JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
Course Structure and syllabus for M.Tech. DIGITAL ELECTRONICS AND COMMUNICATION SYSTEMS (DECS) for affiliated Engineering Colleges2009-10

I YEAR II SEMESTER

Subject	Hours/ Week
Wireless Communications	4
Coding Theory & Techniques	4
High Speed Networks	4
Micro Computer System Design	4
Detection & Estimation of Signals	4
ELECTIVE II a. Image & Video Processing b. Optical Communications c. Compression Techniques	4
LABORATORY: Communications & Signal Processing Lab	4

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech. (DECS)

II SEMESTER

WIRELESS COMMUNICATIONS

UNIT I

INTRODUCTION TO WIRELESS COMMUNICATIONS SYSTEMS: Evolution, Examples of Wireless Communication systems, Comparision, Second Generation Cellular Networks, WLL, Bluetooth and Personal Area Networks.

UNIT II

MOBILE RADIO PROPAGATION: Large-Scale Path Loss, Introduction to Radio Wave Propagation, Free Space Propagation Model, Propagation Mechanisms, Reflection, Ground Reflection (Two-Ray) Model, Diffraction, Scattering.

Small-Scale Fading and Multipath, Impulse Response Model of a Multipath Channel, Small-Scale Multipath Measurements, Parameters of Mobile Multipath Channels, Types of Small-Scale Fading, Rayleigh and Ricean Distributions, Statistical Models for Multipath Fading Channels, Theory of Multipath Shape Factors for Small-Scale Fading Wireless Channels.

UNIT III

DIVERSITY TECHNIQUES: Repetition coding and Time Diversity- Frequency and Space Diversity, Receive Diversity- Concept of diversity branches and signal paths- Combining methods- Selective diversity combining - Switched combining- maximal ratio combining- Equal gain combining- performance analysis for Rayleigh fading channels.

UNIT IV

CELLULAR COMMUNICATION: Cellular Networks, Multiple Access: FDM/TDM/FDMA/TDMA, Spatial reuse, Co-channel interference Analysis, Hand over Analysis, Erlang Capacity Analysis, Spectral efficiency and Grade of Service- Improving capacity - Cell splitting and sectorization.

UNIT V

SPREAD SPECTRUM AND CDMA: Motivation- Direct sequence spread spectrum- Frequency Hopping systems, Time Hopping., Anti-jamming- Pseudo Random (PN) sequence, Maximal length sequences, Gold sequences, Generation of PN sequences.

UNIT VI

DIVERSITY IN DS-SS SYSTEMS: Rake Receiver- Performance analysis. Spread Spectrum Multiple Access, CDMA Systems- Interference Analysis for Broadcast and Multiple Access Channels, Capacity of cellular CDMA networks- Reverse link power control, Hard and Soft hand off strategies.

UNIT VII

FADING CHANNEL CAPACITY: Capacity of Wireless Channels- Capacity of flat and frequency selective fading channels, Multiple Input Multiple output (MIMO) systems- Narrow band multiple antenna system model, Parallel Decomposition of MIMO Channels- Capacity of MIMO Channels.

UNIT VIII

CELLULAR WIRELESS COMMUNICATION STANDARDS: GSM specifications and Air Interface, specifications, IS 95 CDMA- 3G systems: UMTS & CDMA 2000 standards and specifications.

TEXT BOOKS:

1. Andrea Goldsmith, "Wireless Communications", Cambridge University press.
2. Simon Haykin and Michael Moher, "Modern Wireless Communications", Person Education.
3. T.S. Rappaport, "Wireless Communication, principles & practice", PHI, 2001.

REFERENCES:

1. G.L Stuber, "Principles of Mobile Communications", 2nd edition, Kluwer Academic Publishers.
2. Kamilo Feher, 'Wireless digital communication', PHI, 1995.
3. R.L Peterson, R.E. Ziemer and David E. Borth, "Introduction to Spread Spectrum Communication", Pearson Education.
4. A.J.Viterbi, "CDMA- Principles of Spread Spectrum", Addison Wesley, 1995.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech. (DECS)

II SEMESTER

CODING THEORY & TECHNIQUES

UNIT I

SOURCE CODING: Mathematical model of Information, A Logarithmic Measure of Information, Average and Mutual Information and Entropy, coding for Discrete less sources, Source coding theorem, fixed length and variable length coding, properties of prefix codes.

UNIT II

Shannon-Fano coding, Huffman code, Huffman code applied for pair of symbols, efficiency calculations, Lempel-Ziv codes.

UNIT III

LINEAR BLOCK CODES: Introduction to Linear block codes, Generator Matrix, Systematic Linear Block codes, Encoder Implementation of Linear Block Codes, Parity Check Matrix, Syndrome testing, Error Detecting and correcting capability of Linear Block codes.

UNIT IV

Hamming Codes, Probability of an undetected error for linear codes over a Binary Symmetric Channel, Weight Enumerators and Mac-Williams identities, Perfect codes, Application of Block codes for error control in data storage Systems.

UNIT V

CYCLIC CODES: Algebraic structure of cyclic codes, Binary Cyclic code properties, Encoding in systematic and non-systematic form, Encoder using (n-k) bit shift register, Syndrome Computation and Error detection, Decoding of Cyclic Codes.

UNIT VI

CONVOLUTIONAL CODES: encoding of Convolutional codes, Structural properties of Convolutional codes, state diagram, Tree diagram, Trellis Diagram, maximum, Likelihood decoding of Convolutional codes.

UNIT VII

Viterbi Algorithm, Fano, Stack Sequential decoding algorithms, Application of Viterbi and sequential decoding.

UNIT VIII

BCH CODES: Groups, fields, binary Fields arithmetic, construction of Falois fields GF (2^m), Basic properties of Falois Fields, Computation using Falois Field GF (2^m) arithmetic, Description of BCH codes, Decoding procedure for BCH codes.

TEXT BOOKS:

1. SHU LIN and Daniel J. Costello, Jr. "Error Control Coding – Fundamentals and Applications", Prentice Hall Inc.
2. Bernard sklar,"Digital Communications – Fundamental and Application", Pearson Education, Asia.
3. Man Young Rhee, "Error Control Coding Theory", McGraw Hill Publ.

REFERENCES:

1. John G. Proakis, “Digital Communications”, Mc. Graw Hill Publication.
2. K. Sam Shanmugam, “Digital and Analog Communication Systems”, Wisley Publications.
3. Symon Haykin, “Digital Communications”, Wisley Publications.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
M.Tech. (DECS)
II SEMESTER

HI-SPEED NETWORKS

UNIT I

NETWORK SERVICES & LAYERED ARCHITECTURE: Traffic characterization and quality of service, Network services, High performance networks, Network elements, Basic network mechanisms, layered architecture.

UNIT II

ISDN & B-ISDN: Over view of ISDN, ISDN channels, User access, ISDN protocols, Brief history of B-ISDN and ATM, ATM based services and applications, principles and building block of B-ISDN, general architecture of B-ISDN, frame relay.

UNIT III

ATM NETWORKS: Network layering, switching of virtual channels and virtual paths, applications of virtual channels and connections.

UNIT IV

QOS parameters, traffic descriptors, ATM service categories, ATM cell header, ATM layer, ATM adaptation layer.

UNIT V

INTERCONNECTION NETWORKS: Introduction, Banyan Networks, Routing algorithm & blocking phenomenon, Batcher-Banyan networks, crossbar switch, three stage class networks.

UNIT VI

REARRANGEABLE NETWORKS: Rearrangeable class networks, folding algorithm, bens network, looping algorithm.

UNIT VII

ATM SIGNALING, ROUTING AND TRAFFIC CONTROL: ATM addressing, UNI signaling, PNNI signaling, PNNI routing, ABR Traffic management.

UNIT VIII

TCP/IP NETWORKS: History of TCP/IP, TCP application and Services, Motivation, TCP, UDP, IP services and Header formats, Internetworking, TCP congestion control, Queue management: Passive & active, QOS in IP networks: differentiated and integrated services.

TEXT BOOKS:

1. William Stallings, “ISDN & B-ISDN with Frame Relay”, PHI.
2. Leon Garcia widjaja, “Communication Networks”, TMH, 2000.
3. N. N. Biswas, “ATM Fundamentals”, Adventure books publishers, 1998.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech. (DECS)

II SEMESTER

MICRO COMPUTER SYSTEM DESIGN

UNIT I

REVIEW OF 8086 PROCESSOR: Architecture, Register organization, Addressing Modes and Instruction Set (Brief treatment only), Difference between 8086 and 8088 with rest to pin structures.

UNIT II

THE 80286 MICRO PROCESSORS: Architecture, Register Organization, Addressing Modes and instruction sets of 80286 (brief treatment only)

UNIT III

THE 80386, AND 80486 MICRO PROCESSORS: Architectural features, Register Organization, Memory management, Virtual 8086 mode, The Memory Paging Mechanism, Pin Definitions of 80386 and 80486 (brief treatment).

UNIT IV

THE PENTIUM AND PENTIUM PRO PROCESSORS: The Memory System, Input/output system, Branch Pridiction Logic, Cache Structure, Pentium Registers, Serial Pentium pro features.

UNIT V

THE PENTIUM IV AND DUAL CORE MICRO PROCESSORS: Architecture, Special Registers and Pin Structures (brief treatment only)

UNIT VI

I/O PROGRAMMING: Fundamentals of I/O Considerations Programmed I/O, Interrupt I/O, Block Transfers and DMA, I/O Design Example.

UNIT VII

INTRODUCTION TO MULTIPROGRAMMING: Process Management, Semaphores Operations, Common Procedure Sharing, Memory Management, Virtual Memory Concept of 80286 and other advanced Processors.

UNIT VIII

ARITHMETIC COPROCESSOR, MMX AND SIMD TECHNOLOGIES: Data formals for Arithmetic Coprocessor, Internal Structure of 8087 and Advanced Coprocessors. Instruction Set (brief treatment).

TEXTBOOKS:

1. Barry, B. Brey, "The Intel Microprocessors,"8th Edition Pearson Education, 2009.
2. A.K. Ray and K.M. Bhurchandi,"Advanced Microprocessor and Peripherals," TMH.

REFERENCES:

1. YU-Chang, Glenn A. Gibson, "Micro Computer Systems: The 8086/8088 Family Architecture, Programming and Design" 2nd Edition, Pearson Education, 2007.
2. Douglas V. Hall, "Microprocessors and Interfacing," Special Indian Edition, 2006.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech. (DECS)

II SEMESTER

DETECTION & ESTIMATION OF SIGNALS

UNIT I

DETECTION THEORY: Binary decisions - Single observation- Maximum likelihood decision criterion, Neymann-Pearson criterion, Probability of error criterion, Bayes risk criterion, Minimax criterion, Robust detection, Receiver operating characteristics.

UNIT II&III

BINARY DECISIONS - MULTIPLE OBSERVATIONS: Vector observations, the general Gaussian Problem, Waveform Observation in Additive Gaussian Noise, The Integrating Optimum Receiver; Matched Filter Receiver.

UNIT IV&V

ESTIMATION THEORY: Methods -Maximum likelihood estimation; Bayes cost method Bayes estimation criterion - Mean square error criterion; Uniform cost function; absolute value cost function; Linear minimum variance - Least squares method; Estimation in the presence of Gaussian noise - Linear observation; Non-linear estimation.

UNIT VI

PROPERTIES OF ESTIMATORS: Bias, Efficiency, Cramer Rao bound Asymptotic properties, Sensitivity and error analysis.

UNIT VII

STATE ESTIMATION: Prediction, Kalman filter.

UNIT VIII

SUFFICIENT STATISTICS AND STATISTICAL ESTIMATION OF PARAMETERS: Concept of sufficient statistics, Exponential families of Distributions, Exponential families and Maximum likelihood estimation, uniformly minimum variance unbiased estimation.

TEXT BOOKS:

1. James L. Melsa and David L. Cohn, “Decision and Estimation Theory," McGraw Hill, 1978.
2. Dimitri Kazakos, P. Papantoni Kazakos, “Detection and Estimation," Computer Science Press, 1990.
3. Steven M. Kay, “Statistical Signal Processing: Vol. 1: Estimation Theory, Vol. 2: Detection Theory," Prentice Hall Inc., 1998.

REFERENCES:

1. Harry L. Van Trees, “Detection, Estimation and Modulation Theory, Part 1," John Wiley & Sons Inc. 1968.
2. Jerry M. Mendel, “Lessons in Estimation Theory for Signal Processing, Communication and Control," Prentice Hall Inc., 1995
3. Sophocles J. Orfanidis, “Optimum Signal Processing," 2 nd edn., McGraw Hill, 1988.
4. Monson H. Hayes, “Statistical Digital Signal Processing and Modeling," John Wiley & Sons Inc., 1996.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech. (DECS)

II SEMESTER

IMAGE & VIDEO PROCESSING
(ELECTIVE II)

UNIT I

IMAGE REPRESENTATION: Gray scale and colour Images, image sampling and quantization. Two dimensional orthogonal transforms: DFT, WHT, Haar transform, KLT, DCT.

UNIT II

IMAGE ENHANCEMENT: Filters in spatial and frequency domains, histogram-based processing, homomorphic filtering. Edge detection, non parametric and model based approaches, LOG filters, localization problem.

UNIT III

IMAGE RESTORATION: Degradation Models, PSF, circulant and block - circulant matrices, deconvolution, restoration using inverse filtering, Wiener filtering and maximum entropy-based methods.

UNIT IV

IMAGE SEGMENTATION: Pixel classification, Bi-level Thresholding, Multi-level Thresholding, P-tile method, Adaptive Thresholding, Spectral & spatial classification, Edge detection, Hough transform, Region growing.

UNIT V

FUNDAMENTAL CONCEPTS OF IMAGE COMPRESSION: Compression models, Information theoretic perspective, Fundamental coding theorem.

UNIT VI

LOSSLESS COMPRESSION: Huffman Coding, Arithmetic coding, Bit plane coding, Run length coding, Lossy compression: Transform coding, Image compression standards.

UNIT VII

VIDEO PROCESSING: Representation of Digital Video, Spatio-temporal sampling, Motion Estimation.

UNIT VIII

Video Filtering, Video Compression, Video coding standards.

TEXT BOOKS/REFERENCES:

1. R. C. Gonzalez, R. E. Woods,"Digital Image Processing", Pearson Education. 2nd edition,2002
2. W. K. Pratt, "Digital image processing", Prentice Hall, 1989
3. A. Rosenfold and A. C. Kak, "Digital image processing", Vols. 1 and 2, Prentice Hall, 1986.
4. H. C. Andrew and B. R. Hunt, "Digital image restoration", Prentice Hall, 1977
5. R. Jain, R. Kasturi and B.G. Schunck, "Machine Vision", McGraw-Hill International Edition, 1995
6. A. M. Tekalp, "Digital Video Processing", Prentice-Hall, 1995
7. A. Bovik, "Handbook of Image & Video Processing", Academic Press, 2000

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
M.Tech. (DECS)
II SEMESTER

OPTICAL COMMUNICATION
(ELECTIVE II)

UNIT I

INTRODUCTION: Evolution of fiber types, guiding properties of fibers, cross talk between fibers, coupled modes and mode mixing, dispersion properties of fibers, nonlinear properties of optical fibers, SRS, SBS, intensity dependent refractive index; Fiber design considerations: diameter, cladding, thickness, low and high bit rate systems, characterization of materials for fibers, fiber perform preparation, fiber drawing and control, roles of coating and jacketing;

UNIT II

OPTICAL AND MECHANICAL CHARACTERIZATION OF FIBERS, OPTICAL CABLE DESIGN: Design objectives and cable structures, fiber splicing, fiber end preparation, single and array splices, measurement of splicing efficiency, optical fiber connectors, connector alignments, optical sources for communication, LED, injection lasers, modulation technique, direct and indirect methods, optical waveguide devices

UNIT III

OPTICAL DETECTORS: Photodiodes in repeaters, receiver design, digital and analog, transmission system design, system design choices, passive and low speed active optical components for fiber system, micro-optic components, lens-less components.

UNIT IV

OPTICAL FIBER COMPONENTS: couplers, Isolators and Circulators, Multiplexers, Bragg grating, Fabry-perot Filters, Mach zender interfermometers, Arrayed waveguide grating, tunable filters, hi-channel count multiplexer architectures, optical amplifiers, direct and external modulation transmitters, pump sources for amplifiers, optical switching and wave length converters.

UNIT V

OPTICAL FIBER TECHNIQUES-1: Modulation and demodulation, signal formats, direction detection receivers, coherent detection.

UNIT VI

OPTICAL FIBER TECHNIQUES-2: Optical switching, polarization control, inter office transmission system, trunking system, performance and architecture, under sea cable system, optical fibers in loop distribution system, photonic local network.

UNIT-VII

ACCESS NETWORK: Network architecture, HFC, FTTC, optical access network architecture, deployment considerations, upgrading the transmission capacity, SDM, TDM, WDM, application areas, inter exchange, undersea, local exchange networks; Packaging and cabling of photonics components- photonic packet switching, OTDM, multiplexing and demultiplexing, optical logic gates, synchronization, broadcast OTDM network, OTDM testbeds.

UNIT-VIII

SOLITON COMMUNICATION: Basic principle, metropolitan optical network, cable TV network, optical access network, photonics simulation tools, error control coding techniques, nonlinear optical effects in WDM transmission.

TEXT BOOKS:

1. Gil Held, “Deploying Optical Network Components”.
2. Gerd Kaiser, “Optical Fiber Communication”, McGraw Hill.
3. Rajiv Ramaswamy and Kumar and N. Sivaranjan, “Optical Networks”.

REFERENCES:

1. S E Miller, A G Chynoweth, “Optical Fiber Telecommunication”.
2. S E Miller, I Kaninov, “Optical Fiber Telecommunication II”.
3. I Kaninov, T Li, “Optical Fiber Telecommunication IV B”.
4. John. M. Senior, “Optical fiber communications: Principles and Practice”.
5. Govind Agarwal, “Optical Fiber Communications”.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
M.Tech. (DECS)
II SEMESTER

COMPRESSION TECHNIQUES
(ELECTIVE II)

UNIT I&II

REVIEW OF INFORMATION THEORY: The discrete memoryless information source, Kraft inequality; optimal codes Source coding theorem. Compression Techniques, Lossless and Lossy Compression, Mathematical Preliminaries for Lossless Compression, Huffman Coding, Optimality of Huffman codes, Extended Huffman Coding, Adaptive Huffman Coding, Arithmetic Coding, Adaptive Arithmetic coding, Run Length Coding.

UNIT III

DICTIONARY TECHNIQUES: Static Dictionary, Adaptive Dictionary, LZ77, LZ78, LZW, Applications, Predictive Coding, Prediction with Partial Match, Burrows Wheeler Transform, Sequitur, Lossless Compression Standards (files, text, and images, faxes), Dynamic Markov Compression.

UNIT IV

MATHEMATICAL PRELIMINARIES FOR LOSSY CODING: Rate distortion theory: Rate distortion function R(D),Properties of R(D); Calculation of R(D) for the binary source and the Gaussian source, Rate distortion theorem, Converse of the Rate distortion theorem,

UNIT V

QUANTIZATION: Uniform & Non-uniform, optimal and adaptive quantization, vector quantization and structures for VQ, Optimality conditions for VQ, Predictive Coding, Differential Encoding Schemes.

UNIT VI

MATHEMATICAL PRELIMINARIES FOR TRANSFORMS: Karhunen Loeve Transform, Discrete Cosine and Sine Transforms, Discrete Walsh Hadamard Transform, Lapped transforms-Transform coding, Subband coding, Wavelet Based Compression, Analysis/Synthesis Schemes.

UNIT VII

DATA COMPRESSION STANDARDS: Zip and Gzip, Speech Compression Standards: MPEG, JPEG 2000. MPEG, H264.

UNIT VIII

IMAGE COMPRESSION STANDARDS: Binary Image Compression Standards, Continuous Tone Still Image Compression Standards, Video Compression Standards.

TEXT BOOKS:

1. Khalid Sayood, “Introduction to Data Compression”, Morgan Kaufmann Publishers., Second Edn., 2005.
2. David Salomon, “Data Compression: The Complete Reference”, Springer Publications, 4th Edn., 2006.
3. Thomas M. Cover, Joy A. Thomas, “Elements of Information Theory," John Wiley & Sons, Inc.,1991.

REFERENCES:

1. Toby Berger, "Rate Distortion Theory: A Mathematical Basis for Data Compression", Prentice Hall, Inc., 1971.
2. K.R.Rao, P.C.Yip, "The Transform and Data Compression Handbook", CRC Press., 2001.
3. R.G.Gallager, "Information Theory and Reliable Communication", John Wiley & Sons, Inc., 1968.
4. Ali N. Akansu, Richard A. Haddad, "Multiresolution Signal Decomposition: Transforms, Subbands and Wavelets", Academic Press., 1992
5. Martin Vetterli, Jelena Kovacevic, "Wavelets and Subband Coding", Prentice Hall Inc., 1995.
6. Rafael C. Gonzalez, Richard E. Woods, "Digital Image Processing", Pearson Education.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech. (DECS)

II SEMESTER

COMMUNICATIONS & SIGNAL PROCESSING LAB

1. Simulation Rayleigh Fading Channel Using Either Clarke's Model or Jake's Model for different Dopler Spreads (Ex. 50 Hz and 100 Hz).
2. Generation of Maximal Sequences and Gold Sequences.
3. Design and Simulation FIR Filter Using any Windowing Technique.
4. Design of IIR Filters from Analog Filters.
5. Performance Evaluation of QPSK System over Gaussian AWGN Channel.
6. Performance Evaluation of QPSK System over Rayleigh Fading Channel.
7. Equalization of Multipath Channel using LMS or RLS Algorithms.
8. Performance Evaluation of RAKE Receiver over Slow Fading Channel.

NOTE: Use Matlab / COM SIM.