavelength converters; optical amplifiers – EDFA, Raman Amplifiers and hybrid; Transmission system Engineering - System Model, Aimer penalty – transmitter, receiver, cross talk, dispersion compensation, wavelength stabilization, FWM.

UNIT-II	COHERENT SYSTEMS	9

Basic principles of Coherent detections – Practical constraints – Injection laser line width state of polarization, local oscillator power, fiber limitations; Modulation formats – ASK, FSK, PSK, DPSK and polarization shift keying (POL SK); Demodulation schemes – Homodyne, Heterodyne – Synchronous and Non synchronous detection; Comparison; Carrier recovery in Coherent detection.

UNIT-III	OPTICAL NETWORK ARCHITECTURES	9

Introduction: First Generation optical networks –SONET / SDH Network, Second Generation (WDM) Optical Networks – Broad Cast and select, wavelength routing architectures – Media – Access Control protocols

UNIT-IV	OPTICAL TDM AND SOLITON	9

Optical Time division Multiplexing – Interleaving, Packet Interleaving – Multiplexer and Demultiplexers; AND Gates – Non linear optical loop Mirror, Soliton – trapping AND Gate, Synchronization.

UNIT-V	OPTICAL CDMA	9

Prime codes and its properties, Generalized and Extended prime codes, Experimental demonstration of Optical CDMA, Synchronization of Optical CDMA Networks, Multiwavelength Optical CDMA Networks.

L:45	T:0	T: 45 PERIODS

REFERENCES

1. Max Ming-Kang Liu, "Principles and Applications of Optical Communication", Tata McGraw Hill Education Pvt., Ltd., New Delhi.
2. Le Ngyyen Binh , "Digital Optical Communications", CRC Press – Taylor and Francis Group –Indian reprint 2012.
3. Rajiv Ramaswami and Kumar N. Sivarajan, "Optical Networks : A Practical Perspective", Harcourt Asia Pte Ltd., Second Edition 2006.
4. P.E. Green, Jr., "Fiber Optic Networks", Prentice Hall, NJ, 1993.
5. Guu-Chang Yang, "Prime Codes with Application to Optical and Wireless Networks", Artech House, Inc., 2002.

16CM 614	COGNITIVE RADIO NETWORKS	L	T	P	C
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UNIT-I	INTRODUCTION TO SDR	9

Definitions and potential benefits, software radio architecture evolution – foundations, technology tradeoffs and architecture implications, Antenna for Cognitive Radio.

UNIT-II	SDR ARCHITECTURE	9

Essential functions of the software radio, architecture goals, quantifying degrees of programmability, top level component topology, computational properties of functional components, interface topologies among plug and play modules, architecture partitions.

UNIT-III	INTRODUCTION TO COGNITIVE RADIOS	9

Marking radio self-aware, the cognition cycle, organization of congnition tasks, structuring knowledge for cognition tasks, Enabling location and environment awareness in cognitive radios – concepts, architecture, design considerations.

UNIT-IV	COGNITIVE RADIO ARCHITECTURE	9

Primary Cognitive Radio functions, Behaviors, Components, A–Priori Knowledge taxonomy, observe – phase data structures, Radio procedure knowledge encapsulation, components of orient, plan, decide phases, act phase knowledge representation, design rules.

UNIT-V	NEXT GENERATION WIRELESS NETWORKS	9

The XG Network architecture, spectrum sensing, spectrum management, spectrum mobility, spectrum sharing, upper layer issues, cross – layer design.

L:45	T:0	T: 45 PERIODS

REFERENCES

1. Alexander M. Wyglinski, Maziar Nekovee, And Y. Thomas Hou, " Cognitive Radio Communications And Networks - Principles And Practice", Elsevier Inc. , 2010.
2. E. Biglieri, A.J. Goldsmith., L.J. Greenstein, N.B. Mandayam, H.V. Poor, " Principles of Cognitive Radio", Cambridge University Press, 2013.
3. Kwang-Cheng Chen and Ramjee Prasad, " Cognitive Radio Networks" , John Wiley & Sons, Ltd, 2009.
4. Khattab, Ahmed, Perkins, Dmitri, Bayoumi, Magdy, "Cognitive Radio Networks - From Theory to Practice", Springer Series: Analog Circuits and Signal Processing, 2009.
5. J. Mitola, " Cognitive Radio: An Integrated Agent Architecture for software defined radio", Doctor of Technology thesis, Royal Inst. Technology, Sweden 2000.
6. Simon Haykin, "Cognitive Radio: Brain –empowered wireless communications", IEEE Journal on selected areas in communications, Feb 2005.
7. Ian F. Akyildiz, Won – Yeol Lee, Mehmet C. Vuran, Shantidev Mohanty, " NeXt generation/dynamic spectrum access / cognitive radio wireless networks: A Survey Elsevier Computer Networks, May 2006.

16CM 615	COMMUNICATION NETWORK DESIGN	L	T	P	C
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UNIT-I	INTRODUCTION	9

Importance of Quantitative Modeling in Engineering of Telecommunication Networks, The Functional Elements of Networking, Evolution of Networking in the Wired and Wireless Domain.

UNIT-II	MULTIPLEXING	9

Performance Measures and Engineering Issues Network performance and source characterization,Circuit multiplexed Networks, packet Multiplexing over wireless networks, Events and processes in packet multiplexer models, Deterministic traffic Models and network calculus, stochastic traffic models, LRD traffic, Link Scheduling and network capacity in wireless networks.

UNIT-III	SWITCHING	9

Performance Measures of packet switches and circuit switches, queuing in packet switches, delay Analysis in Output Queued Switch, Input Queued Switch and CIOQ Switch with Parallelism, Blocking in Switching Networks, Closed Networks.

UNIT-IV	ROUTING	9

Algorithms for Shortest Path Routing - Dijkstra's Algorithm, Bellman Ford Algorithm, Generalized Dijkstra's Algorithm, Optimal Routing, Routing Protocols-Distance Vector, Link State and Exterior gateway protocols, Formulations of the Routing Problem-minimum interference Routing, MPLS, QoS Routing, Nonadditive and Additive metrics.

UNIT-V	CASE STUDIES	9

Design of a wireless network and a wired network, prototype implementation to be simulated in a network simulator.

L:45	T:0	T: 45 PERIODS

REFERENCES
1. Anurag Kumar, D. Manjunath and Joy "Communication Networking", Morgan Kaufan Publishers,2005.
2. A.Lean Garica and Indra Widjaja,"Communications Networks", Tata Mc Graw Hill,2004.
3. Thomas G.Robertazzi, "Computer Networks and Systems", Third Edition, Springer,2006.
4. Keshav.S., "An Engineering Approach to Computer Networking", Addison – Wesley, 1999.

16CM 616	DIGITAL COMMUNICATION RECEIVERS	L	T	P	C
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UNIT-I	REVIEW OF DIGITAL COMMUNICATION TECHNIQUES	9
Base band communication; signal space representation, linear and nonlinear modulation techniques, Error tracking and Spectral characteristics of digital modulation		

UNIT-II	OPTIMUM RECEIVERS FOR AWGN CHANNEL	9
Correlation demodulator, matched filter, maximum likelihood sequence detector, optimum receiver for CPM signals, M-ary orthogonal signals, envelope detectors for Mary and correlated binary signals		

UNIT-III	RECEIVERS FOR FADING CHANNELS	9
Characterization of fading multiple channels, statistical models, fading and frequency selective fading, diversity technique, Optimal receivers for data detection and synchronization parameter estimation, coded waveform for fading channel		

UNIT-IV	SYNCHRONIZATION TECHNIQUES	9
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	ADAPTIVE EQUALIZATION	9

Zero forcing algorithm, LMS algorithm, adaptive decision-feedback equalizer and Equalization of Trellis-coded signals. Kalman algorithm, blind equalizers and stochastic gradient algorithm.

L:45	T:0	T: 45 PERIODS

REFERENCES

1. John.G.Proakis, "Digital communication" 5th Edition, McGraw-Hill, New York, 2008. [UNIT I-V]
2. Heinrich Meyer, Mare Moeneclacy, Stefan.A.Fechtel, "Digital communication receivers" Vol I & Vol II, John Wiley, New York, 1997. [UNIT II]
3. E.A.Lee and D.G. Messerschmitt, "Digital communication", 2nd Edition, Allied Publishers, New Delhi, 1994. [UNIT I,V]
4. Simon Marvin, "Digital communication over fading channel: A unified approach to performance Analysis ", John Wiley, New York, 2000. [UNIT III]

16CM 617	ULTRA WIDE BAND COMMUNICATION	L	T	P	C
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UNIT-I	INTRODUCTION TO UWB	9

History, Definition, FCC Mask, UWB features, UWB Interference: IEEE 802.11.a Interference, Signal to Interference ratio calculation, Interference with other wireless services.

UNIT-II	UWB TECHNOLOGIES AND CHANNEL MODELS	9

Impulse Radio, Pulsed Multiband, Multiband OFDM, features: Complexity, Power Consumption, Security and achievable data rate. MIMO Multiband OFDM, Differential multiband OFDM, Performance characterization Ultra Wide Band Wireless Channels Channel model: Impulse Response Modeling of UWB Wireless Channels, IEEE UWB channel model, Path loss, Delay profiles, Time and frequency modeling.

UNIT-III	UWB SIGNAL PROCESSING	9

Data Modulation schemes, UWB Multiple Access Modulation, BER, Rake Receiver, Transmit-Reference (T-R) Technique, UWB Range- Data Rate Performance, UWB Channel Capacity UWB Wireless Positioning: Position Locating Methods, Time of Arrival Estimation, NLOS Location Error, Positioning with OFDM

UNIT-IV	UWB ANTENNAS	9
Antenna Requirements, Radiation Mechanism of the UWB Antennas, Types of Broad band antennas, Parameters, Analysis of UWB Antennas, Link Budget for UWB System.Design examples of broad band UWB antennas.		

UNIT-V	UWB APPLICATIONS AND REGULATIONS	9
Wireless Ad hoc Networking, UWB Wireless Sensor, RFID, Consumer Electronics and Personal, Asset Location, Medical applications UWB Regulation and standards in various countries, UWB Regulation in ITU, IEEE Standardization		

L:45	T:0	T: 45 PERIODS

REFERENCES

1. Homayoun Nikookar and Ramjee Prasad, "Introduction to Ultra Wideband for Wireless Communications"1st Edition, Springer Science & Business Media B.V. 2009. [Unit – I to V]
2. Thomas Kaiser, Feng Zheng "Ultra Wideband Systems with MIMO", 1st Edition, John Wiley & Sons Ltd, Newyork, 2010. [Unit – III]
3. W. Pam Siriwongpairat and K. J. Ray Liu, "Ultra-Wideband Communications Systems:Multiband OFDM approach" John Wiley and IEEE press, New York 2008.[Unit – II]

16CM 618	NETWORK ROUTING ALGORITHMS	L	T	P	C
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UNIT-I	INTRODUCTION	9
ISO OSI Layer Architecture, TCP/IP Layer Architecture, Functions of Network layer, General Classification of routing, Routing in telephone networks, Dynamic Nonhierarchical Routing (DNHR), Trunk status map routing (TSMR), real-time network routing (RTNR), Distance vector routing, Link state routing, Hierarchical routing.		

UNIT-II	INTERNET ROUTING	9
Interior protocol : Routing Information Protocol (RIP), Open Shortest Path First (OSPF), Bellman Ford Distance Vector Routing. Exterior Routing Protocols: Exterior Gateway Protocol (EGP) and Border Gateway Protocol (BGP). Multicast Routing: Pros and cons of Multicast and Multiple Unicast Routing, Distance Vector Multicast Routing Protocol (DVMRP), Multicast Open Shortest Path First (MOSPF), MBONE, Core Based Tree Routing.		

UNIT-III	ROUTING IN OPTICAL WDM NETWORKS	9
Classification of RWA algorithms, RWA algorithms, Fairness and Admission Control, Distributed Control Protocols, Permanent Routing and Wavelength Requirements, Wavelength Rerouting- Benefits and Issues, Lightpath Migration, Rerouting Schemes, Algorithms- AG, MWPG.		

UNIT-IV	MOBILE - IP NETWORKS	9
Macro-mobility Protocols, Micro-mobility protocol: Tunnel based : Hierarchical Mobile IP, Intra domain Mobility Management, Routing based: Cellular IP, Handoff Wireless Access Internet Infrastructure (HAWAII).		

UNIT-V	MOBILE AD –HOC NETWORKS	9
Internet-based mobile ad-hoc networking communication strategies, Routing algorithms – Proactive routing: destination sequenced Distance Vector Routing (DSDV), Reactive routing: Dynamic Source Routing (DSR), Ad hoc On-Demand Distance Vector Routing (AODV), Hybrid Routing: Zone Based Routing (ZRP).		

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REFERENCES

1. William Stallings, 'High speed networks and Internets Performance and Quality of Service', IInd Edition,Pearson Education Asia. Reprint India 2002. [Unit I,II]
2. M. Steen Strub, 'Routing in Communication network, Prentice –Hall International, Newyork, 1995. [Unit I,II]
3. S. Keshav, 'An engineering approach to computer networking' Addison Wesley 1999. [Unit I,II]
4. William Stallings, 'High speed Networks TCP/IP and ATM Design Principles, Prentice- Hall, New York, 2nd Edition,1997. [Unit I,II]
5. C.E Perkins, 'Ad Hoc Networking', Addison – Wesley, 2001. [Unit V]
6. Ian F. Akyildiz, Jiang Xie and Shantidev Mohanty, "A Survey of mobility Management in Next generation All IP- Based Wireless Systems", IEEE Wireless Communications Aug.2004, pp 16-27. [Unit IV]
7. A.T Campbell et al., "Comparison of IP Micro mobility Protocols," IEEE Wireless Communications Feb.2002, pp 72-82. [Unit IV]
8. C.Siva Rama Murthy and Mohan Gurusamy, "WDM Optical Networks – Concepts, Design and Algorithms", Prentice Hall of India Pvt. Ltd, New Dhi –2002. [Unit III]

16CM 619	SPEECH AND AUDIO SIGNAL PROCESSING	L	T	P	C
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UNIT-I	MECHANICS OF SPEECH AND AUDIO	9

Introduction - Review of Signal Processing Theory-Speech production mechanism – Nature of Speech signal – Discrete time modelling of Speech production – Classification of Speech sounds – Phones – Phonemes – Phonetic and Phonemic alphabets –Articulatory features. Absolute Threshold of Hearing - Critical Bands- Simultaneous Masking, Masking-Asymmetry, and the Spread of Masking- Non simultaneous Masking -Perceptual Entropy - Basic measuring philosophy -Subjective versus objective perceptual testing - The perceptual audio quality measure (PAQM) - Cognitive effects in judging audio quality.

UNIT-II	TIME-FREQUENCY ANALYSIS: FILTER BANKS AND TRANSFORMS	9

Introduction -Analysis-Synthesis Framework for M-band Filter Banks- Filter Banks for Audio Coding: Design Considerations - Quadrature Mirror and Conjugate Quadrature Filters- Tree-structured QMF and CQF M-band Banks - Cosine Modulated "Pseudo QMF" M-band Banks - Cosine Modulated Perfect Reconstruction (PR) M-band Banks and the Modified Discrete Cosine Transform (MDCT) - Discrete Fourier and Discrete Cosine Transform - Pre-echo Distortion- Pre-echo Control Strategies.

UNIT-III	AUDIO CODING AND TRANSFORM CODERS	9

Lossless Audio Coding-Lossy Audio Coding- ISO-MPEG-1A,2A,2A Advanced , 4 Audio Coding - Optimum Coding in the Frequency Domain - Perceptual Transform Coder - Brandenburg-Johnston Hybrid Coder - CNET Coders - Adaptive Spectral Entropy Coding -Differential Perceptual Audio Coder - DFT Noise Substitution -DCT with Vector Quantization - MDCT with Vector Quantization.

UNIT-IV	TIME AND FREQUENCY DOMAIN METHODS FOR SPEECH PROCESSING	9

Time domain parameters of Speech signal – Methods for extracting the parameters: Energy, Average Magnitude – Zero crossing Rate – Silence Discrimination using ZCR and energy Short Time Fourier analysis – Formant extraction – Pitch Extraction using time and frequency domain methods

HOMOMORPHIC SPEECH ANALYSIS:

Cepstral analysis of Speech – Formant and Pitch Estimation – Homomorphic Vocoders.

UNIT-V	LINEAR PREDICTIVE ANALYSIS OF SPEECH	9

Formulation of Linear Prediction problem in Time Domain – Basic Principle – Auto correlation method – Covariance method – Solution of LPC equations – Cholesky method – Durbin's Recursive algorithm – lattice formation and solutions – Comparison of different methods – Application of LPC parameters – Pitch detection using LPC Parameters – Formant analysis – VELP – CELP.

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REFERENCES

1. Ben Gold and Nelson Morgan, "Speech and Audio Signal Processing", John Wiley and Sons Inc. , Singapore, 2004.[Unit III, IV]
2. L.R.Rabiner and R.W.Schaffer, "Digital Processing of Speech signals", Prentice Hall, 1978. [Unit I-IV]
3. Quatier, "Discrete-time Speech Signal Processing", Prentice Hall, 2001.[Unit I, II, III, V]
4. J.L.Flanagan, "Speech analysis: Synthesis and Perception", 2nd Edition, Berlin,1972. [Unit I, III, IV, V]
5. I.H.Witten, "Principles of Computer Speech", Academic Press, 1982. [Unit I, III, IV,V]

16CM 620	ADVANCED WIRELESS COMMUNICATION TECHNIQUES	L	T	P	C
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UNIT-I	COOPERATIVE COMMUNICATIONS AND GREEN CONCEPTS	9

Network architectures and research issues in cooperative cellular wireless networks ; Cooperative communications in OFDM and MIMO cellular relay networks: issues and approaches; Fundamental trade-offs on the design of green radio networks, Green modulation and coding schemes, Cooperative techniques for energy efficiency.

UNIT-II	COOPERATIVE BASE STATION TECHNIQUES	9

Cooperative base station techniques for cellular wireless networks; Turbo base stations ; Antenna architectures for cooperation; Cooperative communications in 3GPP LTE-Advanced, Partial information relaying and Coordinated multi-point transmission in LTE-Advanced.

UNIT-III	RELAY-BASED COOPERATIVE CELLULAR NETWORKS	9
Distributed space-time block codes ; Collaborative relaying in downlink cellular systems ; Radio resource optimization; Adaptive resource allocation ; Cross-layer scheduling design for cooperative wireless two-way relay networks ; Network coding in relay-based networks.		

UNIT-IV	GREEN RADIO NETWORKS	9
Base Station Power-Management Techniques- Opportunistic spectrum and load management, Energy-saving techniques in cellular wireless base stations, Power-management for base stations in smart grid environment , Cooperative multicell processing techniques for energy-efficient cellular wireless communications , Green communications in cellular networks with fixed relay nodes.		

UNIT-V	ACCESS TECHNIQUES FOR GREEN RADIO NETWORKS	9
Cross-layer design of adaptive packet scheduling for green radio networks; Energy-efficient relaying for cooperative cellular wireless networks ; Energy performance in TDD-CDMA multihop cellular networks Resource allocation for green communication in relay-based cellular networks ; Green Radio Test-Beds and Standardization Activities.		

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REFERENCES

1. Ekram Hossain, Dong In Kim, Vijay K. Bhargava , "Cooperative Cellular Wireless Networks",Cambridge University Press, 2011.
2. Ekram Hossain, Vijay K. Bhargava(Editor), Gerhard P. Fettweis (Editor), "Green Radio Communication Networks", Cambridge University Press, 2012.

16CM 621	MULTIUSER DETECTION IN WIRELESS COMMUNICATION	L	T	P	C
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UNIT-I	CODE DIVISION MULTIPLE ACCESS CHANNEL	9

Basic synchronous and asynchronous CDMA model – signature waveforms – Data streams – Modulation – fading – Antenna arrays – Background noise – Discrete time synchronous and asynchronous models.

UNIT-II	SINGLE-USER MATCHED FILTER	9

Hypothesis testing – optimal receiver for the single user channel – The Q function – the matched filter in the CDMA system – Asymptotic multi user efficiency and related measures – coherent single user matched filter in Rayleigh fading – Differentially coherent demodulation – Non-coherent modulation.

UNIT-III	OPTIMUM MULTI USER DETECTION	9

Optimum detector for synchronous channels – Optimum detector for asynchronous channels – Minimum error probability in synchronous channel – K user optimum asymptotic efficiency and near-far resistance – Minimum error probability in the asynchronous channel – Performance analysis in Rayleigh fading – Optimum noncoherent multi user detection.

UNIT-IV	DECORRELATING DETECTOR	9

Optimum linear multi user detection – Minimum mean square error(MMSE) linear multi user detection – Performance of MMSE linear multi user detection – Adaptive MMSE linear multi user detection – Canonical representation of linear multi user detectors – Blind MMSE multi user detector.

UNIT-V	DECISION – DRIVEN MULTI USER DETECTOR	9

Successive cancellation – performance analysis of Successive cancellation – synchronous decorellating decision-feedback – synchronous MMSE decision-feedback – asynchronous decision-feedback..

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REFERENCES
1. Sergioverdu, “Multi User Detection”, Cambridge University press, 1998. [Unit I-V] 2. Sergioverdu, “Recent Progress in Multi User Detection advances in communication and control systems”, IEEE Press, 1993.

16CM 622	ADVANCED DIGITAL IMAGE PROCESSING	L	T	P	C
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UNIT-I	FUNDAMENTALS OF DIGITAL IMAGE PROCESSING	9
Elements of visual perception, brightness, contrast, hue, saturation, mach band effect, 2D image transforms-DFT, DCT, KLT, and SVD. Image enhancement in spatial and frequency domain, Review of morphological image processing		

UNIT-II	SEGMENTATION	9
Edge detection, Thresholding, Region growing, Fuzzy clustering, Watershed algorithm, Active contour methods, Texture feature based segmentation, Model based segmentation, Atlas based segmentation, Wavelet based Segmentation methods		

UNIT-III	FEATURE EXTRACTION	9
First and second order edge detection operators, Phase congruency, Localized feature extraction-detecting image curvature, shape features Hough transform, shape skeletonization, Boundary descriptors, Moments, Texture descriptors- Autocorrelation, 240 Co-occurrence features, Runlength features, Fractal model based features, Gabor filter, wavelet features.		

UNIT-IV	REGISTRATION AND IMAGE FUSION	9
Registration- Preprocessing, Feature selection-points, lines, regions and templates Feature correspondence-Point pattern matching, Line matching, region matching and Template matching. Transformation functions-Similarity transformation and Affine Transformation. Resampling- Nearest Neighbour and Cubic Splines Image FusionOverview of image fusion, pixel fusion, Multiresolution based fusion discrete wavelet transform, Curvelet transform. Region based fusion.		

UNIT-V	3D IMAGE VISUALIZATION	9

Sources of 3D Data sets, Slicing the Data set, Arbitrary section planes, The use of color, Volumetric display, Stereo Viewing, Ray tracing, Reflection, Surfaces, Multiply connected surfaces, Image processing in 3D, Measurements on 3D images

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REFERENCES

1. John C.Russ, "The Image Processing Handbook", CRC Press, 2007 [Unit – I to V]
2. Mark Nixon, Alberto Aguado, "Feature Extraction and Image Processing", Academic Press, 2008. [Unit – III]
3. Ardeshir Goshtasby, "2D and 3D Image registration for Medical, Remote Sensing and Industrial Applications", John Wiley and Sons, 2005. [Unit – IV]
4. Rafael C. Gonzalez, Richard E. Woods, 'Digital Image Processing', Pearson, Education, Inc., Second Edition, 2004.[Unit – II and III]
5. Anil K. Jain,'Fundamentals of Digital Image Processing', Pearson Education,Inc.,2002.[Unit – I]
6. Rick S.Blum, Zheng Liu, "Multisensor image fusion and its Applications", Taylor& Francis, 2006. [Unit – IV]

16CM 704	MEDICAL SYSTEMS AND SIGNAL PROCESSING	L	T	P	C
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UNIT-I	ELECTRO PHYSIOLOGY	9

Medical terminology – Electrical activity of nerve and muscle cells-ion pumps – membrane potential – An electrical model for the source of internal cell potential Resting– Resting and action potentials – propagation of Action potentials – The bioelectric potentials.

UNIT-II	CARDIO PULMONARY PHYSIOLOGY	9

Electrical basis of cardiac activities – Cardiac muscle and conduction system – Electrical potential on surfaces – projections of cardiac vector – Frontal plane projections – Unipolar chest leads – Electrical axis of the hear – Vector cardiography – ECG waveform and related heart action.

UNIT-III	NEUROPHYSIOLOGY	9
The anatomy of nervous system – The Neuron – Neuronal communication – ionic environment of neuron – Neuronal Receptors – Central and peripheral nervous system –EEG – Evoked potential – Electrical activity in muscular system – EMG.		

UNIT-IV	SIGNAL CLASSIFICATION AND RECOGNITION	9
Statistical Signal Classification - Linear Discriminated Function – Direct Feature Selection and Ordering.		

UNIT-V	ADAPTIVE FILTERING, WAVELET DETECTION & APPLICATIONS	9
Least Mean Square Adaptive Filtering – Adaptive Noise canceling – Contour Limiting Matched Filtering – Adaptive Wavelet detector – applications.		

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REFERENCES

1. Cromwell. L, “Biomedical Instrumentation and Measurements”, Prentice Hall of India, 1995. [Unit I, III]
2. Jacabson. B, Webster J.G., “Medicine and Clinical Engineering”, Prentice hall of India, 1979. [Unit I, II, III]
3. Khandpur R.S., “Handbook of Biomedical Instrumentation”, Tata McGraw Hill,1999. [Unit I, II, III]
4. Cohen A., “Bio-Medical Signal Processing”, Vol. I and II, CRC Press Inc., Florida,1988. [Unit IV, V]

16CM 705	COMMUNICATION NETWORK SECURITY	L	T	P	C
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UNIT-I	INTRODUCTION ON 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, Substitution Ciphers, Transposition Ciphers, Stream and Block Ciphers- Steganography- Revision on Mathematics for Cryptography.

UNIT-II	SYMMETRIC & ASYMMETRIC KEY ALGORITHMS	9

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 512, Whirlpool**, Digital signatures: Digital signature standards. Authentication: Entity Authentication: Biometrics, Key management Techniques.

UNIT-IV	NETWORK SECURITY, 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. E-mail security: PGP, MIME,S/MIME. 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 Broadband networks: Secure Ad hoc Network, Secure Sensor Networks.

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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 Hill, 2008.
3. R.K.Nichols and P.C. Lekkas ," Wireless Security"
4. H. Yang et al., Security in Mobile Ad Hoc Networks: Challenges and Solution, IEEE Wireless Communications, Feb. 2004.
5. Securing Ad Hoc Networks," IEEE Network Magazine, vol. 13, no. 6, pp.24-30, December 1999.
6. David Boel et.al (Jan 2008) "Securing Wireless Sensor Networks – Security Architecture " Journal of networks , Vol.3. No. 1. pp. 65 -76.
7. Perrig, A., Stankovic, J., Wagner, D. (2004), "Security in Wireless Sensor Networks", Communications of the ACM, 47(6), 53-57.

16CM 706	EMBEDDED AND REAL TIME SYSTEMS	L	T	P	C
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UNIT-I	INTRODUCTION TO EMBEDDED SYSTEMS	9

Embedded Systems-Applications of Embedded Systems-Processors in the System-Other Hardware Units-Software Embedded into a System-Exemplar Embedded Systems-Embedded System-on-Chip (SOC) and in VLSI circuit.

UNIT-II	DEVICES AND BUSES FOR DEVICE NETWORK	9

I/O Devices-Timer and Counting Devices-Serial Communication using I2C,CAN and USB. Parallel Communication using PCI, PCIX and Advanced Parallel High Speed Buses.

UNIT-III	DEVICE DRIVERS AND INTERRUPTS SERVICING MECHANISM	9

Device Drivers-Parallel Port Device Drivers in a System, Serial Port Device Drivers in a System, Device Drivers for Internal Programmable Timing Devices – Interrupt Servicing Mechanism-Context and the Periods for Context Switching, Deadline and Interrupt Latency.

UNIT-IV	EMBEDDED SOFTWARE DEVELOPMENT USING IDE	9

Introduction to Integrated Development Environment (IDE)- Programming Concepts and Embedded Programming in Assembly and C- Creating a New Project – Adding Files to a Project-Building a Project-Debugging and Simulating the application-Getting Embedded Software into the Target System.

UNIT-V	REAL TIME OPERATING SYSTEMS (RTOS)	9

Tasks and Task States, Tasks and Data, Semaphores and Shared Data, Message Queues, Mailboxes and Pipes, Timer functions, Events, Memory Management, Interrupt Routines in RTOS Environment. Case study of programming with RTOS

L:45	T:0	T: 45 PERIODS

REFERENCES

1. Rajkamal, "Embedded Systems: Architecture, Programming and Design", Tata McGraw-Hill,2006.
2. David E Simon, "An Embedded Software Primer" Pearson Education Asia, 2006.
3. Arnold Berger, "Embedded System Design: An Introduction to Processes, Tools, and Techniques" CMP Books, 2001.
4. Wayne Wolf, "Computers as Components" Morgan Kaufmann Publishers, 2005.
5. Douglas V Hall, "Microprocessors and Interfacing: Programming and Hardware", Second Edition, Tata McGraw-Hill Edition, 2001.

16CM 707	SMART ANTENNAS	L	T	P	C
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UNIT-I	INTRODUCTION	9

Antenna gain, Phased array antenna, power pattern, beam steering, degree of freedom, optimal antenna, adaptive antennas, smart antenna - key benefits of smart antenna technology, wide band smart antennas, Digital radio receiver techniques and software radio for smart antennas

UNIT-II	NARROW BAND PROCESSING	9

Signal model conventional beamformer, null steering beamformer, optimal beamformer, Optimization using reference signal, beam space processing.

UNIT-III	ADAPTIVE PROCESSING	9

Sample matrix inversion algorithm, unconstrained LMS algorithm, normalized LMS algorithm, Constrained LMS algorithm, Perturbation algorithms, Neural network approach, Adaptive beam space processing, Implementation issues.

Broadband Processing: Tapped delay line structure, Partitioned realization, Derivative constrained processor, Digital beam forming, Broad band processing using DFT method

UNIT-IV	DIRECTION OF ARRIVAL ESTIMATION METHODS	9

Spectral estimation methods, linear prediction method, Maximum entropy method, Maximum likelihood method, Eigen structure methods, Music algorithm – root music and cyclic music algorithm, the ESPRIT algorithm.

UNIT-V	DIVERSITY COMBINING	9

Spatial diversity selection combiner, switched diversity combiner, equal gain combiner, maximum ratio combiner, optical combiner.

L:45	T:0	T: 45 PERIODS

REFERENCES

1. Lal Chand Godara, “Smart Antennas” CRC press, 2004.
2. Joseph C Liberti.Jr and Theodore S Rappaport, “Smart Antennas for Wireless Communication: IS-95 and Third Generation CDMA Applications”, Prentice Hall 1999.
3. Balanis, “Antennas”, John Wiley and Sons, 2005.

16CM 708	INFORMATION THEORY AND CODING	L	T	P	C
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UNIT-I	MEMORYLESS FINITE SCHEMES	9

Self information measure - Entropy function – Conditional Entropies - Characteristics of Entropy function - Derivation of the noise characteristics of a channel - Mutual information - Redundancy - Efficiency and channel capacity - capacities of channels with symmetric noise structure – BSC and BEC – Capacity of Binary channels - Markov Sources - Entropy of Markov Sources - Sequences of Symbols - Adjoint Source of a Markov Source.

UNIT-II	CONTINUOUS CHANNELS	9

Definitions of different entropies - Mutual information - Maximization of the entropy of a continuous random variable - Entropy maximization problems - Channel capacity under the influence of additive white Gaussian Noise. - Information Capacity Theorem - Rate Distortion Theory.

UNIT-III	ELEMENTS OF ENCODING	9

Separable binary codes - Shannon - Fano encoding - Necessary and sufficient conditions for noiseless coding - Shannon's binary coding - fundamental theorem of discrete noise-less coding - Huffman's code - Gilbert Moore coding - Fundamental theorem of discrete coding in presence of noise - Instantaneous Codes - Kraft Inequality and McMillan's Theorem - Average Length and Compact Codes - - Dictionary Coding and Lempel-Ziv coding - Arithmetic Coding - Data Compression - Run-length Coding - Block-sorting Compression.

UNIT-IV	ERROR CONTROL CODES	9

Hamming's single error correcting code - BCH codes – Reed-Solomon codes – Decoding BCH and RS codes – finding the Error Locator Polynomial – Non-binary BCH and RS Decoding – Erasure decoding for Non binary BCH and RS codes – Galois field Fourier Transform method – variations and extensions of Reed-Solomon codes - Turbo codes – Encoding Parallel Concatenated codes – Turbo MAP decoding algorithm - BCJR algorithm – Log likelihood ratio decoding - LDPC codes- LDPC code construction – Encoding LDPC codes – Serial Concatenated codes- Concatenations with LDPC and Turbo codes – design of LDPC decoders.

UNIT-V	SPACE-TIME CODING	9

Introduction – Fading Channels – Diversity Transmission and Reception: the MIMO channel – Space-time block codes – complex orthogonal Designs – Space-time trellis codes.

L:45	T:0	T: 45 PERIODS

REFERENCES

1. Reza F M,"An Introduction to Information theory", McGraw Hill, 2000. [Unit I,III]
2. Todd K Moon, "Error Correction Coding – Mathematical methods and Algorithms", John Wiley & Sons, 2005. [Unit IV,V]
3. Roberto Togneri, Christopher J.S DeSilva, "Fundamentals of Information Theory and Coding Design", CRC press, 2003. [Unit II]
4. Richard B.Wells, "Applied Coding and Information Theory for Engineers", Pearson Education, 1st Indian reprint, 2004.
5. Ranjan Bose, "Information Theory Coding and Cryptography", Tata McGraw Hill, 2007.
6. Thomas M. Cover and Joy A. Thomas, "Elements of Information Theory", John Wiley & Sons, 2nd Edition, 2006.
7. Bernard Sklar, "Digital Communications: Fundamentals and Applications", Pearson Education, 2nd Edition, 2001.

16CM 709	ADVANCED MICROWAVE COMMUNICATION	L	T	P	C
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UNIT-I	MICROWAVE AMPLIFIERS AND OSCILLATORS	9

Klystron Amplifier – Reflex Klystron Amplifier –Travelling wave tube Amplifier – Magnetron Oscillator and Modulator-Varactor diode – Solid State Broad band Amplifiers – diode detector and mixer-- YIG tuned Oscillators– Comb generators. GUNN, Tunnel IMPATT diode oscillators.

UNIT-II	MICROWAVE PASSIVE COMPONENTS	9

Scattering parameters-S-Matrix – Attenuator –Phase shifters – T Junctions – Hybrid T Junctions – Directional couplers – Isolater, Properties of ferrite devices – YIG devices—Step recovery Diodes – Gyrator – Circulator – Scattering parameter measurement.

UNIT-III	MICROWAVE RESONATORS AND FILTERS	9

Review of resonant circuits – principle of Microwave resonators – field analysis of cavity resonators – Characteristics of filters –YIG tuned filters – Filter and resonant applications – SRD Frequency multipliers and frequency Discriminators.

UNIT-IV	MICROWAVE ANTENNAS	9

Characteristics of Microwave Antennas – Half Wave Dipole –Array – Horn – Paraboloidal Reflector – feeds – Lens and slot Antennas – Leaky and surface wave Antennas – Broad band Antennas – Micro strip Antennas – Antenna measurements.

UNIT-V	MICROWAVE RADIO SYSTEM	9

Types of propagation – Line of sight transmission – Radio horizon – Broadband Microwave Surveillance Receivers—ELINT and Electronic support measures--Microwave links-Repeaters – Diversity – frequency and space diversity systems – Fading – System gain and path losses - Noise and Absorption in Microwave links.

L:45	T:0	T: 45 PERIODS

REFERENCES

1. Roddy.D., “Microwave Technology” Reston Publications.1986.
2. Chatterjee R. “Microwave Engineering “East West Press. 1988.
3. Rizzi.P.”Microwave Engineering Passive circuits”. Prentice Hall.1987
4. Tomasi.W “Advanced Electronic communication systems “Prentice Hall.1987.
5. Clock.P.N. “Microwave Principles and Systems” Prentice Hall.1986.
6. Combes, Graffewil and Sauterean “Microwave Components, Devices and Active Circuits”. John wiley.1987.
7. Annapurana Das.Sisir.K.Das,”Microwave Engineering” Tata Mc Graw Hill, 2000.

16CM 710	MULTIRATE SIGNAL PROCESSING	L	T	P	C
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UNIT-I	REVIEW OF DIGITAL FILTERS	9
Digital FIR filter design, Filter specifications, ideal filters; Equiripple filters; Windowing and the Gibbs phenomenon; The Remez Algorithm, Digital IIR filter design – Bilinear transformation.		

UNIT-II	DECIMATION AND INTERPOLATION	9
Introduction – Representation of discrete signals –Reducing the sampling rate – Increasing the sample rate. Decimation with transversal filters – Interpolation withtransversal filters – Decimation with Polyphase filters – Interpolation with polyphase filters – Decimation and Interpolation with Rational sampling factors		

UNIT-III	TWO CHANNEL FILTER BANKS	9
Analysis and synthesis filter banks – Quadrature mirror filter banks – Filter banks with perfect reconstruction – Paraunitary filter banks – Biorthogonal and linear phase filterbanks – Transmuliplexer filter banks.		

UNIT-IV	UNIFORM M-CHANNEL FILTER BANKS	9
Filter banks with tree structure – Filter banks with parallel structure – complex modulated filter banks –cosine modulated filter banks – Transmultiplexer filter banks.		

UNIT-V	FILTER BANKS WITH POLYPHASE STRUCTURE	9
Fundamental polyphase structures – polyphase QMF banks – General two channel polyphase filter banks – General M-channel polyphase filter banks – Paraunitary polyphase filter banks – DFT polyphase filter banks – applications.		

L:45	T:0	T: 45 PERIODS

REFERENCES
1.Fliege N J, "Multirate Digital Signal Processing", John Wiley and sons, 1994. [Unit III, IV] 2. Vaidyyanathan P P, "Multirate Systems and Filter Banks", Prentice Hall Inc.,1993. [Unit III] 3. Proakis J G and Manolakis D G, "Digital Signal Processing Principles, Algorithms and Applications", Prentice Hall of India, 2002. [Unit II] 4. Sanjit K Mitra, "Digital Signal Processing-A Computer Based Approach", Tata McGraw Hill, 2003. [Unit V] 5. S. Salivahanan, A. Vallavaraj, C.Gnanapriya, "Digital Signal Processing", Tata McGraw Hill International, 2007. [Unit I]

16CM 711	TELECOMMUNICATION SYSTEM MODELING AND SIMULATION	L	T	P	C
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UNIT-I	SIMULATION METHODOLOGY	9

Introduction, Aspects of methodology, Performance Estimation, Simulation sampling frequency, Low pass equivalent simulation models for band pass signals, Multicarrier signals, Non-linear and time varying systems, Post processing – Basic graphical techniques and estimations.

UNIT-II	RANDOM SIGNAL GENERATION & PROCESSING	9

Uniform random number generation, Mapping uniform random variables to an arbitrary pdf, Correlated and Uncorrelated Gaussian random number generation, PN sequence generation, Random signal processing, Testing of random number generators.

UNIT-III	MONTE CARLO SIMULATION	9

Fundamental concepts, Application to communication systems, Monte Carlo integration, Semianalytic techniques, Case study: Performance estimation of a wireless system

UNIT-IV	ADVANCED MODELS & SIMULATION TECHNIQUES	9

Modeling and simulation of non-linearities : Types, Memoryless non-linearities, Non-linearities with memory, Modeling and simulation of Time varying systems : Random process models, Tapped delay line model, Modelling and simulation of waveform channels, Discrete memoryless channel models, Markov model for discrete channels with memory.

UNIT-V	EFFICIENT SIMULATION TECHNIQUES	9

Tail extrapolation, pdf estimators, Importance Sampling methods, Case study: Simulation of a Cellular Radio System.

L:45	T:0	T: 45 PERIODS

REFERENCES

1. William.H.Tranter, K. Sam Shanmugam, Theodore. S. Rappaport, Kurt L. Kosbar, Principles of Communication Systems Simulation, Pearson Education (Singapore) Pvt. Ltd, 2004.
2. M.C. Jeruchim, P.Balaban and K. Sam Shanmugam, Simulation of Communication Systems: Modeling, Methodology and Techniques, Plenum Press, New York, 2001.
3. Averill.M.Law and W. David Kelton, Simulation Modeling and Analysis, McGraw Hill Inc., 2000.
4. Geoffrey Gorden, System Simulation, Prentice Hall of India, 2nd Edition, 1992.
5. Jerry Banks and John S. Carson, Discrete Event System Simulation, Prentice Hall of India, 1984.

16CM 712	ADVANCED PROCESSOR ARCHITECTURE	L	T	P	C
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UNIT-I	INTRODUCTION TO PARALLEL PROCESSING	9

Evolution of computer systems. Generation of computer systems – Trends towards parallel processing- Parallel processing mechanisms- parallel computer structure- Architectural classification schemes – Application.

UNIT-II	MEMORY AND I/O SUBSYSTEMS	9

Hierarchical Memory structure – Virtual memory system - cache memory management- Memory allocation and management – I/O subsystems .

MULTIPLE PROCESSORS ISSUE

Overview of Multiple issue processors – Cache access and Instruction fetch – Dynamic branch prediction and control speculation – Decode – Rename – Execution stages – Super scalar processors – VLIW and EPIC Processors. Principles - Classification of pipeline processors - Reservation tables – Interleaved memory organization – Design of arithmetic pipeline – Design of instruction pipeline.

UNIT-III	VECTOR PROCESSING	9

Need – Basic vector processing architecture - Issues in vector processing – Vectorization and optimization methods.

ARRAY PROCESSING

SIMD Array processors – SIMD interconnection networks – Parallel algorithms for array processors – associative array processing.

UNIT-IV	MULTIPROCESSOR ARCHITECTURE	9

Functional structures - Interconnection network – Multi cache problems and solutions – Exploiting concurrency for multiprocessing.

UNIT-V	PRINCIPLES OF PARALLEL ALGORITHM DESIGN	9

Design approaches-Design issues-Performance measures and analysis-Complexities-Anomalies in parallel algorithms - Pseudo code conventions for parallel algorithms-Comparison of SIMD and MIMD algorithms.

L:45	T:0	T: 45 PERIODS

REFERENCES

1. Kai Hwang, "Advanced Computer Architecture: Parallelism, Scalability and Programmability", Tata McGraw Hill, 1992.
2. Seyed Roosta, "Parallel Processing and Parallel Algorithms", Springer Series, 1999.
3. John L Hennessy, "Computer Architecture a Quantitative Approach", Harcourt Asia Pvt. Ltd., 1999.
4. Jurij Silc, ”Processor Architecture : From Superscalar to Data Flow and Beyond “, Springer; 1999.
5. David E Culler, Jaswinder Pal Singh and Anoop Gupta, “Parallel Computer Architecture: Hardware/Software Approach”. 1998.

OPEN ELECTIVE OFFERED TO OTHER PG PROGRAMMES

16CM 001	3D IMAGE AND VIDEO PROCESSING	L	T	P	C
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UNIT-I	INTRODUCTION TO 3D IMAGE PROCESSING	9
Overview, 3D image, Types and characteristics of 3D image processing, Examples of 3D image processing, Continuous and digitized images, Models of image operations, Algorithm of image operations.		

UNIT-II	LOCAL PROCESSING OF 3D IMAGES	9
Classification of local operations, Smoothing filter, Difference filter, Differential features of a curved surface, Region growing.		

UNIT-III	GEOMETRICAL PROPERTIES OF 3D DIGITIZED IMAGES	9
Neighborhood and connectivity, Simplex and simplicial decomposition, Local feature of a connected component and topology of a figure, Local patterns and their characterization , Calculation of connectivity index and connectivity number, Calculation of the Euler number, Algorithm of deletability test, Path and distance functions, Border surface.		

UNIT-IV	VIDEO PROCESSING	9
Introduction to Video Processing, Video Sampling and Interpolation, Motion Detection and Estimation, Video Enhancement and Restoration, Video Stabilization and Mosaicing-Video Segmentation.		

UNIT-V	VIDEO CODING	9
Basic Transform Video Coding MPEG-1 and MPEG-2 Video Standards MPEG-4 Visual and H.264/AVC: Standards for Modern Digital Video, Interframe Subband/ Wavelet Scalable Video Coding, Digital Video Transcoding, Embedded Video Codecs		

L:45	T:0	T: 45 PERIODS

REFERENCES
1. Junichiro Toriwaki · Hiroyuki Yoshida, " Fundamentals of Three-Dimensional Digital Image Processing"- Springer 2009 [Unit – I , II and III] 2. Alan C. Bovik , The Essential Guide to Video Processing- Academic Press-2009 [Unit - IV and V] 3. Milan Sonka,Vaclav Hlavac, Roger Boyle, "Image Processing, Analysis, and Machine Vision", 2007. [Unit – III] 4. Robert Haralick and Linda Shapiro, "Computer and Robot Vision", Vol I & II, Addison-Wesley, 1993.

16CM002	WIRELESS SYSTEMS AND STANDARDS	L	T	P	C
		3	0	0	3

UNIT-I	INTRODUCTION	9

Introduction to Wireless Local Area Networks, The Need for standardization – Future Trends – The IrDA Standard – Introduction to IrDA: General Description – Physical Layer (SIR) – Serial Infrared Link Access Protocol (IrLAP)- IrDA Link Management Protocol (Ir-LMP)- IrDA Transport Protocol: Tiny TP-LAN. Access Extensions for Link Management Protocol: IrLAN.

UNIT-II	WIRELESS SYSTEMS	9

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

UNIT-III	THE IEEE 802.11 STANDARD	9

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-IV	THE HIPERLAN STANDARD	9

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

UNIT-V	UPCOMING STANDARDS AND FUTURE TRENDS	9

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

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

L:45	T:0	T: 45 PERIODS

REFERENCES

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.

16CM 003	ARTIFICIAL INTELLIGENCE AND OPTIMIZATION TECHNIQUES	L	T	P	C
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UNIT-I	NEURAL NETWORKS	9

Neural Networks: Back Propagation Network, generalized delta rule, Radial Basis Function Network, interpolation and approximation RBFNS, comparison between RBFN and BPN, Support Vector **Machines :** Optimal hyperplane for linearly separable patterns, optimal hyperplane for non-linearly separable patterns, Inverse Modeling.

UNIT-II	FUZZY LOGIC SYSTEMS	9

Fuzzy Logic System: Basic of fuzzy logic theory , crisp and fuzzy sets, Basic set operation like union ,interaction , complement , T-norm , T-conorm , composition of fuzzy relations, fuzzy if-then rules ,fuzzy reasoning, Neuro-Fuzzy Modeling: Adaptive Neuro-Fuzzy Inference System (ANFIS) , ANFIS architecture , Hybrid Learning Algorithm.

UNIT-III	EVOLUTIONARY COMPUTATION AND GENETIC ALGORITHMS	9

Evolutionary Computation (EC) - Features of EC - Classification of EC - Advantages - Applications. **Genetic Algorithms:** Introduction - Biological Background - Operators in GA-GA Algorithm - Classification of GA – Applications

UNIT-IV	ANT COLONY OPTIMIZATION	9

Ant Colony Optimization: Introduction - From real to artificial ants – Theoretical Considerations - Convergence proofs - ACO Algorithm - ACO and model based search - Application principles of ACO.

UNIT-V	PARTICLE SWARM OPTIMIZATION	9

Particle Swarm Optimization: Introduction -Principles of bird flocking and fish schooling - Evolution of PSO -Operating principles - PSO Algorithm – Neighborhood Topologies - Convergence criteria -Applications of PSO, Honey Bee Social Foraging Algorithms, Bacterial Foraging Optimization Algorithm.

L:45	T:0	T: 45 PERIODS

REFERENCES
1. Christopher M. Bishop, "Neural Networks for Pattern Recognition", Oxford University Press [Unit I] 2. Nello Cristianini, John Shawe-Taylor, "An Introduction to Support Vector Machines and Other Kernel-based Learning Methods",Cambridge University Press. [Unit I] 3. Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani," Neuro-fuzzy and soft computing: a computational approach to learning and machine intelligence",Prentice Hall of India, New Delhi. [Unit II] 4. David E. Goldberg, "Genetic Algorithms in search, Optimization & Machine Learning", Pearson Education. [Unit III] 5. Marco Dorigo and Thomas Stutzle, "Ant Colony optimization", Prentice Hall of India, New Delhi. [Unit IV] 6. N P Padhy, "Artificial Intelligence and Intelligent Systems", Oxford University Press, 2005. 7. Engelbrecht, A.P. "Fundamentals of Computational Swarm Intelligence", Wiley. [Unit V]

16CM 004	NETWORK MANAGEMENT	L	T	P	C
		3	0	0	3

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 networks 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

L:45	T:0	T: 45 PERIODS

REFERENCES

1. Mani Subramanian, "Network Management Principles and practice ", Addison Wesly New York, 2000. [Unit I-V]
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.
4. Moshe Rozenblit, "Security for Telecommunication Network Management", Prentice Hall of India, New Delhi, 2001.
5. William Stallings, "SNMP, SNMPv2, SNMPv3 and RMONI and 2 ", Pearson Education, 1999.

16CM 005	MOBILE AND PERVASIVE COMPUTING	L	T	P	C
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UNIT-I	INTRODUCTION TO PERVASIVE COMPUTING	9

Principles of pervasive computing: De-centralization, Diversification, Connectivity, Simplicity – Pervasive Information technology. Over view of Mobile communication and Computing: Mobile Communication - Mobile Computing - Mobile Computing Architecture - Mobile Devices - Mobile System Networks - Mobile phones - Digital music players - Hand held pocket computers - Hand held devices: Operating systems, Smart systems, Limitations of mobile devices, Automotive systems.

UNIT-II	MOBILE IP NETWORK LAYER AND TRANSPORT LAYERS	9

Mobile IP Layer: packet delivery – handover – location management – registration – Tunneling and encapsulation – route optimization - Dynamic Host Configuration Protocol
Transport Layer: Problems of conventional TCP in mobile networks – snooping TCP – indirect TCP – Mobile TCP – Transaction oriented TCP - TCP over 2.5 3G wireless networks

UNIT-III	DATABASES AND SYNCHRONISATION	9

Review of database hoarding techniques – caching mechanisms – client-server computing and adaptation – transaction models – query processing - Data synchronization – synchronization software, protocols – SyncML language – Synchronized Multimedia Markup language SMIL

UNIT-IV	DEVICES, SERVER AND MANAGEMENT	9

Mobile agent – application server- Gateways – Portals – Service discovery – device management- Mobile file systems – security.
Sample protocol: WAP1.1 ans WAP 2.0 architectures.

UNIT-V	MOBILE APPLICATION LANGUAGES & OPERATING SYSTEMS	9

Introduction - XML - JAVA - Java 2 Micro Edition (J2ME) - Java Card - Operating system – Palm OS - Windows CE - Symbian OS - Linux for Mobile Devices.

L:45	T:0	T: 45 PERIODS

REFERENCES

1. Raj Kamal, "Mobile Computing", Oxford University Press, New Delhi, 2007. [Unit II – V]
2. Hansmann, Merk, Nicklous, Stober, "Principles of Mobile Computing", 2nd edition, Springer, 2009. [Unit I,IV,V]
3. Jochen H. Schiller, "Mobile Communications", 2nd edition, Pearson Education, New Delhi, 2007. [Unit II]
4. Charles E. Perkins, "Mobile IP: Design Principles and Practices", Addison Wesley, 2008.[Unit II]
5. James D. Solomon, "Mobile IP, The Internet Unplugged", Prentice Hall, 1998.

16VL002	BLUETOOTH TECHNOLOGY (Common to M.E CS and M.E. VLSI)	L	T	P	C
		3	0	0	3

UNIT-I	THE BLUETOOTH MODULE	9

Introduction-overview - the Bluetooth module-antennas-baseband-introduction-Bluetooth device address – masters, slaves, and Pico nets-system timing-physical links-Bluetooth packet structure-logical channels frequency hopping.

UNIT-II	THE LINK CONTROLLER	9

The link controller-link control protocol-link controller operation-Pico net, scatter net operation master/slave role switching-base band/link controller architectural overview -link manager-the host controller interface.

UNIT-III	THE BLUE TOOTH HOST	9

The blue tooth host-logical link control and adaptation protocol –RFCOMM- the service discovery protocol –the wireless access protocol-OBEX and IrDA-telephony control protocol.

UNIT-IV	CROSS LAYER FUNCTIONS	9

Cross layer functions-Encryption and security-low power operations-controlling low power modes-hold mode sniff mode-park mode-quality of service-managing Bluetooth devices.

UNIT-V	TEST AND QUALIFICATION	9

Test and qualification- test mode-qualification and type approval-implementation – related standards and technologies.

L:45	T:0	T: 45 PERIODS

REFERENCES

1. Jennifer Bray, Brain Senese, Gordon McNutt, Bill Munday, " Bluetooth Application Developer's Guide", Syngress Media, 2001.
2. Micheal Mille," Discovering Bluetooth".
3. C S R Prabhu, P A Reddi, " Bluetooth Technology and its applications with JAVA and J2ME", PHI ,2006