NATIONAL ENGINEERING COLLEGE

(An Autonomous Institution – Affiliated to Anna University, Chennai)

K.R.NAGAR, KOVILPATTI – 628 503

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REGULATIONS – 2015

DEPARTMENT OF

INFORMATION TECHNOLOGY

CURRICULUM AND SYLLABI OF
M.E. – COMMUNICATION AND NETWORKING

SEMESTER – I

S. No.	Course Category	Course Code	Course Title	L	T	P	C	Question pattern⊕
THEORY COURSES								
1.	SFC	15CN11C	Applied mathematics for Network Engineers	3	2	0	4	B
2.	SFC	15CN12C	Advanced Signal Processing Techniques	3	0	0	3	B
3	PCC	15CN13C	Digital Communication	3	0	0	3	B
4.	PCC	15CN14C	Advanced Computer Networks	3	0	0	3	B
5.	PCC	15CN15C	Data Communication and Networking	3	0	0	3	B
6.	PCC	15CN16C	Wireless Networks	3	0	0	3	B
PRACTICAL COURSES								
7.	PCC	15CN17C	Networking Laboratory	0	0	4	2	
			Total	**18**	**2**	**4**	**21**	

SEMESTER – II

S. No.	Course Category	Course Code	Course Title	L	T	P	C	Question pattern⊕
THEORY COURSES								
1.	PCC	15CN21C	Wireless Mobile Communication	3	2	0	4	B
2.	PCC	15CN22C	Optical Fiber Communication and Networking	3	0	0	3	B
3.	PCC	15CN23C	Communication Theory and Systems	3	0	0	3	B
4.	PEC		Elective-I	3	0	0	3	
5.	PEC		Elective -II	3	0	0	3	
PRACTICAL COURSES								
6.	PCC	15CN24C	Optical Fiber Communication and Networking Laboratory	0	0	4	2	
7.	PCC	15CN25C	Research Paper and Patent Review – Technical Seminar	0	0	4	2	
			Total	**15**	**2**	**8**	**20**	

SFC – Specific Foundation Course, PCC – Programme Core Course, PEC – Programme Elective Course, OEC – Open Elective Course
¥ Common to CS and CN, £ Common to HVE and CN

SEMESTER – III

S. No.	Course Category	Course Code	Course Title	L	T	P	C	Question pattern⊕
THEORY COURSES								
1.	PEC		Elective -III	3	0	0	3	
2.	PEC		Elective –IV	3	0	0	3	
3.	PEC		Elective –V	3	0	0	3	
4.	OEC		Elective - VI	3	0	0	3	
PRACTICAL COURSES								
5.	PCC	15CN31C	Project Work Phase-I	0	0	12	6	
			Total	**12**	**0**	**12**	**18**	

SEMESTER – IV

S. No.	Course Category	Course Code	Course Title	L	T	P	C	Question pattern⊕
PRACTICAL COURSES								
1.	PCC	15CN41C	Project Work Phase-II	0	0	24	12	
			TOTAL	**0**	**0**	**24**	**12**	

TOTAL CREDITS TO BE EARNED FOR THE AWARD OF THE DEGREE - 71

PROGRAMME ELECTIVE COURSES

S. No.	Course Category	Course Code	Course Title	L	T	P	C	Question pattern⊕
THEORY COURSES								
1.	PEC	15CN01E	Speech Recognition and Synthesis	3	0	0	3	B
2.	PEC	15CN02E	Information Theory and Coding	3	0	0	3	B
3.	PEC	15CN03E	Wireless Sensor Network Design	3	0	0	3	B
4.	PEC	15CN04E	Advanced Operating Systems	3	0	0	3	B
5.	PEC	15CN05E	Social Networking	3	0	0	3	B
6.	PEC	15CN06E	Next Generation Networks	3	0	0	3	B
7.	PEC	15CN07E	Cloud Computing	3	0	0	3	B
8.	PEC	15CN08E	Network Routing Algorithms	3	0	0	3	B
9.	PEC	15CN09E	Adaptive Signal Processing¥	3	0	0	3	B

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¥ Common to CS and CN, £ Common to HVE and CN

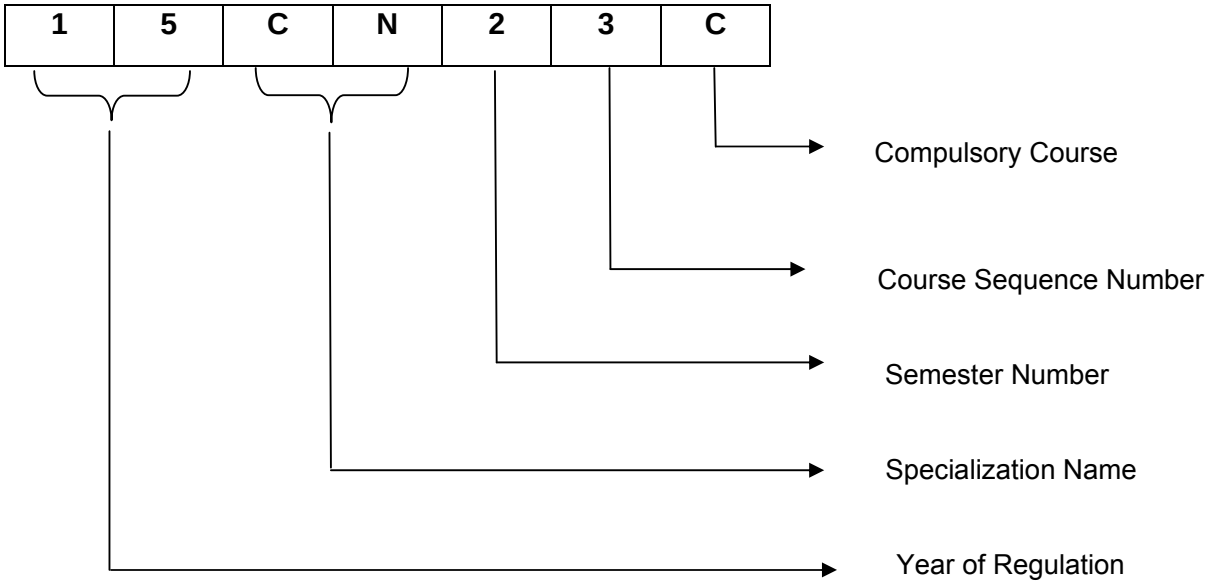
S. No.	Course Category	Course Code	Course Title	L	T	P	C	Question pattern⊕
10.	PEC	15CN10E	Cyber Security	3	0	0	3	B
11.	PEC	15CN11E	Information Security	3	0	0	3	B
12.	PEC	15CN12E	Big data Analytics	3	0	0	3	B
13.	PEC	15CN13E	Advanced Wireless Communication	3	0	0	3	B
14.	PEC	15CN14E	Image Processing	3	0	0	3	B
15.	PEC	15CN15E	Multimedia Compression Techniques¥	3	0	0	3	B
16.	PEC	15CN16E	Evolutionary Computing£	3	0	0	3	B
17.	PEC	15CN17E	Security in Wireless Sensor Networks	3	0	0	3	B
18.	PEC	15CN18E	Neural Networks and its applications	3	0	0	3	B
19.	PEC	15CN19E	Cognitive Radio Networks	3	0	0	3	B
20.	PEC	15CN20E	Real Time Embedded Systems	3	0	0	3	B
21.	PEC	15CN21E	Image and Video Processing	3	0	0	3	B
22.	OEC		Courses offered by other PG programmes					

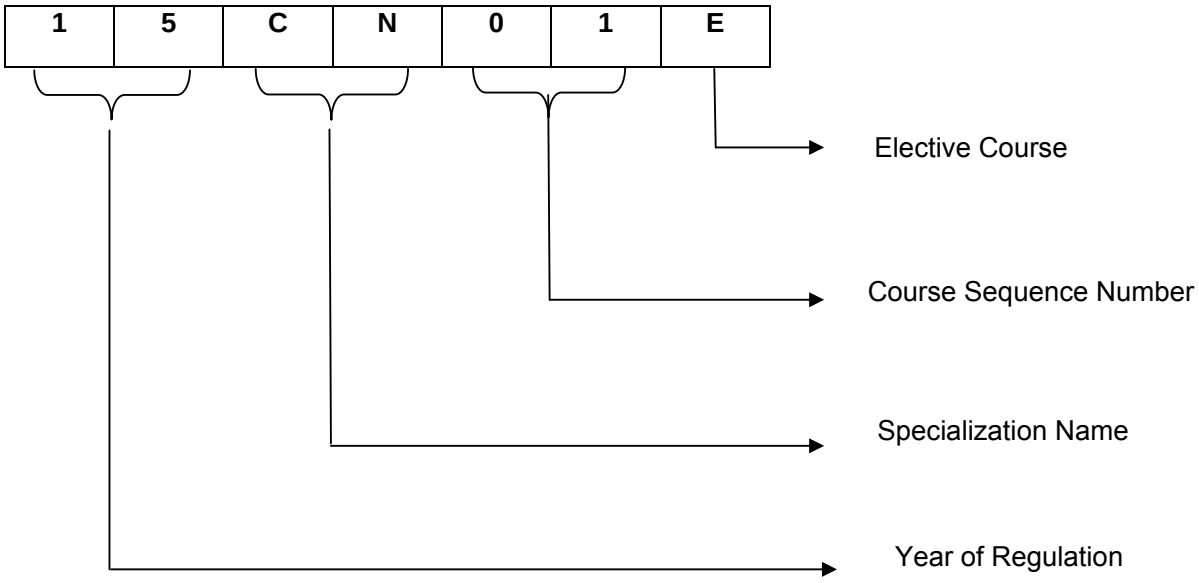
⊕

Question pattern	1 mark	2 marks	4 marks	10 marks	12 marks	16 marks	20 marks	Total
A	-	-	-	-	--	-	1 Qn Compulsory & 4 Qns (either or type)	100
B	-	10	-	-	--	1 Qn Compulsory & 4 Qns (either or type)	--	100
C	10	-	10 out of 12	1 Qn Compulsory & 4 Qns (either or type)	--	--	--	100
D	10	10	5 out of 6	1 Qn Compulsory & 4 Qns (either or type)	--	--	--	100
E	-	10	5 out of 6	-	1 Qn Compulsory & 4 Qns (either or type)	--	--	100

SFC – Specific Foundation Course, PCC – Programme Core Course, PEC – Programme Elective Course, OEC – Open Elective Course
¥ Common to CS and CN, £ Common to HVE and CN

FORMAT FOR COURSE CODE





15CN11C APPLIED MATHEMATICS FOR NETWORK ENGINEERS **L T P C**
3 2 0 4

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: Infer the concepts and properties of bessel's functions and fourier-bessel expansion. (K2)
CO2: enrich the knowledge about matrix theory (K1)
CO3: acquire the knowledge about moment generating functions and some distributions. (K1)
CO4: Interpret the concepts of two dimensional random variables (K2)
CO5: learn the various queuing models (K3)

UNIT I SPECIAL FUNCTIONS **15**

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

UNIT II ADVANCED MATRIX THEORY **15**

Eigen-values using QR transformations - Generalized Eigen vectors - Canonical forms – Singular value decomposition and applications - Pseudo inverse - Least square approximations.

UNIT III ONE DIMENSIONAL RANDOM VARIABLES **15**

Random variables - Probability function - moments - moment generating functions and their properties - Binomial, Poisson, Uniform, Exponential, Gamma and Normal distributions.

UNIT IV TWO DIMENSIONAL RANDOM VARIABLES **15**

Joint distributions - Marginal and Conditional distributions - Correlation and Regression, Regression Curve for means.

UNIT V QUEUEING MODELS **15**

Poisson Process - Markovian queues - Single and Multi-server Models - Little's formula - steady State analysis - Self Service queue.

L: 45 T: 30 TOTAL: 75 PERIODS

REFERENCES

1. Taha, H.A., "Operations Research, An introduction", 7th Edition, Pearson Education Editions, Asia, New Delhi, 2002.
2. Bronson.R, "Matrix operation, Schaum's outline series", McGraw Hill, New York, 1989.
3. Grewal,B.S, "Higher Engineering Mathematics", 37th Edition, Khanna Publishers, 2003.
4. Ramana B.V, “Higher Engineering Mathematics”, 42nd Edition, Tata McGraw Hill, 2007.
5. Donald Gross and Carl M. Harris, "Fundamentals of Queuing theory", 2nd Edition, John Wiley and Sons, New York, 1985.

15CN12C ADVANCED SIGNAL PROCESSING TECHNIQUES L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: summarize the basic concepts and apply in discrete random signal processing. (K3)

CO2: estimate the spectrum using parametric methods and non parametric methods. (S2)

CO3: design adaptive filters for a given application. (S5)

CO4: apply multirate signal processing fundamentals. (K3)

UNIT I DISCRETE RANDOM SIGNAL PROCESSING 9

Discrete Random Processes - Ensemble Averages - Stationary processes - Bias and Estimation - Auto covariance – Autocorrelation - Parseval's theorem - Wiener-Khintchine relation - White noise - Power Spectral Density - Spectral factorization - Filtering Random Processes - Special types of Random Processes – ARMA – AR - MA.

UNIT II SPECTRAL ESTIMATION 9

Estimation of spectra from finite duration signals - Nonparametric methods – Periodogram - Modified periodogram - Bartlett, Welch and Blackman-Tukey methods - Parametric methods – ARMA - AR and MA model based spectral estimation - Yule-Walker equations - Solution using Levinson-Durbin algorithm.

UNIT III LINEAR ESTIMATION AND PREDICTION 9

Linear prediction - Forward and Backward prediction - Signal modeling - Solution of Prony's normal equations - Least mean-squared error criterion - Wiener filter for filtering and prediction - FIR and IIR Wiener filters - Discrete Kalman filter.

UNIT IV ADAPTIVE FILTERS 9

FIR adaptive filters - adaptive filter based on steepest descent method- Widrow - Hoff LMS algorithm - Normalized LMS algorithm - Adaptive channel equalization - Adaptive echo cancellation - Adaptive noise cancellation - RLS adaptive algorithm.

UNIT V MULTIRATE DIGITAL SIGNAL PROCESSING 9

Upsampling and down sampling - Interpolation and Decimation - Sampling rate conversion by a rational factor - Polyphase filter structures - Multistage implementation of multirate system - Application to subband coding.

L:45 TOTAL: 45 PERIODS

REFERENCES

1. Monson H. Hayes, "Statistical Digital Signal Processing and Modeling", 1st Edition, John Wiley and Sons Inc., New York, 1996.
2. John G. Proakis, Dimitris G. Manolakis, "Digital Signal Processing", 4th Edition, Prentice Hall of India, New Delhi, 1995.
3. Alan V. Oppenheim and Ronald W. Schafer, "Discrete-Time Signal Processing", 3rd Edition, Prentice Hall, 2009
4. Emmanuel C. Ifeachor and Barrie W. Jervis, "Digital Signal Processing: A practical approach", 2nd Edition, Prentice Hall, 2002.

15CN13C DIGITAL COMMUNICATION L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: describe the elements of digital communication systems (K2)
CO2: classify the different modulation techniques and its characteristics. (K1, S1)
CO3: explain the concept of pulse code modulation generation and its functions. (K2)
CO4: work with various linear block codes. (K4)
CO5: explain various spread spectrum technique in digital communication and its uses. (K2)

UNIT I ELEMENTS OF DIGITAL COMMUNICATION SYSTEMS 9

Elements of Digital Communication Systems: Model of Digital Communication Systems - Digital Representation of Analog Signal - advantages of Digital Communication Systems – Bandwidth - S/N tradeoff - Hartley Shannon Law - Sampling Theorem.

UNIT II DIGITAL MODULATION TECHNIQUES 9

Digital Modulation Techniques: Introduction – ASK - ASK Modulator - Coherent ASK Detector - Non-Coherent ASK Detector – FSK - Bandwidth and Frequency Spectrum of FSK - Non coherent FSK Detector - Coherent FSK Detector - FSK Detection Using PLL – BPSK - Coherent PSK Detection – QPSK - Differential PSK

UNIT III PULSE CODE MODULATION 9

Pulse Code Modulation: PCM Generation and Reconstruction - Quantization noise - Non uniform Quantization and Companding – DPCM - Adaptive DPCM - DM and Adaptive DM - Noise in PCM and DM.

UNIT IV CONVOLUTION CODED DIGITAL COMMUNICATION 9

Convolution Codes: Encoding Decoding using State - tree and trellis diagrams - Decoding using viterbi algorithm - Comparison of Error Rates in Coded and Uncoded transmission - Linear Block Codes: Matrix description of Linear Block Codes - Error detection and error Correction capabilities of linear block codes - Cyclic Codes - Reed – Solomon codes.

UNIT V SPREAD SPECTRUM MODULATION 9

Spread Spectrum Modulation: Use of Spread Spectrum - Direct Sequence Spread Spectrum (DSSS) - Code Division Multiple Access - Ranging using DSSS - Frequency Hopping Spread Spectrum - PN - sequences: Generation and Characteristics - Synchronization in Spread Spectrum Systems.

L: 45 TOTAL: 45 PERIODS

REFERENCES

1. John G. Proakis. Masoud salehi, “Digital Communications”, 5th Edition, McGraw- Hill, 2008.
2. Simon Haykin, ”Digital Communication”, 2nd Edition, John Wiley, 2005.
3. Herbert Taub. Donald L Schiling, Goutam Sana, “Principles of communication systems”, 3rd Edition, McGraw-Hill, 2008.
4. Sam Shanmugam, “Digital and Analog Communicator Systems”, John Wiley, 2005.
5. Ian A. Glover, Peter M. Grant, “Digital Communications”, 3rd Edition, Pearson Education 2008.
6. B.P. Lathi, “Communication Systems”, 3rd Edition, BS Publication, 2007.

15CN14C ADVANCED COMPUTER NETWORKS L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: familiar with various network architectures and applications. (K3, S3, A2)
CO2: explain about different characteristics of internet protocols. (K3, S3, A2)
CO3: acquire knowledge on routing and switching strategies. (K2, S2, A2)
CO4: describe the role of multimedia in networking. (K2, S3, A2)
CO5: explain about applications and security of protocols in networking. (K2, S3, A2)

UNIT I REVIEW OF BASIC NETWORK ARCHITECTURES 9

OSI reference model - TCP/IP reference model - ATM reference model; Applications (WWW, Audio/Video Streaming, Video conference, Networked Games, Client/Server); - Traffic Characterization (CBR, VBR) - Switching Paradigms – Multiplexing

UNIT II IP NETWORKS 9

Limitations of current IP Networks - Internet Protocol Version 6 (IPv6) features - IPv6 Extension Header - Quality of Service in IP - Integrated Services Architecture (ISA) - Processor Sharing - Weighted Fair Queuing (WFQ) - Random Early detection (RED) - Differentiated Services.

UNIT III MULTICAST AND INTERNETWORKING 9

The Multicast Backbone (MBONE) - Link State Multicast - Distance Vector Multicast - Reverse Path Broadcast - Reverse Path Multicast (RPM) - Protocol Independent Multicast (PIM) - Multiprotocol Label switching (MPLS) - Destination Based Forwarding - Explicit Routing - Virtual Private Networks (VPNs) and Tunnels.

UNIT IV MULTIMEDIA NETWORKING 9

Requirements on Internet - Streaming Audio and Video – Access through Web Server - Real Time Streaming Protocol (RTSP) - Voice over IP (VoIP) and Internet Phone - Packet Loss - End to-End Delay - Delay Jitter - Fixed and Adaptive Play-out – RTP - RTCP and SIP protocols

UNIT V CASE STUDIES AND APPLICATION 9

Network security at various layers. Secure – HTTP – SSL – ESP - Authentication header - Key distribution protocols - Digital signatures - digital certificates.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. Behrouz A. Forouzan, “Data Communications and Networking”, 4th Edition, Tata McGraw Hill, 2006.
2. Larry L. Peterson and Bruce S.Davie, “Computer Networks: A System Approach”, 4th Edition, Morgan Kaufmann, 2007.

REFERENCES

1. Kurose and Ross, “Computer Networking”, 3rd Edition, Pearson Education, 2006.
2. Stallings, “High-Speed Networks and Internet”, 2nd Edition, Pearson Education, 2002.
3. W.Stallings “Cryptography and Network Security: Principles and Practice”, 2nd Edition, Prentice Hall, 1998.

15CN15C DATA COMMUNICATION AND NETWORKING L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: identify the data communication systems, protocol layers and technologies (K2, S3, A2)
CO2: describe the various point-to-point protocols and its functions (K2, S2, A2)
CO3: explain the various delay models in data networks with their usages. (K3, S3, A2)
CO4: discuss the principles of various multi-access communication methods in data networks. (K3, S3, A2)
CO5: explain the principles of routing mechanism in data networks. (K3, S3, A2)

UNIT I INTRODUCTION 9

Introduction to Data communication and Networks - Network Topologies - Network categories - The OSI Model & TCP/IP Protocol Suite - Transmission media - Error Detection and Correction - Multiple Access: Random access - Controlled access - Channelization - Local Area Networks - High-speed LANs - Wireless LANs

UNIT II POINT-TO-POINT PROTOCOLS AND LINKS 9

Introduction - The Physical Layer: Channels and Modems - ARQ: Retransmission Strategies – Framing - Point-to-Point Protocols at the Network Layer - Broadband ISDN and the Asynchronous Transfer Mode

UNIT III DELAY MODELS IN DATA NETWORKS 9

Introduction - Queuing Models: Little's Theorem - The M / M /1 Queueing System - The M/ M/m, M/ M/ , M/ M/ m /m, and Other Markov Systems - The M/G/1 System - Time Reversibility-Burke's Theorem - Networks of Queues-Jackson's Theorem

UNIT IV MULTIACCESS COMMUNICATION 9

Introduction - Slotted Multiaccess and the Aloha System - Splitting Algorithms: Tree Algorithms - First-Come First-Serve Splitting Algorithms - Carrier Sensing - Multiaccess Reservations - Packet Radio Networks

UNIT V ROUTING IN DATA NETWORKS 9

Introduction - Main Issues in Routing - Wide-Area Network Routing: An Overview - Network Algorithms and Shortest Path Routing - Broadcasting Routing Information: Coping with Link Failures - Flow Models, Optimal Routing, and Topological Design

L: 45 TOTAL: 45 PERIODS

REFERENCES

1. Bertsekas, Dimitri and Robert Gallager “Data Networks”, Upper Saddle River, 2nd Edition, NJ: Prentice Hall, 1991.
2. Behrouz A. Forouzan, “Data Communications and Networking”, 5th Edition, Tata McGraw-Hill Education, 2012.
3. Peterson and Davie, “Computer Networks”, 2nd Edition, San Francisco, CA: Morgan Kaufmann Publishers, 1999.
4. Walrand and Varaiya, “High Performance Communication Networks”, San Francisco, CA: Morgan Kaufmann Publishers, 1996.
5. Tanenbaum. A. S, “Computer Networks”, Upper Saddle River, 4th Edition, NJ: Prentice Hall, 2003. ISBN: 0130661023.

15CN16C WIRELESS NETWORKS L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: explain about wireless local area networks (K2,S2,A1)
CO2: explain about 3G and 2G evolution (K2,S2,A1)
CO3: describe about routing mechanism of adhoc and sensor networks (K3,S3,A2)
CO4: familiar with interworking between WLAN and 3G WWAN (K1,S2,A1)
CO5: explain about 4G technologies (K2,S2,A1)

UNIT I WIRELESS LOCAL AREA NETWORKS 9

Introduction to wireless LANs - IEEE 802.11 WLANs - Physical Layer - MAC sublayer- MAC Management Sublayer - Wireless ATM - HIPERLAN- HIPERLAN-2 - WiMax- WPAN- IEEE 802.15

UNIT II 3G OVERVIEW AND 2.5G EVOLUTION 9

Migration path to UMTS - UMTS Basics - Air Interface - 3GPP Network Architecture - CDMA2000 overview- Radio and Network components - Network structure - Radio network - TD-CDMA - TD-SCDMA.

UNIT III ADHOC AND SENSOR NETWORKS 9

Characteristics of MANETs - Table-driven and Source-initiated On Demand routing protocols - Hybrid protocols - Wireless Sensor networks- Classification - MAC and Routing protocols.

UNIT IV INTERWORKING BETWEEN WLANS AND 3G WWANS 9

Interworking objectives and requirements - Schemes to connect WLANs and 3G Networks - Session Mobility - Interworking Architectures for WLAN and GPRS - System Description - Local Multipoint Distribution Service - Multichannel Multipoint Distribution system.

UNIT V 4G AND BEYOND 9

4G features and challenges - Technology path - IMS Architecture - Convergent Devices - 4G technologies - Advanced Broadband Wireless Access and Services – Multimedia – MVNO - Security in Wireless Networks

L: 45 TOTAL: 45 PERIODS

REFERENCES

1. Vijay. K. Garg, “Wireless Communication and Networking”, Morgan Kaufmann Publishers, http://books.elsevier.com/9780123735805:, 2007.
2. B. S. Manoj, C. Siva Ram Murthy, “Ad Hoc Wireless Networks Architectures and Protocols”, 1st Edition, Publisher: Prentice Hall, 2004
3. Kaveth Pahlavan, K. Prashanth Krishnamuorthy, "Principles of Wireless networks", Prentice Hall of India, 2006.
4. Clint Smith. P.E., and Daniel Collins, “3G Wireless Networks”, 2nd Edition, Tata McGraw Hill, 2007.
5. William Stallings, "Wireless Communications and networks", 2nd Edition, Pearson / Prentice Hall of India, 2007.

15CN17C NETWORKING LABORATORY L T P C
0 0 4 2

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: implement error coding techniques. (K3)

CO2: design MAC and routing protocols in wired and wireless environment using NS2 (K5,S3)

CO3: design WLAN/LAN systems to meet out real time requirements. (K6,S3)

LIST OF EXPERIMENTS

- Implementation of Linear and Cycle Code.
- Simulation of PCM.
- Simulation of Table Driven Routing protocol.
- Simulation of On Demand Routing protocol.
- MAC protocols Wired and Wireless.
- Configuration of LAN.
- Configuration of VLAN-Tunneling.
- Configuration of WLAN.

P: 60 TOTAL: 60 PERIODS

15CN21C WIRELESS MOBILE COMMUNICATION L T P C
3 2 0 4

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: apply diversity techniques in wireless systems. (K4)
CO2: identify the suitable cellular systems to achieve a given GoS (Grade of Service) in coverage and blocking probability. (K2)
CO3: explain digital radio links considering various analytical and empirical models.
CO4: carry out link budget calculations. (K3,S2)
CO5: describe frequency reuse patterns for cellular communication.(K2)

UNIT I THE WIRELESS CHANNEL 15

Overview of wireless systems – Physical modeling for wireless channels – Time and Frequency coherence – Statistical channel models – Capacity of wireless Channel- Capacity of Flat Fading Channel –– Channel Distribution Information known – Channel Side Information at Receiver – Channel Side Information at Transmitter and Receiver – Capacity with Receiver diversity – Capacity comparisons – Capacity of Frequency Selective Fading channels.

UNIT II PERFORMANCE OF DIGITAL MODULATION OVER WIRELESS CHANNELS 15

Fading– Outage Probability– Average Probability of Error – Combined Outage and Average Error Probability – Doppler Spread – Intersymbol Interference.

UNIT III MULTIANTENNA COMMUNICATION 15

Realization of Independent Fading Paths – Receiver Diversity – Selection Combing – Threshold Combing – Maximal-Ratio Combing – Equal - Gain Combing – Transmitter Diversity – Channel known at Transmitter – Channel unknown at Transmitter – The Alamouti Scheme – Transmit & Receive Diversity-MIMO Systems.

UNIT IV MULTICARRIER MODULATION 15

Data Transmission using Multiple Carriers – Multicarrier Modulation with Overlapping Sub channels – Mitigation of Subcarrier Fading – Discrete Implementation of Multicarrier Modulation – Peak to average Power Ratio- Frequency and Timing offset – Case study IEEE 802.11a

UNIT V CELLULAR CONCEPTS 15

Frequency Reuse – Channel Assignment Strategies – Hand off Strategies – Interference and system capacity - Co-Channel Interference- Adjacent Channel Interference – Trunking and Grade of service – Improving coverage & capacity in cellular systems-Cell Splitting- Sectoring-Repeaters for Range Extension - Microcell Zone Concept.

L: 45 T: 30 TOTAL: 75 PERIODS

REFERENCES

1. Andrea Goldsmith, “Wireless Communications”, 1st Edition, Cambridge University Press, 2005.
2. Theodore.S. Rappaport, “Wireless Communications: Principles and Practice", 2nd Edition, Pearson Education, India, 2009.
3. William Stallings, “Wireless Communications and Networks”, 2nd Edition, Prentice Hall, 2004.
4. David Tse and Pramod Viswanath, “Fundamentals of Wireless Communication”, Wiley Series in Telecommunications, Cambridge University Press, 2005.
5. Arogyaswami Paulraj, Rokit Nabar, Dhananjay Gore, “Introduction to Space-Time Wireless Communication”, 1st Edition, Cambridge University Press, 2008.
6. W.C.Y.Lee, “Mobile Cellular Telecommunications - Analog and Digital Systems”, 2nd Edition, Tata McGraw Hill, 2006.

15CN22C OPTICAL FIBER COMMUNICATION AND NETWORKING **L T P C**
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: describe the basic concepts of optical communication system and the performance of different fibers. (K2)

CO2: illustrate different optical transceivers and their operations.(K4)

CO3: explain the basic concepts behind multichannel systems and issues related to their implementation. (K2)

CO4: compare and classify different dispersion management schemes. (K4)

CO5: explain the performance of different layered architectures in optical networks.(K2)

UNIT I FIBER OPTIC WAVE GUIDES **9**

Light wave generation systems - system components - optical fibers - SI, GI, fibers – modes - Dispersion in fibers - limitations due to dispersion - Fiber loss - non linear effects - Dispersion shifted and Dispersion flattened fibers.

UNIT II OPTICAL TRANSCEIVER **9**

Basic concepts - LED's structure - spectral distribution - semiconductor lasers - gain coefficients – modes - SLM and STM operation - Transmitter design - Receiver PIN and APD diodes design - noise sensitivity and degradation - Receiver amplifier design - Basic concepts of Semiconductor Optical amplifiers and EDFA operation.

UNIT III LIGHT WAVE AND MULTICHANNEL SYSTEM **9**

Coherent - homodyne and heterodyne keying formats - BER in synchronous and asynchronous receivers – Multichannel – WDM - multiple access networks - WDM components - TDM, Subcarrier and Code division multiplexing.

UNIT IV DISPERSION COMPENSATION **9**

Limitations - Post and Pre- compensation techniques - Equalizing filters - fiber based gratings - Broadband compensation - Soliton communication system, fiber Soliton - Soliton based communication system design.

UNIT V OPTICAL NETWORKS **9**

First and second generation optical networks: system network evaluation - SONET / SDH - MAN layered architecture broadcast and select networks MAC protocols - test beds - wavelength routing networks.

L: 45 TOTAL: 45 PERIODS

REFERENCES

1. G.P. Agarwal, "Fiber Optic Communication Systems", 2nd Edition, John Wiley & Sons, New York, 2008.
2. G. Keiser, "Optical Fiber Communications", 4th Edition, Tata McGraw-Hill, New Delhi, 2008.
3. Rajiv Ramaswami, Kumar Sivarajan and Galen Sasaki, "Optical Networks: A Practical Perspective", 3rd Edition, Morgan Kaufmann, 2009.
4. Harold Kolimbiris, "Fiber Optic Communication", 1st Edition (Reprint), Pearson Education, 2004.

15CN23C COMMUNICATION THEORY AND SYSTEMS L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: make a right choice on the signaling scheme based on their relative performance. (K4)

CO2: arrive at detailed specification for the synchronization and equalization techniques. (K1, S2)

CO3: estimate synchronization and equalization techniques. (K4)

CO4: apply the concepts of random process to communication system design. (K3)

UNIT I RANDOM PROCESS 9

Random variables- Random Process- Covariance- Power Spectral Density – Stationary Process- Wide Sense Stationary - Ergodicity- Cyclo stationary Process.

UNIT II SIGNALING SCHEMES 9

Base band Signaling - Line Coding schemes & their Power spectra- band pass Signaling – Geometric Representation of signals – Principles of Binary ASK, PSK, FSK - QPSK& QAM-CPFSK, OQPSK, MSK, GMSK – BER & PSDs-ML Detection.

UNIT III SIGNAL ACQUISITION & SYNCHRONIZATION 9

Receiver structure for BPSK- QPSK-QAM- Carrier Synchronization- Bit synchronization.

UNIT IV EQUALIZATION 9

Channel Models - ISI-Eye Diagram - Receiver Front End - ML Sequence estimation - Linear Equalization - Decision Feedback Equalization.

UNIT V INFORMATION THEORETIC LIMITS 9

DMS-Entropy - Mutual information - Capacity of AWGN Channel- Hartley - Shannon Law -Source Coding theorem-Channel Coding Theorem.

L: 45 TOTAL: 45 PERIODS

REFERENCES

1. J.G.Proakis, M.Salehi, “Fundamentals of Communication Systems”, 4th Edition, Pearson Education, 2009.
2. B.Sklar, “Digital Communications, Fundamentals and Applications”, 2nd Edition, Pearson Education, 2007.
3. B.P.Lathi, “Modern Digital and Analog Communication Systems”, 3rd Edition, Oxford University Press, 2007.
4. U. Madhow, “Fundamentals of Digital Communication”, 1st Edition, Cambridge, 2008.
5. S.Haykin, “Communication Systems”, 3rd Edition, John Wiley, 2007.
6. Couch, “Digital & Analog Communication Systems”, 7th Edition, Pearson Education, India, 2008.

15CN24C OPTICAL FIBER COMMUNICATION AND NETWORKING LABORATORY

L T P C
0 0 4 2

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: demonstrate various characteristics of sources, detectors and transmission using OTDM and simulators.(K3,S2)

CO2: analyze various techniques used in communication through simulation.(K4,S2)

CO3:demonstrate the various applications used in mobile communication environment(K5,S3)

LIST OF EXPERIMENTS

- DC characteristics of PIN PD & APD.
- PI characteristics of LED & LASER.
- Characteristics of Ultra high speed optical Soliton transmission.
- Application of optical system simulation software in a fiber optic telecommunication.
- Simulation of Modulation and Coding in a AWGN Communication Channel using Simulation Packages.
- Testing of GSM mobile station.
- Radio communication receiver.
- Testing of DECT cordless telephone.
- Parameter changes of GSM network.

P: 60 TOTAL: 60 PERIODS

15CN25C RESEARCH PAPER AND PATENT REVIEW – TECHNICAL SEMINAR

L T P C
0 0 4 2

The student will make at least two technical presentations on current topics related to the specialization. The same will be assessed by a committee appointed by the department. The students are expected to submit a report at the end of semester covering the various aspects of his/her presentation.

P: 60 TOTAL: 60 PERIODS

15CN01E SPEECH RECOGNITION AND SYNTHESIS L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: explain the basic characteristics of speech (K2)
CO2: describe various techniques for speech analysis and speech modeling (K2)
CO3: investigate speech processing applications like speech synthesis and speech recognition (K5)

UNIT I BASIC CONCEPTS 9

Speech fundamentals: Articulatory phonetics - Production and Classification of Speech Sounds - Acoustic Phonetics – acoustics of speech production - Review of Digital Signal Processing concepts - Short-time Fourier transform - Filter Bank and LPC Methods.

UNIT II SPEECH ANALYSIS 9

Features, Feature Extraction and Pattern Comparison Techniques - Spectral distortion measures mathematical and perceptual – Log Spectral Distance - Cepstral Distances - Weighted Cepstral Distances and Liftering - Likelihood Distortions - Spectral Distortion using a Warped frequency Scale – LPC - PLP and MFCC Coefficients - Time Alignment and Normalization – Dynamic Time Warping - multiple Time – Alignment Paths

UNIT III SPEECH MODELLING 9

Hidden Markov Models: Markov Processes - HMMs – Evaluation - Optimal State Sequence – Viterbi search - Baum – Welch Parameter Re-estimation - Implementation issues

UNIT IV SPEECH RECOGNITION 9

Large Vocabulary Continuous Speech Recognition: Architecture of a large vocabulary Continuous Speech Recognition system – acoustics and language models - Sub-word units - models for phonemes – syllables – triphones - Language models - n-grams - context dependent sub-word units.

UNIT V SPEECH SYNTHESIS 9

Text-to-speech synthesis: Concatenative and waveform synthesis methods - sub-word units for TTS - intelligibility and naturalness - role of prosody - Applications.

L: 45 TOTAL: 45 PERIODS

REFERENCES

1. Lawrence Rabiner and Biiing – Hwang Juang, “Fundamentals of Speech Recognition”, Pearson Education, 2003.
2. Daniel Jurafsky and James H Martin, “Speech and Language Processing – An introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition”, 2nd Edition, Pearson Education, 2002.
3. Steven W. Smith, “The Scientist and Engineer’s Guide to Digital Signal Processing”, 1st Edition, California Technical Publishing, 1997.
4. Thomas F Quatieri, “Discrete- Time Speech Signal Processing- Principles and Practice”, 3rd Edition, Pearson Education, 2004.
5. Claudio Becchetti and Lucio Prina Ricotti, “Speech Recognition”, John Wiley and Sons, 1999.

15CN02E INFORMATION THEORY AND CODING L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: explain the basic concepts of information theory, source coding, channel and channel capacity, channel coding and relation among them. (K4)

CO2: identify the encoding and decoding techniques of text, audio and speech (S2)

CO3: apply the compression techniques to images and videos (K2)

CO4: implement the encoder and decoder of block codes or convolutional codes (K6)

UNIT I INFORMATION THEORY 9

Introduction - Measure of information - Entropy and information rate of mark-off source – Classification of codes – Kraft-Mcmillan inequality - Joint and conditional entropies - Source coding theorem - Shannon-Fano coding, Huffman coding Extended Huffman coding – Channel coding theorem - Discrete memory less channels – BSC, BEC – Channel capacity Theorem - Shannon limit

UNIT II SOURCE CODING: TEXT, AUDIO AND SPEECH 9

Text: Adaptive Huffman Coding - Arithmetic Coding - LZW algorithm – Audio: Perceptual coding - Masking techniques - Psychoacoustic model - MEG Audio layers - Dolby AC3 - Speech: Channel Vocoder, Linear Predictive Coding

UNIT III SOURCE CODING: IMAGE AND VIDEO 9

Image and Video Formats – GIF, TIFF, SIF, CIF, QCIF – Image compression: READ, JPEG – Video Compression: Principles-I, B, P frames - Motion estimation - Motion compensation - H.261 - MPEG standard.

UNIT IV ERROR CONTROL CODING: BLOCK CODES 9

Introduction to Error Control Coding: Introduction - Types of errors - Types of codes – Definitions: Hamming weight, Hamming distance, Minimum distance decoding - Single parity codes - Hamming codes - Repetition codes - Linear block codes - Cyclic codes - Syndrome calculation - Encoder and decoder – CRC

UNIT V ERROR CONTROL CODING: CONVOLUTIONAL CODES 9

Introduction to Convolutional codes – Time domain approach and Transform domain approach - Convolutional Encoder Representation - Tree, State and Trellis diagrams – Distance Properties of Convolutional Codes - Decoding of Convolutional Codes: Maximum Likelihood Detection, Viterbi Algorithm - Principle of Turbo coding

L: 45 TOTAL: 45 PERIODS

REFERENCES

1. K. Sam Shanmugam, “Digital and analog communication systems”, John Wiley, 2005.
2. Simon Haykin, “Digital communication”, 2nd Edition, John Wiley, 2005.
3. Ranjan Bose, “ITC and Cryptography”, 2nd Edition, Tata McGraw-Hill, 2007.
4. Thomas M. Cover, Joy A. Thomas, ”Elements of Information Theory”, 2nd Edition, Wiley Publication.
5. Roberto Togneri, Christopher J.S deSilva, “Fundamentals of Information Theory and Coding Design”, 3rd Edition, CRC Press.

15CN03E WIRELESS SENSOR NETWORK DESIGN L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: describe the sensor network architecture and principles (K2,S2,A1)
CO2: familiar with wireless channels and communication fundamentals (K2,S2,A1)
CO3: explain about MAC and routing protocols of WSN (K2,S2,A1)
CO4: describe the routing mechanism in network layer (K2,S2,A1)
CO5: explain about applications of WSN (K2,S2,A1)

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, Design principles

UNIT II PHYSICAL LAYER 9

Introduction, wireless channel and communication fundamentals, physical layer and transceiver design consideration in wireless sensor networks, Example physical Layers Bluetooth, IEEE 802.11b, WINS, µAMPS

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, LEACH, PEGASIS .Embedded operating system - Introduction – TinyOS-Mate - MagnetOS-MANITS-OSPM- SenOS- PicOS

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 aggregation

UNIT V APPLICATIONS OF WSN & CASE STUDY 9

Target detection tracking, Habitat monitoring, military battlefield awareness Environmental disaster monitoring, Underwater Acoustic and Deep space networks, Wireless Body Area Networks (WBAN) for health-monitoring, Highway monitoring, Willdfire instrumentation. Security in Sensor networks, Localization ,IEEE 802.15.4 low rate WPAN, Practical implementation issues, Sensor Node Hardware- Node-level software platforms, Node-level simulators

L: 45 TOTAL: 45 PERIODS

TEXT BOOK

1. Holger Karl, Andreas willig, “Protocols and Architecture for Wireless Sensor Networks”, John Wiley publication, Oct 2007.

REFERENCES

1. Philip Levis, David Gay, “TinyOS programming”, Cambridge University Press, Oct 2006.
2. Feng zhao, Leonidas guibas, Elsevier, “Wireless Sensor Networks: an information processing approach”, 1st Edition, Elsevier publication, 2004.
3. Edgar H .Callaway, “Wireless Sensor Networks: Architecture and protocol”, 1st Edition, CRC press 2003.
4. C.S.Raghavendra Krishna, M.Sivalingam and Tarib znati, “Wireless Sensor Networks”, 1st Edition, Springer publication, 2006.

15CN04E ADVANCED OPERATING SYSTEMS L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: describe the overview of process management & memory management of operating system. (K2)

CO2: demonstrate the mutual exclusion, deadlock detection and agreement protocols of distributed operating system. (K3)

CO3: explain the distributed operating system concept that includes architecture, mutual exclusion algorithms, deadlock detection algorithms and agreement protocols. (S2)

CO4: discuss the distributed resource management components viz. the algorithms for implementation of distributed shared memory, recovery and commit protocols. (K5)

CO5: analyze the components involved in real time and mobile operating systems. (K4)

UNIT I OPERATING SYSTEM BASICS 9

Overview – Synchronization Mechanisms – Process and Threads- Process Scheduling – Deadlocks: Detection – Prevention- Recovery – Models of Resources – Memory Management.

UNIT II DISTRIBUTED OPERATING SYSTEM 9

Issues in Distributed Operating System – Architecture – Communication Primitives – Lamport's Logical clocks – Causal Ordering of Messages – Distributed Mutual Exclusion Algorithms – Centralized and Distributed Deadlock Detection Algorithms – Agreement Protocols.

UNIT III DISTRIBUTED RESOURCE MANAGEMENT 9

Distributed File System – Design Issues - Distributed Shared Memory – Algorithms for Implementing Distributed Shared memory–Issues in Load Distributing – Scheduling Algorithms – Synchronous and Asynchronous Check Pointing and Recovery – Fault Tolerance – Two-Phase Commit Protocol – Nonblocking Commit Protocol – Security and Protection.

UNIT IV REAL TIME & MOBILE OPERATING SYSTEMS 9

Basic Model of Real Time Systems - Characteristics- Applications of Real Time Systems – Real Time Task Scheduling - Handling Resource Sharing - Mobile Operating Systems –Micro Kernel Design - Client Server Resource Access – Processes and Threads - Memory Management - File system.

UNIT V CASE STUDIES 9

Linux System: Design Principles - Kernel Modules - Process Management Scheduling – Memory Management - Input-Output Management - File System - Interprocess Communication. Windows XP: Design Principles - System Components - Process and Thread Management - Memory Management - File System. iphone iOS4: Architecture and SDK Framework - Media Layer - Services Layer – Core OS Layer - File System.

L: 45 TOTAL: 45 PERIODS

REFERENCES

1. Abraham Silberschatz; Peter Baer Galvin; Greg Gagne, "Operating System Concepts", Eighth Edition, John Wiley & Sons, 2012.
2. Mukesh Singhal, Niranjan G Shivaratri, "Advanced Concepts in Operating Systems – Distributed, Database, and Multiprocessor Operating Systems", Tata McGraw-Hill, 2008.
3. Rajib Mall, "Real-Time Systems: Theory and Practice", Pearson Education India, 2006.
4. Neil Smyth, "iPhone iOS 4 Development Essentials – Xcode", 4th Edition, Payload media, 2011.

15CN05E SOCIAL NETWORKING L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: explain the network data concepts related to social networking. (K2)
CO2: describe the Market and strategic interaction and information networks.(K2)
CO3: obtain the knowledge about social network models (K4)
CO4: identify the institutional behavior and information aggregation. (K4)

UNIT I INTRODUCTION 9

Introduction: Networks, Relations, and Structure - Relations and networks in the social and behavioral sciences - Social network data: collection and application - Review of Graph Theory Basics – Evolutionary Game Theory - Modeling Network Traffic using Game Theory.

UNIT II MARKET AND STRATEGIC INTERACTION IN NETWORK 9

Matching Market: Bipartite Graphs and Perfect Matching - Prices and Market - Clearing Property. Network Models of Markets with Intermediaries - Price Setting in Market - Social Welfare – Trader Profit. Bargaining and Power in Network - Power in Social Network - Results of Network Exchange Experts - Modeling with Network Exchange - Stable outcomes - Modeling with Network Exchange - Balanced outcomes.

UNIT III INFORMATION NETWORKS AND THE WORLD WIDE WEB 9

The Structure of the Web: The World Wide Web-Information Networks - Hypertext and Associative Memory - The Web as a Directed Graph - The Bow-Tie Structure of the Web-Link Analysis and Web Search: Searching the Web: The Problem of Ranking – Page Rank - Applying Link Analysis in Modern Web Search - Sponsored Search Markets: Advertising as a Matching Market - Analyzing the VCG Procedure: Truth - Telling as a Dominant Strategy - Ad Quality

UNIT IV NETWORK DYNAMICS AND POPULATION MODELS 9

Information Cascade - Networks Effects - The Economy with Network Effects -Industries with Network goods - Advanced Materials for Positive Externalities - Power Laws - The Effect of Search Tools and Recommendations.

UNIT V INSTITUTION AND AGGREGATE BEHAVIOR 9

Market and Information: Market with Exogenous Events - Aggregate Beliefs and Wisdom of Asymmetric Information in other Markets. Voting: Group Discussion Making - Voting as an Information Aggregation. Property Rights.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. David Easley, Jon Kleinberg, “Networks, Crowds, and Markets: Reasoning about a Highly Connected World”, 1st Edition, Cambridge University Press, 2010.
2. Stanley Wasserman, Katherine Faust, “Social Network Analysis: Methods and Applications”, 2nd Edition, Cambridge University Press, 1999.

REFERENCES

1. Peter R. Monge, Noshir S. Contractor, “Theories of Communication Networks”, 1st Edition, Oxford University Press, 2003.
2. Ajith Abraham, “Computational Social Networks: Mining and Visualization”, Springer, 2012.

15CN06E NEXT GENERATION NETWORKS L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: discuss the various technologies of next generation networks (K2,S2,A2)
CO2: illustrate the principles of IMS and convergent management in next generation networks (K3,S4,A2)
CO3: explain the functions of IP networks and its technologies (K2,S3,A2)
CO4: explain the principles of multi service networks with MPLS technologies (K2,S3,A2)
CO5: describe various applications of next generation networks (K2,S3,A2)

UNIT I NEXT GENERATION TECHNOLOGIES 9

Introduction - Motivations for IP based services - Changes, Opportunities and Challenges – HFC Network – Digital TV - Next Generation Technologies - Next Generation Networks - Next Generation Services – Management of NG Services - Next Generation Society

UNIT II IMS AND CONVERGENT MANAGEMENT 9

IMS Architecture - IMS services - QoS Control and Authentication - Network and Service management for NGN - IMS advantages - Next Generation OOS Architecture: Importance to OSS Architecture - OSS Interaction with IMS and SuM – NGN OSS Function/Information View Reference Model – Designing Technology – Neutral Architectures – UML and Domain Specific Languages

UNIT III IP NETWORKS 9

IP Networks: IP past, present and future - IP influence and confluence - IP versions - IP Network convergence - LAN Technologies - IP Routing - LAN Switching –Wide Area Technologies and Topologies - Wireless IP LANS - Mobility Networks - Global IP Networks: Global capacity - Globally Resilient IP - Internet – A Network of Networks

UNIT IV MUTI SERVICE NETWORKS 9

Origin of multi service ATM - Next Generation Multi service Networks - Next Generation Multi service ATM switching - Multi protocol Label switching Networks: Frame Based MPLS - Cell based MPLS - MPLS services and their benefits - multi service provisioning platforms (MSPP) & Multi service switching platform (MSSP)

UNIT V SERVICES, ARCHITECTURES AND APPLICATIONS 9

Introduction – Intelligent Network Services: Softswitches and application servers – The future of IN – Voice based services – Internet based services - RAN architecture: Radio Access Network Architecture for GSM, GPRS and UMTS - network devices - interfaces and protocols - QoS definition and management in GPRS and UMTS – Applications: Internet connectivity - e-commerce - call centres - third party application service provision – WAP – WiMAX - integrated billing - security and directory enable networks.

L: 45 TOTAL: 45 PERIODS

REFERENCES

1. Thomas Plavyk, “Next generation Telecommunication Networks, Services and Management”, Wiley & IEEE Press Publications, 2010.
2. Robert Wood, “Next-Generation Network Services”, CISCO Press, 2006.
3. Neill Wilkinson,” Next Generation Network Services: Technologies & Strategies”, 1st Edition, Wiley Publications, 2002.
4. Next Generation Telecoms Networks, Parliament office of Science and Technology (postnote). December 2007, No: 296
5. Josef F. Huber, “Mobile Next Generation Networks”, IEEE Multimedia, Vol. 11, Issue I, PP: 72-83, Jan- March 2004.

15CN07E CLOUD COMPUTING L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: know the fundamentals of cloud computing (K2)

CO2: distinguish the various cloud services (K4)

CO3: explore some important cloud computing driven commercial systems such as Google Apps, Microsoft Azure and Amazon web services and other businesses cloud applications. (K2)

UNIT I UNDERSTANDING CLOUD COMPUTING 9

Cloud Computing – History of Cloud Computing – Cloud Architecture – Cloud Storage – Why Cloud Computing Matters – Advantages of Cloud Computing – Disadvantages of Cloud Computing – Companies in the Cloud Today – Cloud Services

UNIT II DEVELOPING CLOUD SERVICES 9

Web-Based Application – Pros and Cons of Cloud Service Development – Types of Cloud Service Development – Software as a Service – Platform as a Service – Web Services – On-Demand Computing – Discovering Cloud Services Development Services and Tools – Amazon Ec2 – Google App Engine – IBM Clouds

UNIT III CLOUD COMPUTING FOR EVERYONE 9

Centralizing Email Communications – Collaborating on Schedules – Collaborating on To-Do Lists – Collaborating Contact Lists – Cloud Computing for the Community – Collaborating on Group Projects and Events – Cloud Computing for the Corporation

UNIT IV USING CLOUD SERVICES 9

Collaborating on Calendars, Schedules and Task Management – Exploring Online Scheduling Applications – Exploring Online Planning and Task Management – Collaborating on Event Management – Collaborating on Contact Management – Collaborating on Project Management – Collaborating on Word Processing - Collaborating on Databases – Storing and Sharing Files

UNIT V OTHER WAYS TO COLLABORATE ONLINE 9

Collaborating via Web-Based Communication Tools – Evaluating Web Mail Services – Evaluating Web Conference Tools – Collaborating via Social Networks and Groupware – Collaborating via Blogs and Wikis

L: 45 TOTAL: 45 PERIODS

TEXT BOOK

1. Michael Miller, "Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online", 1st Edition, Que Publishing, August 2009.

REFERENCE

1. Haley Beard, "Cloud Computing Best Practices for Managing and Measuring Processes for On-demand Computing, Applications and Data Centers in the Cloud with SLAs", 2nd Edition, Emereo Private Limited, July 2008

15CN08E NETWORK ROUTING ALGORITHMS L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: identify a suitable routing algorithm, implement it and analyze its performance.(K4)

CO2: design a new algorithm or modify an existing algorithm to satisfy the evolving demands in the network and by the user applications.(K6)

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 Non hierarchical Routing (DNHR) – Trunk status map routing (TSMR) – real-time network routing (RTNR) – Distance vectorrouting– Link state routing – Hierarchical routing.

UNIT II INTERNET ROUTING 9

Interior protocol: Routing Information Protocol (RIP) – Open Shortest Path First (OSPF) – BellmanFord Distance Vector Routing. Exterior Routing Protocols: Exterior Gateway Protocol (EGP) andBorder Gateway Protocol (BGP) – Multicast Routing: Pros and cons of Multicast and MultipleUnicast Routing – Distance Vector Multicast Routing Protocol (DVMRP) – Multicast Open ShortestPath 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 – Intradomain Mobility Management–Routing based: Cellular IP– Handoff Wireless Access Internet Infrastructure (HAWAII).

UNIT V MOBILE AD–HOC NETWORKS 9

Internet-based mobile ad-hoc networks 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 Routing (ZRP).

L:45 TOTAL: 45 PERIODS

REFERENCES

1. William Stallings, “High speed networks and Internets Performance and Quality of Service”, 2nd Edition, Pearson Education Asia (Reprint), India, 2002
2. M. Steen Strub, “Routing in Communication network”, Prentice – Hall International, Newyork, 1995.
3. S. Keshav, “An engineering approach to computer networking”, Addison Wesley, 1999.
4. William Stallings, “High speed Networks TCP/IP and ATM Design Principles”, 2nd Edition, Prentice Hall, New York, 1995
5. C.E Perkins, “Ad Hoc Networking”, Addison – Wesley, 2001
6. C.Siva Rama Murthy and Mohan Gurusamy, “ WDM Optical Networks – Concepts, Design and Algorithms”, Prentice Hall of India Private Limited, New Delhi, 2002.

15CN09E	ADAPTIVE SIGNAL PROCESSING (Common to CS and CN)	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

Upon completion of the course, the students will be able to

CO 1: Describe the fundamentals of adaptive filtering (K1 – K2)
CO 2: Design the LMS filter for different applications (K1 – K4)
CO 3: Design an adaptive filter based on conventional RLS algorithm (K1 – K4)
CO 4: Design an adaptive filter based on fast traversal, adaptive lattice and QR decomposition based RLS algorithms (K1 – K4)

UNIT I FUNDAMENTALS OF ADAPTIVE FILTERING 9

Signal Representation - Correlation Matrix – Wiener Filter - Linearly Constrained Wiener Filter – Mean Square Error Surface – Bias and Consistency – Newton Algorithm – Steepest Descent Algorithm – Applications: System Identification, Signal Enhancement, Signal Prediction, Channel Equalization.

UNIT II THE LMS ALGORITHM 9

The LMS algorithm – properties – Behavior in nonstationary environments – Applications - LMS Newton Algorithm –Normalized LMS – Transform Domain LMS – Affine Projection Algorithm.

UNIT III CONVENTIONAL RLS ALGORITHM 9

Recursive Least Squares Algorithm – Properties: Orthogonality principle, Relation between Least Squares and Wiener Solutions, Influence of the Deterministic Autocorrelation Initialization, Steady state behavior of coefficient vector, Coefficient-Error-Vector Covariance Matrix, Behavior of the Error Signal, Excess mean square error and Misadjustment – Behavior in Nonstationary Environments

UNIT IV ADAPTIVE LATTICE BASED RLS ALGORITHMS 9

Recursive Least Square Prediction – Order updating Equations – Time updating Equations – Joint Process Estimation – Time recursions of the Least Squares Error – Normalized Lattice RLS algorithm – Error Feedback Lattice RLS Algorithm

UNIT V FAST TRANSVERSAL AND QR DECOMPOSITION BASED RLS ALGORITHM 9

Stabilized Fast Transversal RLS Algorithm – Triangularization using QR Decomposition: Initalization Process, Input data matrix triangularization, QR Decomposition RLS algorithm – Systolic Array Implementation – Implementation Issues - Fast QR-RLS Algorithm

L:45 TOTAL: 45 PERIODS

REFERENCES

1. Paulo S.R.Diniz," Adaptive Filtering: Algorithm and Practical Implementation", 4th Edition, Springer, 2012.
2. Bernard Widrow, Samuel D.Strearns, "Adaptive Signal Processing", 1st Edition, Pearson Education, 2005.
3. Simon Haykin, "Adaptive Filter Theory", 5th Edition, PE Asia, 2013.
4. Sophocles. J. Orfamadis, "Optimum signal processing: An introduction", 2nd Edition, McGraw-Hill, New York, 2007.
5. James V. Candy, "Signal Processing: A Modern Approach", McGraw-Hill, International Edition, 1988.

15CN10E CYBER SECURITY L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: explain the legal issues associated with cyber security (K2)
CO2: recognize advanced security issues and technologies (K2)
CO3: explain the various security services available for preventing threats. (S1)

UNIT I INFORMATION SYSTEMS AND THREATS 9

History of Information Systems – Importance of Information Systems – Changing Nature of Information System – Distributed Information Systems – Role of Internet and Web Services – Information System Threats – Types of Threats.

UNIT II SECURITY IN MOBILE AND WIRELESS COMPUTING 9

Introduction – Characteristics of Communication Devices - Technical and security challenges of Mobile devices – Security implications for organizations – Authentication service security – Laptop security- Principles of information security – Classification of Information and Information system – Confidential – Integrity – Availability.

UNIT III SECURITY SERVICES AND METRICS 9

Introduction – Cryptography – Cryptanalysis – Public Key Cryptography – Firewall Design Pinciples – An Introduction to Digital Signatures – Intruders – Network perimeter security – Virtual Private Network (VPN) – Security metrics categories – Classes of security metrics

UNIT IV CYBER CRIMES 9

Introduction to cyber crime – Software privacy – Virus dissemination – Types of cyber crime – Preventing cyber crimes(Safety Measures) – Privacy software

UNIT V CYBER LAWS AND ETHICS 9

Detecting cyber crime – Cyber laws – legal issues – Indian IT Act – Ethical issues in IT – copy rights – Ethical Hacking – Plagiarism

L: 45 TOTAL: 45 PERIODS

REFERENCES

1. Charles P. Pfleeger, Shari Lawerance Pfleeger, “Analysing Computer Security”, Pearson Education India.
2. Anukur Shree Aggarwal Prof.Sanjeev Kumar Sharma, Anuradha Tyagi.Shalu Goel “Information Security and Cyber Laws” , Vayu Education of India, 2011
3. Pankaj Agarwal, “Information Security & Cyber Laws”, 1st Edition, ACME Learning Private Limited, New Delhi, 2010

15CN11E INFORMATION SECURITY L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: define key terms and critical concepts of information security (K1)
CO2: enumerate the phases of the security systems development life cycle (S2)
CO3: describe the information security roles of professionals within an organization. (K2)

UNIT I INFORMATION SECURITY & NEEDS FOR SECURITY 9

Information Security: Introduction- History of Information security - What is Security - CNSS Security Model - Components of Information System - Balancing Information Security and Access -Approaches to Information Security Implementation - The Security Systems Development Life Cycle, Threats, Attacks, Secure Software development.

UNIT II RISK MANAGEMENT & PROFESSIONAL ISSUES IN INFORMATION SECURITY 9

Law & Ethics in Information Security-Risk Management-Risk Identification-Risk Assessment-Risk Control Strategies- Information Security Planning & Governance-Information Security Policy, Standards, and Practices – Continuity Strategies

UNIT III CRYPTOGRAPHY 9

Foundation of Cryptology - Cipher methods – Cryptographic Algorithms – Cryptographic tools – Protocol for secure communications - Attacks on cryptosystems - Physical Security.

UNIT IV SECURITY TECHNOLOGY 9

Introduction – Access Control – Firewall – Protecting Remote Connections- Intrusion Detection and Prevention systems – Honeypots, Honeynets and padded cell systems – Scanning and Analysis Tools – Biometric access Controls.

UNIT V IMPLEMENTATION AND MAINTENANCE 9

Information Security Project Management – Bull's Eye Model – Security Certification and Accreditation - Credentials of Information Security Professionals – Employment Policy and Practices – Security Management Maintenance Models – Digital Forensics.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. Michael E. Whitman, Herbert J. Mattord, "Principles of Information Security", 4th Edition, CENGAGE Learning, 2012.
2. William Stallings, "Cryptography and Network Security", 4th Edition, Pearson Education, 2011.
3. Forouzan Mukhopadhyay, "Cryptography and Network Security", 2nd Edition, Mc Graw Hill, 2010

REFERENCES

1. C K Shyamala, N Harini, Dr T R Padmanabhan, "Cryptography and Network Security", 1st Edition, Wiley, India
2. Bernard Menezes, "Network Security and Cryptography", 1st Edition, CENGAGE Learning, 2010.
3. Atul Kahate, "Cryptography and Network Security", 2nd Edition, Mc Graw Hill.
4. WM.Arthur Conklin, "Principles of Computer Security", 2nd Edition, Greg White, TMH, 2008.
5. Neal Krawetz, "Introduction to Network Security", 1st Edition, CENGAGE Learning, 2007.

15CN12E BIG DATA ANALYTICS L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: use the statistical analysis methods to big data platform. (K2, S2, A2)
CO2: analyze problems appropriate to mining data streams. (K2, S3, A2)
CO3: apply the knowledge of clustering techniques in data mining. (K2, S3, A2)
CO4: explain about social networking data analytics. (K1, S2, A1)
CO5: use visualization techniques for distributed file systems (K2, S3, A1)

UNIT I INTRODUCTION TO BIG DATA 9

Introduction to Big Data Platform – Challenges of conventional systems - Web data – Evolution of Analytic scalability - analytic processes and tools - Analysis vs reporting - Modern data analytic tools - Statistical concepts: Sampling distributions – resampling - statistical inference - prediction error.

UNIT II MINING DATA STREAMS 9

Introduction to Streams Concepts – Stream data model and architecture - Stream Computing, Sampling data in a stream – Filtering streams – Counting distinct elements in a stream – Estimating moments – Counting oneness in a window – Decaying window - Realtime Analytics Platform(RTAP) applications - real time sentiment analysis, stock market predictions.

UNIT III FREQUENT ITEMSETS AND CLUSTERING 9

Mining Frequent itemsets - Market based model – Apriori Algorithm – Handling large data sets in Main memory – Limited Pass algorithm – Counting frequent item sets in a stream – Clustering Techniques – Hierarchical – K- Means – Clustering high dimensional data – CLIQUE and PROCLUS – Frequent pattern based clustering methods – Clustering in non-euclidean space – Clustering for streams and Parallelism.

UNIT IV SOCIAL NETWORKING DATA ANALYTICS 9

An introduction to social network data Analytics - Introduction, Online Social Networks: Research Issues - Research Topics in Social Networks - Data mining in social media - Data mining in a Nutshell - Social Media - Motivations for Data Mining in Social Media - Data Mining Methods for Social Media - visualizing social networks - A Taxonomy of Visualizations - The Convergence of Visualization - Interaction and Analytics

UNIT V FRAMEWORKS AND VISUALIZATION 9

MapReduce – Hadoop – Hive - MapR – Sharding – NoSQL Databases - S3 - Hadoop Distributed file systems – Visualizations - Visual data analysis techniques - interaction techniques - Systems and applications

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. Michael Berthold, David J. Hand, “Intelligent Data Analysis”, 1st Edition, Springer, 2007
2. Anand Rajaraman and Jeffrey David Ullman, “Mining of Massive Datasets”, 2nd Edition, Cambridge University Press, 2012.
3. Charu C. Aggarwal , “Social Network Data Analytics”, Springer,2011.

REFERENCES

1. Bill Franks, “Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with advanced analytics”, 1st Edition, John Wiley & sons, 2012.
2. Glenn J. Myatt, “Making Sense of Data”, 2nd Edition, John Wiley & Sons, 2007.
3. Pete Warden, “Big Data Glossary”, 1st Edition, O‟Reilly publication, 2011.
4. Jiawei Han, Micheline Kamber “Data Mining Concepts and Techniques”, 2nd Edition, Elsevier, Reprinted 2008.

15CN13E ADVANCED WIRELESS COMMUNICATION L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: describe various wireless channels modeling technique based on transmitter and receiver. (k2)

CO2: explain algorithms and technologies including diversity, fading, interference averaging and interference management.(K2,S1)

CO3: explain various spread spectrum technique in wireless communication. (K2,S1)

UNIT I THE WIRELESS CHANNEL 9

Overview of wireless systems - Physical modeling for wireless channels - Time and Frequency coherence - Statistical channel models – Fading - Capacity of wireless Channel - Capacity of Flat Fading Channel - Channel Distribution Information known - Channel Side Information at Receiver - Channel Side Information at Transmitter and Receiver.

UNIT II PERFORMANCE OF DIGITAL MODULATION OVER WIRELESS CHANNELS 9

Capacity with Receiver diversity - Capacity comparisons - Capacity of Frequency Selective Fading channels - Outage Probability - Average Probability of Error - Combined Outage and Average Error Probability - Doppler Spread - Intersymbol Interference.

UNIT III DIVERSITY 9

Realization of Independent Fading Paths - Receiver Diversity - Selection Combining - Threshold Combining - Maximal-Ratio Combining - Equal Gain Combining - Transmitter Diversity - Channel known at Transmitter - Channel unknown at Transmitter - The Alamouti Scheme.

UNIT IV MULTICARRIER MODULATION 9

Data Transmission using Multiple Carriers - Multicarrier Modulation with Overlapping Sub channels - Mitigation of Subcarrier Fading - Space-time Multiplexing - Peak to Average Power Ratio-Frequency and Timing offset - Case study IEEE 802.11a.

UNIT V SPREAD SPECTRUM 9

Spread Spectrum Principles - Direct Sequence Spread Spectrum - Spreading Codes – Synchronization - RAKE receivers - Frequency Hopping Spread Spectrum - Multiuser DSSS Systems - Multi user FHSS Systems.

L: 45 TOTAL: 45 PERIODS

REFERENCES

1. Andrea Goldsmith, “Wireless Communications”, 1st Edition, Cambridge University Press, 2005.
2. T.S. Rappaport, “Wireless Communications: Principles and Practices”, 2nd Edition, Pearson Education, 2010.
3. David Tse and Pramod Viswanath, “Fundamentals of Wireless Communication”, 1st Edition, Cambridge University Press, 2005.
4. Andreas F. Molisch, “Wireless Communications”, 2nd Edition, Wiley - IEEE, 2011.

15CN14E IMAGE PROCESSING L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: expalin how images are formed, sampled, quantized and represented digitally (K2)
CO2: analyze how image are processed by discrete, linear, time-invariant systems (K4)
CO3: expain transform-domain representation of images (K3)
CO4: design median filters for image enhancement (K6)
CO5: describe the principles of image compression (K2)

UNIT I DIGITAL IMAGE FUNDAMENTALS 9

Elements of digital image processing systems - Vidicon and Digital Camera working principles - Elements of visual perception – brightness – contrast – hue – saturation - Mach Band effect - Image sampling – Quantization – Dither - Two dimensional mathematical preliminaries.

UNIT II IMAGE TRANSFORMS 9

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

UNIT III IMAGE ENHANCEMENT AND RESTORATION 9

Histogram modification - Noise distributions - Spatial averaging - Directional Smoothing – Median - Geometric mean - Harmonic mean - Contraharmonic and Yp mean filters - Design of 2D FIR filters - 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 IMAGE SEGMENTATION AND RECOGNITION 9

Image segmentation - Edge detection - Edge linking and boundary detection - Region growing - Region splitting and Merging - Image Recognition - Patterns and pattern 13 classes - Matching by minimum distance classifier - Matching by correlation - Neural networks - Backpropagation network and training - Neural network to recognize shapes.

UNIT V IMAGE COMPRESSION 9

Need for data compression – Huffman - Run Length Encoding - Shift codes - Arithmetic coding - Vector Quantization - Block Truncation Coding - Transform coding - JPEG standard - JPEG 2000 – EZW – SPIHT - MPEG.

L: 45 TOTAL: 45 PERIODS

REFERENCES

1. Rafael C. Gonzalez, Richard E. Woods, " Digital Image Processing", Pearson Education, Inc., 2nd Edition, 2004
2. Anil K. Jain, "Fundamentals of Digital Image Processing", Prentice Hall of India, 9th Edition, 2002.
3. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins, "Digital Image Processing using MATLAB", Pearson Education, Inc., 2004.
4. D.E. Dudgeon and R.M. Mersereau, "Multidimensional Digital Signal Processing", Prentice Hall Professional Technical Reference, 1990.
5. William K. Pratt, "Digital Image Processing", 4th Edition, John Wiley, New York, 2002.

15CN15E	MULTIMEDIA COMPRESSION TECHNIQUES (Common to CS and CN)	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

Upon completion of this course, students will be able to:

CO 1: Describe fundamentals concepts and characteristics of text audio, image and video. (K1- K3)
CO 2: Analyze various types of text compression techniques (K1- K4)
CO 3: Express several types of audio and speech compression techniques. (K1- K3)
CO 4: Compare the different image compression techniques. (K1- K4)
CO 5: Illustrate the principles and standards for video compression. (K1- K4)

UNIT I INTRODUCTION 9

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 TEXT COMPRESSION 9

Compression techniques, Shannon-Fano coding, Huffman coding, Adaptive Huffman Coding, Arithmetic coding, Dictionary techniques, LZW family algorithms.

UNIT III AUDIO COMPRESSION 9

Audio compression techniques - μ- Law and A- Law companding, Basic sub-band coding, Design of Filter banks, Application to speech coding-G.722, Application to audio coding-MPEG audio, Silence compression, Speech compression techniques-Vocoders – Channel Vocoders, Formant Vocoders, Linear Predictive Coder, CELP.

UNIT IV IMAGE COMPRESSION 9

Prediction in DPCM, Adaptive DPCM, Delta Modulation, Transform Coding, Wavelet based compression: Implementation using filters, EZW, SPIHT coders, Image Compression standards-JPEG, JPEG 2000, JBIG, JBIG2.

UNIT V VIDEO COMPRESSION 9

Video compression Principles, Motion estimation and compensation techniques, Video Compression standards - MPEG Video Coding I: MPEG - 1 and 2, MPEG Video Coding II: MPEG – 4 and 7, H.261 Standard, DVI technology, PLV performance, DVI real time compression, Packet Video.

L: 45 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, 2007.
3. Mark S.Drew, Ze-Nian Li, “Fundamentals of Multimedia”, PHI, 1st Edition, 2003.
4. John F. Buford, “Multimedia Systems”, 6th Edition, Pearson Education, 2009.

15CN16E EVOLUTIONARY COMPUTING **L T P C**
(Common to HVE and CN) **3 0 0 3**

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO 1; explain the basic concepts of evolutionary computation. (K2)
CO 2: classify the various representations, selection and search operations (K2)
CO 3: discuss the basics of fitness evaluation and constraint handling mechanism. (K2)
CO 4: outline the concepts of hybrid systems. (K2)
CO 5: interpret the effect of parameter setting and applications. (K3)

UNIT I INTRODUCTION TO EVOLUTIONARY COMPUTATION 9

Introduction – Possible applications of evolutionary computations – History of evolutionary computation – Genetic algorithms – Evolution strategic – Evolutionary programming – Derivative methods – Stochastic processes – Modes of stochastic convergence – Schema processing – Transform methods – Fitness landscape – Probably Approximately Correct (PAC) learning analysis – Limitation of evolutionary computation methods – Local performance measures.

UNIT II REPRESENTATION, SELECTION AND SEARCH OPERATORS 9

Representation – Binary strings – Real-valued vectors – Permutations – Finite-state representation – Parse trees – Guidelines for a suitable encoding – Other representations Selection – Proportional selection and sampling algorithms – Tournament selection – Rank based selection – Boltz Mann selection – Other selection methods – Hybrids Generation gap methods – A comparison of selection mechanisms – Interactive evolution – Search Operators – Mutation – recombination – Other operators.

UNIT III FITNESS EVALUATION AND CONSTRAINT HANDLING 9

Fitness Evaluation – Encoding and decoding functions – Competitive fitness evaluation – Complexity based fitness evaluation – Multi objective optimization – Constraint handling techniques – Penalty functions – Decoders – Repair algorithms – Constraint preserving operators – Other constraint handling methods – Constraint satisfaction problems – Population structures – Niching Methods – Specification methods – Island(migration)models.

UNIT IV HYBRID SYSTEM 9

Self-adaptation – Meta evolutionary approaches – Neural – Evolutionary systems – New areas for evolutionary computation research in evolutionary systems – Fuzzy-Evolutionary Systems – Combination with Other Optimization Methods – Combination with local search – Combination with dynamic programming – Simulated annealing and tabu search – Comparison with existing optimization.

UNIT V PARAMETER SETTING AND APPLICATIONS 9

Heuristics for Parameter setting Issues – Population size – Mutation parameters – Recombination parameters – Implementation of Evolutionary Algorithms – Efficient implementation of algorithms – Computation time of evolutionary operators – Applications – Classical optimization problems – Control Identification – Scheduling – Pattern recognition – Simulation models.

L:45 TOTAL:45 PERIODS

REFERENCES

1. Thomas Back et al, “Handbook on evolutionary computation”, Institute of Physics, Publishing, 2000.
2. Xin Yao, “Evolutionary Computations: Theory and Applications”, World Scientific 39 Publishing, 1999.
3. Goldberg, “Genetic algorithm in search, optimization and machine learning”, Addison Wesley, 1998.
4. Davis, “Hand book on Genetic Algorithms”, NewYork, 1991.
5. Kenneth A De Jong, “Evolutionary Computation: A Unified Approach”, MIT Press, 2006.

15CN17E SECURITY IN WIRELESS SENSOR NETWORKS L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: describe about vulnerabilities and threats in WSN (K2, S1)
CO2: explain authentication mechanisms and broadcasting techniques.(K3)
CO3: explain secure routing protocols in WSN. (K3)
CO4: describe trust based mechanisms and intrusion detection system in WSN. (K2)

UNIT I INTRODUCTION 9

Communication architecture of WSN – Constraints – security requirements – Threats – evaluation – attacks; Vulnerabilities of physical layer – jamming, tampering; Vulnerabilities of data link layer – collisions, exhaustion, unfairness; Vulnerabilities of network layer - Spoofed, Altered, or Replayed Routing Information - Selective Forwarding - Sinkhole, Sybil, Wormholes, Hello Flood Attacks, Acknowledgment Spoofing - Vulnerabilities of transport layer – Flooding - Desynchronization.

UNIT II KEY MANAGEMENT PROTOCOLS AND BROADCAST AUTHENTICATION 9

Key distribution – classifications: deterministic and probabilistic; protocols: LEAP BROSK, IOS/DMBS, PIKE, SKEW; Broadcast authentication: ìTesla - Certificate-Based Authentication Scheme - Basic Merkle Hash Tree Based Authentication Scheme - Enhanced Merkle Hash Tree Based Authentication Scheme - ID-Based Authentication Scheme.

UNIT III SECURE ROUTING PROTOCOLS 9

EAR – PRSA - R-LEACH - S-SPIN - Secure-SPIN - Segment transmission secure routing protocol – SONS - SS-LEACH – INSENS

UNIT IV DATA AGGREGATION, INTRUSION DETECTION AND AUTOCONFIGURATION 9

Data Aggregation – plain text based secure data aggregation – SIA, SINP, ESPDA, SSDA, WDA; cipher based secure data aggregation – CDA, HSC, Secure hierarchical data aggregation; Intrusion Detection: IHOP- SEF- DIDS - Decentralized intrusion detection; Auto Configuration – LEADS – PDAA - Dynamic address allocation.

UNIT V TRUST MANAGEMENT 9

Trust model - Certificate based - Behavior based, Combinational approach; Trust based routing protocols-secure routing based on multiple criteria decision - LEACH – TM - TRANS; Trust based node selection algorithm - cross layer trust model - reliable sensor selection algorithm - novel sensor node selection algorithm.

L: 45 TOTAL: 45 PERIODS

REFERENCES

1. Yang Xiao, “Security in distributed, grid, mobile and pervasive computing”, 3rd Edition, Auerbach publications, 2006.
2. Yong Wang, Garhan Attebury and Byrav Ramamurthy, “A Survey of security issues in wireless sensor networks”, IEEE Communication Surveys & Tutorials, Second Quarter 2006.
3. Mohsen Sharifi, Saeid Peurroostaei Ardakani, Saeed Sedighian Kashi, “SKEW: An Efficient Self Key Establishment Protocol for Wireless Sensor Networks”, IEEE 2009.
4. Kui Ren, Kai Zeng, Wenjing Lou and Patrick J.Moran, “On Broadcast Authentication in Wireless Sensor Networks”, Proc. First International Conference on Wireless Algorithms, Systems, and Applications, Springer Publication, WASA 2006.
5. Hani Alzaid, Ernest Foo and Juan Genzalez Nieto, “Secure Data Aggregation in Wireless Sensor Network: a survey”, Australasian Information Security Conference (ACSC2008), Wollongong, Australia, January 2008. Australian Computer Society Inc.

15CN18E NEURAL NETWORKS AND ITS APPLICATIONS L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: explore the concepts of neural-network algorithms. (K3)
CO2: verify and validate various neural network models. (K5)
CO3: describe the variety of neural networks techniques. (K2)

UNIT I BASIC LEARNING ALGORITHMS 9

Biological Neuron – Artificial Neural Model – Types of activation functions – Architecture: Feedforward and Feedback – Learning Process: Error Correction Learning – Memory Based Learning – Hebbian Learning – Competitive Learning – Boltzman Learning – Supervised and Unsupervised Learning – Learning Tasks: Pattern Space – Weight Space – Pattern Association – Pattern Recognition – Function Approximation – Control – Filtering – Beamforming – Memory – Adaptation – Statistical Learning Theory – Single Layer Perceptron – Perceptron Learning Algorithm – Perceptron Convergence Theorem – Least Mean Square Learning Algorithm – Multilayer Perceptron – Back Propagation Algorithm – XOR problem – Limitations of Back Propagation Algorithm.

UNIT II RADIAL BASIS FUNCTION NETWORKS AND SUPPORT VECTOR MACHINES 9

Radial Basis Function Networks: Cover's Theorem on the Separability of Patterns - Exact Interpolator – Regularization Theory – Generalized Radial Basis Function Networks - Learning in Radial Basis Function Networks - Applications: XOR Problem – Image Classification.

Support Vector Machine: Optimal Hyperplane for Linearly Separable Patterns and Nonseparable Patterns – Support Vector Machine for Pattern Recognition – XOR Problem insensitive Loss Function – Support Vector Machines for Nonlinear Regression

UNIT III COMMITTEE MACHINES 9

Ensemble Averaging - Boosting – Associative Gaussian Mixture Model – Hierarchical Mixture of Experts Model (HME) – Model Selection using a Standard Decision Tree – A Priori and Postpriori Probabilities – Maximum Likelihood Estimation – Learning Strategies for the HME Model - EM Algorithm – Applications of EM Algorithm to HME Model

Neurodynamics Stems: Dynamical Systems – Attractors and Stability – Non-linear Dynamical Systems - Lyapunov Stability – Neurodynamical Systems – The Cohen – Grossberg

UNIT IV ATTRACTOR NEURAL NETWORKS 9

Associative Learning – Attractor Neural Network Associative Memory – Linear Associative Memory – Hopfield Network – Content Addressable Memory – Strange Attractors and Chaos - Error Performance of Hopfield Networks - Applications of Hopfield Networks – Simulated Annealing – Boltzmann Machine – Bidirectional Associative Memory – BAM Stability Analysis – Error Correction in BAMs – Memory Annihilation of Structured Maps in BAMS – Continuous BAMs – Adaptive BAMs – Applications

ADAPTIVE RESONANCE THEORY

Noise-Saturation Dilemma - Solving Noise-Saturation Dilemma – Recurrent On-center – Off-surround Networks – Building Blocks of Adaptive Resonance – Substrate of Resonance Structural Details of Resonance Model – Adaptive Resonance Theory – Applications

UNIT V SELF ORGANISING MAPS 9

Self-organizing Map – Maximal Eigenvector Filtering – Sanger's Rule – Generalized Learning Law – Competitive Learning – Vector Quantization – Mexican Hat Networks - Self-organizing Feature Maps – Applications

PULSED NEURON MODELS

Spiking Neuron Model – Integrate-and-Fire Neurons – Conductance Based Models – Computing with Spiking Neurons.

L: 45 TOTAL: 45 PERIODS

TEXT BOOKS

1. Satish Kumar, “Neural Networks: A Classroom Approach”, Tata McGraw-Hill Publishing Company Limited, New Delhi, 1st Edition, Reprint 2007.
2. Simon Haykin, “Neural Networks: A Comprehensive Foundation”, 2nd Edition, Addison Wesley Longman (Singapore) Private Limited, Delhi, 2001.

REFERENCES

1. Martin T.Hagan, Howard B. Demuth, and Mark Beale, “Neural Network Design”, 2nd Edition, Thomson Learning, New Delhi, 2003.
2. James A. Freeman and David M. Skapura, “Neural Networks Algorithms, Applications and Programming Techniques”, Pearson Education (Singapore) Private Limited, Delhi, 2003.
3. Simon Haykin, “Neural Networks and Learning Machines”, 3rd Edition, Prentice Hall, 2009.

15CN19E COGNITIVE RADIO NETWORKS **L T P C**
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: acquire the basic knowledge of cognitive radio networks (K2, S3, A2)
CO2: describe the various capacity models and channels in cognitive radio networks (K2, S2, A2)
CO3: discuss the various spectrum sensing with OFDM techniques (K2, S3, A2)
CO4: illustrate the security principles of cognitive radio networks (K3, S3, A3)
CO5: explore advanced concepts of cognitive radio networks and their associated challenges. (K3, S3, A3)

UNIT I INTRODUCTION **9**

Introduction to Software-Defined Radio - Motivation for cognitive radios – Introduction to cognitive radio - Spectrum policy: present and future - Data explosion: future spectrum implications - Cognitive radio network design - Hardware and system design considerations - Spectrum coexistence - Cognitive radio network paradigms - Applications.

UNIT II CAPACITY OF COGNITIVE RADIO **9**

Introduction - Cognitive radio network paradigms - limits of wireless networks - Interference channels without cognition - Underlay cognitive radio networks - Interweave cognitive radio networks - Overlay cognitive radio networks - Introduction to path loss - Path loss models for wireless channels - Small-scale fading and the Doppler spectrum.

UNIT III SPECTRUM SENSING **9**

Introduction - Interference temperature for cognitive underlaying - White-space detection for cognitive interweaving - An application: spectrum sensing with OFDM - Effects of imperfect knowledge of noise power - Effects of an inaccurate model of interference - Advanced spectrum sensing techniques - Optimized spectrum exploration and exploitation: sensing and access policy design.

UNIT IV COGNITIVE RADIO NETWORK SECURITY **9**

Introduction - Primary-User Emulation Attacks: Spectrum Sensing in Hostile Environments - Classification of PUE Attacks - Noninteractive Localization of Primary Signal Transmitters - Robust Distributed Spectrum Sensing - Security Vulnerabilities in IEEE 802.22

UNIT V ADVANCED CONCEPTS **9**

Biologically Inspired Networking - Machine Learning for Cognitive Networks: Problem Formulations in Machine Learning - Tasks in Cognitive Networking - Open Issues and Research Challenges - Cross-Layer Design and Optimization in Wireless Networks: Motivations for Cross-Layer Design - Taxonomy of Cross-Layer Design Proposals.

L: 45 TOTAL: 45 PERIODS

REFERENCES

1. Alexander M. Wyglinski, Maziar Nekovee, Y. Thomas Hou, “Cognitive Radio Communications and Networks - Principles and Practice”, 1st Edition, Academic Press, 2010.
2. Qusay H.Mahmoud, “Cognitive Networks - Towards Self-Aware Networks”, John Wiley & Sons Ltd, 2007.
3. Yan Zhang, Jun Zheng, Hsiao-Hwa Chen, “Cognitive Radio Networks - Architectures, Protocols and Standards”, CRC Press, 2010.
4. Huseyin Arslan, “Cognitive Radio, Software Defined Radio and Adaptive Wireless Systems”, Springer Publication, 2007.
5. Kwang-Cheng Chen, Ramjee Prasad, “Cognitive Radio Networks”, Wiley Publications, 2009.

15CN20E REAL TIME EMBEDDED SYSTEMS L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: explain the applications of embedded systems (K2)
CO2: describe the memory concepts in embedded systems (K2)
CO3: demonstrate the RTOS using multiprocessing and multitasking (K4)

UNIT I INTRODUCTION TO EMBEDDED SYSTEMS 9

Definition of Embedded System - Embedded Systems Vs General Computing Systems - History of Embedded Systems – Classification - Major Application Areas - Purpose of Embedded Systems - Characteristics and Quality Attributes of Embedded Systems.

UNIT II TYPICAL EMBEDDED SYSTEM 9

Core of the Embedded System: General Purpose and Domain Specific Processors - ASICs, PLDs - Commercial Off-The-Shelf Components (COTS) - Memory: ROM, RAM, Memory according to the type of Interface - Memory Shadowing - Memory selection for Embedded Systems - Sensors and Actuators - Communication Interface: Onboard and External Communication Interfaces.

UNIT III EMBEDDED FIRMWARE 9

Reset Circuit - Brown-out Protection Circuit - Oscillator Unit - Real Time Clock - Watchdog Timer - Embedded Firmware Design Approaches and Development Languages.

UNIT IV RTOS BASED EMBEDDED SYSTEM DESIGN 9

Operating System Basics - Types of Operating Systems – Tasks - Process and Threads - Multiprocessing and Multitasking - Task Scheduling.

UNIT V TASK COMMUNICATION 9

Shared Memory - Message Passing - Remote Procedure Call and Sockets - Task Synchronization: Task Communication/Synchronization Issues - Task Synchronization Techniques - Device Drivers - How to Choose an RTOS.

L: 45 TOTAL: 45 PERIODS

TEXT BOOK

1. Shibu K.V, “Introduction to Embedded Systems”, Mc Graw Hill, 2009.

REFERENCES

1. Raj Kamal, “Embedded Systems Architecture, Programming and Design”, 2nd Edition, TMH-2003.
2. Frank Vahid, Tony Givargis, “Embedded System Design”, John Wiley, 2002.
3. Lyla, ”Embedded Systems an Integrated Approach”, 1st Edition, Pearson Education, 2013.
4. David E. Simon,”An Embedded Software Primer”, 12th Indian Reprint Edition, Pearson Education, volume 1, 2004.

15CN21E IMAGE AND VIDEO PROCESSING L T P C
3 0 0 3

COURSE OUTCOMES

Upon completion of this course, the students will be able to

CO1: describe the basic concepts of image and video processing.(K1)
CO2: apply transforms in real time images.(K3)
CO3: explain image processing techniques such as enhancement and segmentation.(K1)
CO4: illustrate various compression models.(S3)
CO5: explain various 2D motion estimation methods.(K1)

UNIT I FUNDAMENTALS OF IMAGE PROCESSING AND IMAGE TRANSFORMS 9

Basic steps of Image processing system sampling and quantization of an Image – Basic relationship between pixels Image Transforms: 2 – D Discrete Fourier Transform - Discrete Cosine Transform (DCT) - Discrete Wavelet transforms.

UNIT II IMAGE PROCESSING TECHNIQUES 9

Image Enhancement: Spatial Domain method- Histogram Processing - Fundamentals of Spatial Filtering - Smoothing Spatial filters - Sharpening Spatial filters - Frequency Domain methods: Basics of filtering in frequency domain - image smoothing - image sharpening - selective filtering

Image Segmentation: Segmentation concepts - point, line and Edge detection – Thresholding - region based segmentation.

UNIT III IMAGE COMPRESSION 9

Image compression fundamentals – coding Redundancy - spatial and temporal redundancy Compression models : Lossy and Lossless - Huffmann coding - Arithmetic coding, LZW coding - run length coding - Bit Plane codin - transform coding - predictive coding - wavelet coding - JPEG standards.

UNIT IV BASIC STEPS OF VIDEO PROCESSING 9

Analog video - Digital Video - Time varying Image Formation models: 3D motion models - Geometric Image formation - Photometric Image formation - sampling of video signals - filtering operations

UNIT V 2-D MOTION ESTIMATION 9

Optical flow - general methodologies - pixel based motion estimation - Block matching algorithm - Mesh based motion Estimation - global Motion Estimation - Region based motion estimation - multi resolution motion estimation - Waveform based coding - Block based transform coding - predictive coding - Application of motion estimation in video coding.

L: 45 TOTAL: 45 PERIODS

REFERENCES

1. Gonzaleze and Woods,"Digital Image Processing ", 3rd Edition, Prentice Hall 2007.
2. Yao wang, Joem Ostarmann and Ya – quin Zhang, "Video processing and communication", 1st Edition, PHI, 2002.
3. M. Tekalp, "Digital video Processing", Prentice Hall, 1995.