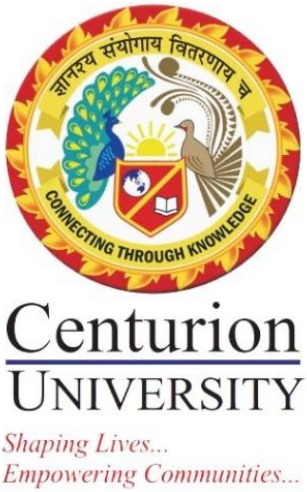
CENTURION UNIVERSITY OF TECHNOLOGY & MANAGEMENT

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING



SYLLABUS of M.Tech in Communication systems

2022

COURSE STRUCTURE OF M.TECH (Communication Systems) (2 Years)

First semester				Second Semester			
Code	**Subject**	**L-T-P**	**Credits**	**Code**	**Subject**	**L-T-P**	**Credits**
MTCS 1101	Advance Digital Signal Processing	3-1-0	4	MTCS 1201	Wireless and Mobile Communication	3-1-0	4
MTCS 1102	Advance Communication systems	3-1-0	4	MTCS 1202	Modern Digital communication Techniques	3-1-0	4
MTCS 1103	Information Theory, coding & cryptography	3-1-0	4	MTCS 1203	Digital Integrated circuits design	3-1-0	4
	Elective---1	3-1-0	4		Elective --- 2	3-1-0	4
Elective---1 (Any One of the following subjects)				Elective --- 2 (Any one of the following subjects)			
CSPE 1101	Digital Image Processing	3-1-0	4	CSPE 1201	EMI / EMC	3-1-0	4
CSPE 1102	Advance Microprocessor& Microcontroller			CSPE 1202	Embedded System Design		
CSPE 1103	High Performance Communication Networks			CSPE 1203	Nano Technology and Applications		
CSPE 1104	Statistical Signal Processing			CSPE 1204	Network Routing Algorithm		
CSPE 1105	Microwave & Radar Engineering			CSPE 1205	Adaptive Signal Processing		
				CSPE 1206	Global Positioning Systems		
CSPR 1107	Advance Commn. System Lab-1	0-0-3	2	CSPR 1207	Advance Commn. System Lab-2	0-0-3	2
CSPT 1108	Seminar (Pre-thesis work)- 1	0-0-3	2	CSPT 1208	Seminar (Pre-thesis work)-2	0-0-3	2
	Semester credits		20		Semester credits		20

THIRD SEMESTER				FOURTH SEMESTER			
CODE	**SUBJECT**	**L-T-P**	**Credits**	**CODE**	**SUBJECT**	**L-T-P**	**Credits**
MTCS 2101	**Telecommunication Switching and Network**	**3-1-0**	**4**	**CSPT 2201**	**Thesis / Project (Part-2)**		**16**
	Elective --- 5	**3-1-0**	**4**				
(Any ONE of the following subjects)							
CSPE 2101	**Wavelets & Multi resolution Processing**						
CSPE 2102	**Speech and Audio Signal Processing**						
CSPE 2103	**Digital Communication Receivers**						
CSPE 2104	**Video Processing and Communication**	**3-1-0**					
CSPT 2105	**Thesis / project (Part-1)**		6				
CSCV 2106	**Comprehensive viva**		**2**				
	Semester credits		**16**		**Semester credits**		**16**

TOTAL CUMULATIVE CREDITS (4 SEMESTERS) ---------- 72

FIRST SEMESTER

MTCS 1101 ADVANCED DIGITAL SIGNAL PROCESSING (3-1-0)

MODULE 1 (10 HOURS) :

Digital Filter design Techniques & DSP algorithms: Brief recapitulation of linear and circular convolution, linear filtering, DFT, Goertzel and chirp- Z transform algorithms, Radix-4 FFT algorithms, Quantization errors in FFT algorithms. Linear phase FIR filters , realizations , FIR filter design using rectangular window, Bartlett window, Hanning window, Hamming window, Kaiser window using MATLAB.

MODULE 2 (15 HOURS):

Multirate DSP: Multirate signal processing, decimation, interpolations, sampling rate conversion, filters in sampling rate alternation systems, MATLAB examples, Polyphase decomposition. Filter banks, decimation & inverse decimation, M-band filter banks reconstruction, trans multiplexers, QMF & CQF filter banks, cosine modulated filter banks, lapped, Orthogonal transforms, Wavelet Transforms.

MODULE 3 (10 HOURS) :

Signal Processing Hardware : Multipliers, dividers, different forms of FIR Hardware, multiplexing, DTTR, TDM to FDM translator, realization of frequency synthesizer, FET hardware realization, different FFT architectures, special FFT processors, convolvers, Lincoln laboratory FDP and the compatible computer configurations.

MODULE 4 (8 HOURS):

Applications of DSP : Speech : Model of speech production, speech analysis – synthesis system vocoder analyzers and synthesizers, linear prediction of speech. DTMF System **.**

TEXT BOOKS :

1. Theory and applications of digital signal processing by Lawrence R. Rabiner and Bernard Gold, PHI
2. Digital Signal Processing. Principles, algorithms, and applications by John G. Proakis and Dimitris G. Manolakis, PHI, 1997.
3. Digital Signal Processing, A Computer – Based approach, by Sanjit K. Mitra, Tata Mc Graw-Hill, 1998.
4. Digital Signal Processors – Emmanuel Ifeachor Barry Jer5. Digital Signal Processors –Architectures , Implementation & applications – Sen M.Kuo woon, Seng S. Gan- PHI .
6. Clark.Cory L " Labview DSP & digital communication" – TMH 2005
7. Digital Signal Processors – Venkataramani, Bhaskar.

MTCS 1102 ADVANCED COMMUNICATION SYSTEMS (3-1-0)

MODULE 1 (15 HOURS)

Data communications: Review of fundamentals concepts of data communications. Data link protocol and data communication networks, data link protocol function, character and bit oriented data link protocols. Asynchronous data link protocol, Synchronous data-link protocols, High level data link control, public switched data networks, Integrated services digital network(ISDN), Asynchronous Transfer mode (ATM) , Local area networks, Ethernet.

MODULE 2 (8 HOURS):

Optical networks: WDM, TDM , Telecommunication infrastructure, switching 3G systems, SONET, SDH, Architecture of optical transport networks, Link management protocols, solutions.Routing and Wavelength Assignment.

MODULE 3 (12 HOURS):

Satellite Communication: Basic transmission theory, system noise temperature and G/T ratio, Design of down links, Domestic satellite systems using small earth stations, uplink design, Design of satellite link for specified (C/N) .Multiple access techniques, frequency division multiple access (FDMA), TDMA, CDMA, Estimating channel requirements. Practical demand access systems, random access, Multiple access with on board processing VSAT.

MODULE 4 (5 HOURS):

Mobile Communication : Mobile telephone service, Transmission protocols, introduction to GSM, GPRS, CDMA switching techniques, Fading, Quality of service (QOS).

TEXT BOOKS:

1. Advanced Communication Systems- Wayne Tomasi- Pearsons Education.
2. Digital communications by Proakis.-PHI
3. Optical networks by Vyless Black- pearson education.
4. Satellite Communication- Timothy Pratt.
5. Related IEEE/IEE Publications.

MTCS 1103 Information Theory, Coding and Cryptography 3-1-0

Module - I

Source Coding

Introduction to information theory, uncertainty of information, Information measure, entropy, source coding Theorem, Huffman Coding, runlength encoding, rate distortion function, JPEG and MPEG standards in image compression.

Channel Capacity and Coding

Channel models, Channel Capacity, Channel Coding, Information Capacity Theorem, The Shannon Limit.

Module - II

Error Control Coding

Linear Block Codes: Introduction, Basic definition, equivalent codes, parity - check matrix, decoding, syndrome decoding, Perfect Codes, Hamming Codes, Optimal Linear codes.

Cyclic Codes

Introduction polynomials, The division Algorithm, Method for generating cyclic codes, Burst Error correction, Fire Codes, Golay Codes, CRC Codes, Circuit implementation.

Bose Chaudhuri Hocquenghem (BCH)

Introduction, Primitive elements, minimum polynomials, Examples of BCH codes, Decoding of BCH codes, Recd - Solomon codes.

Module - III

Convolution Codes

Introduction, Tree Codes and Trellis Codes, Polynomial description, The Generating function, Matrix Description, Viterbi Decoding, Distance bounds, Turbo Codes, Turbo Decoding.

Trellis Coded Modulation (TCM)

Introduction, the concept of coded modulation, Mapping by set Partitioning, Design rules, TCM Decoder.

Module - IV

Introduction To The Concepts Of Security

Introduction, The Need for Security, Security Approaches, Principles of Security, Types of Attacks.

Cryptographic Techniques:

Introduction, Plain Text and Cipher Text, Substitution Techniques, Transposition Techniques, Encryption and Decryption, Symmetric and Asymmetric Key Cryptography, Steganography, Key Range and Key Size, Possible Types of Attacks.

Computer Based Symmetric Key Cryptographic Algorithms:

Introduction, Algorithm Types and modes, An Overview of Symmetric Key Cryptography, Data Encryption Standard (DES), International Data Encryption Algorithm (DEA), RC5, Blowfish, Advanced Encryption, Standard (AEC), Differential and Linear Cryptanalysis

Computer Based Asymmetric Key Cryptographic Algorithms:

Introduction, Brief history of Asymmetric Key Cryptography, An Overview of Asymmetric Key Cryptography, the RSA Algorithm, Symmetric and Asymmetric Key Cryptography Together, Digital Signatures, Knapsack Algorithm, Some other Algorithms.

Textbooks:

*1. Ranjan Bose, **Information Theory, Coding and Cryptography**, 2nd Edn., Tata McGraw-Hill Publishing Co. Ltd., New Delhi, 2008. ISBN-10: 0-07-066901-5, ISBN-13: 978-0-07-066901-7.*

2.*A. Kahate, "Cryptography and Network Security", PHI Publication*

Recommended Reading:

1. *R. Avudaiammal, **Information Coding Techniques**, 2nd Edn., Tat McGraw-Hill Education Pvt. Ltd., New Delhi. ISBN(10): 0-07-067282-2, ISBN(13): 978-0-067282-*

CSPE 1101 DIGITAL IMAGE PROCESSING (3-1-0)

MODULE-I

Introduction

Brief overview of digital image fundamentals, image enhancement, image restoration

Color Image Processing

Color fundamentals, Color models, Pseudo-color image processing, Basics of full-color image processing, Color transformations, smoothing and sharpening, Color segmentation.

MODULE-II

Wavelets and Multi-resolution processing

Introduction, multi-resolution exapansions, wavelet transforms in one dimension, the fast wavelet transform wavelet transforms in two dimensions, wavelet packets.

Image compression

Fundamentals, image compression models, error-free compression, lossy compression, image compression standards.

MODULE-III

Morphological Image Processing

Binary morphology-Dilation and erosion, opening and closing, edge detection and skeleonization, hit-miss, thinning, thiening and pruning, granulometries and pattern spectrum, gray-level morphology.

Image segmentation

Detection of discontinuities, edge linking and boundary detection, thresholding, regionbased
segmentation by morphological watersheds.

MODULE-IV

Representation and Description

Representation, boundary descriptors, regional descriptors, relational descriptors.

Object Recognition

Patterns and pattern classes, recognition based on decision-theoretic methods, structural
methods.

Text Books:

1. Digital image processing by R.C.Gonzalez and R.E.Woods,Pearson
2. Fundamentals of electronic Image processing by Arthur R. weeks.Jr.-PHI

Reference Books:

Digital Image Processing and Analysis by B.Chanda and D.Dutt Majumdar.PHI

CSPE 1102 ADVANCE MICROPROCESSOR & MICROCONTROLLERS 3-1-0

Module -I :

Intel 80286 Microprocessor:

80287 math coprocessor, Salient feature of 80286, Architecture, Pin description, Adressing modes, Special operation, 80286 bus interface, Interfacing 80286 with memory and I/O devices. Interrupt sequencing, Instruction set features.

80386 Microprocessor-80387 Math Coprocessor and 80486:

Salient features of 80386, Architecture, Pin description, Register organization, Addressing modes, Data types, Real address modes of 80386, segmentation, paging, virtual 80386 modes, The co-processor 80387, The CPU with a Numeric Coprocessor-80486.

Module – II:

Design with Atmel Microcontrollers: Atmel Microcontrollers (89CXX and 89C20XX), Architectural Overview of Atmel 89C51 and Atmel 89C2051, Pin Description of 89C51 and 89C2051, Using Flash Memory Devices Atmel 89CXX and 89C20XX, Power Saving

Options.

Applications of MCS-51 and Atmel 89C51 and 89C2051 Microcontrollers: Applications of MCS-51 and Atmel 89C51 and 89C2051 microcontrollers, Square Wave Generation, Rectangular Waves, Pulse Generation, Pulse Width Modulation (PWM), Staircase Ramp Generation, Sine Wave Generation, Pulse Width Measurement, Frequency Counter.

Introduction to PIC Microcontrollers: PIC Microcontrollers – Overview and Features, PIC 16C6X/7X, FSR (File Selection Register) [Indirect Data Memory Address Pointer], PIC ResetActions, PIC Oscillator Connections, PIC Memory Organization, PIC 16C6X/7X Instructions,Addressing Modes, I/O Ports, Interrupts in PIC 16C61/71, PIC 16C61/71 Timers, PIC 16C71 Analog-to-Digital Converter (ADC).

Module - III

Introduction to PIC PIC 16F8XX Flash Microcontrollers: Introduction, Pin Diagram of 16F8XX, STATUS Register, OPTION_REG Register, Power Control Register (PCON), PIC 16F8XX Program Memory, PIC 16F8XX Data Memory, DATA EEPROM and Flash Program EEPROM, Interrupts in 16F877, I/O Ports, Timers.

Interfacing and Microcontroller Applications: Introduction, Light Emitting Diodes (LEDs), Push Buttons, Relays and Latch Connections, Keyboard Interfacing, Interfacing 7-Segment Displays, LCD Interfacing, ADC and DAC Interfacing with 89C51 Microcontrollers.

Module - IV

Industrial Applications of Microcontrollers: Introduction, Measurement Applications, Automation and Control Applications.

Advanced Programming and Math Calculations: Introduction, Fixed-Point Numbers, Addition of two 16-bit Numbers, Unsigned 32-bit Addition, Subtraction of Two 16-bit Numbers, Conversion of 8-bit Signed Number into a 16-bit Signed Number, 16-bit Signed Addition, Binary to BCD Conversion, Square Root Calculations, Integration, Differentiation, Floating-Point Arithmetic.

Text Books:

1. Bary B Brey, **Intel 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium and Pentium processor Architecture, programming and Interfacing**, Pearson Education
2. A.k. Ray & K.M. Bhurchandi**, Advanced Microprocessor & Peripherals**, TMH Publication.
3. Ajay V. Deshmukh, **Microcontrollers [Theory and Applications]**, TMH, New Delhi, 2005.

Reference Books:

1. Myke Predko, **Programming and Customizing the PIC Microcontroller**, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2008.
2. John B. Peatman, **Design with PIC Microcontrollers**, Pearson Education, 2005.
3. Han Way Huang, **PIC Microcontroller**, Cengage Learning.
4. Martin Bates, **PIC Microcontrollers**, 2nd Edition, Elsevier Publications.

CSPE 1103 High Performance Communication Networks 3-1-0

Module-I: TCP/IP and Local Area Networks (16)

OSI and TCP/IP Reference models, The Internet Protocol – IPv4 - IP Packet (Header), IP Addressing, Subnet Addressing, Classless Inter domain Routing (CIDR), Fragmentation and Reassembly, IPv6 Header Format, Network Addressing, User Datagram Protocol (UDP), Transmission Control Protocol – TCP Segment and Connection Establishment (Three Way Hand Shake), Ethernet (IEEE 802.3), Token Ring (IEEE 802.5), FDDI, Wireless LAN (IEEE 802.11) – Frame Structure and Addressing,

Module-II: Data Link Layer and Network Layer (14)

Error Detection and Correction – Two-Dimensional Parity Checks, Internet Checksum,ARQ Protocols and Reliable Data Transfer Service – Stop and Wait, Go Back–N, Selective Repeat Sliding Window Protocols, Channelization – FDMA, TDMA and CDMA, Shortest Path Routing – Dijkstra's Algorithm, TCP Congestion Control, ISDN – Overview, ISDN Channels, LAP-D Protocol and Broadband ISDN

Module-III: ATM and Frame Relay (14)

ATM Layer – ATM Cell Header, Quality of Service Parameters and Traffic Management, ATM Adaptation Layer, ATM Signalling

Frame Relay Protocol Architecture and User Data Transfer, Frame Relay Congestion Control,

Module-IV: Advance Network Architecture (12)

Integrated services in the internet, Resource Reservation Protocol – RSVP Architecture, RSVP Message Format, Differentiated Services, Network Interconnection Models – Overlay Model and Peer to Peer Model.

Text Book:

1 Alberto Leon Gracia, Indra Widjaja, "Communication Networks", Second Edition, Tata McGraw-Hill Publishers, New Delhi, 2004.

2 William Stallings, "Data and Computer Communications", Eighth Edition, Pearson, 2007

Reference Book:

1 Behrouz A Forouzan, "Data Communications and Networking", Fourth Edition, Tata McGraw-Hill Publishers, New Delhi, 2006.

2 Andrew S. Tanenbaum, "Computer Networks" Fourth Edition, Pearson, 2003.

CSPE 1104 STATISTICAL SIGNAL PROCESSING 3-1-0

Module - I

Estimating in Signal Processing, Mathematical Estimation Problem, Assessing Estimator Performance, Minimum Variance Unbiased Estimation: Unbiased Estimators, Minimum Variance Criterion, Existence of the Minimum Variance Unbiased Estimator, Finding the Minimum Variance Unbiased Estimator, Cramer Rao Lower Bound, Estimator Accuracy considerations, CRLB, CRLB for signals in White Gaussian Noise, Transformation of Parameters, Signal Processing Examples.

Module -II

Maximum Likelihood Estimation: Introduction, Finding the MLE, Properties of the MLE, MLE for transformed parameters, Numerical Determination of the MLE, Asymptotic MLE,Signal Processing Examples, Least Squares Estimation: Introduction, Least Squares Approach, Linear Least Squares, Geometrical Interpretations, Order Recursive Least Squares,Signal Processing Examples.

Module -III

Bayesian Estimation: Introduction, Prior Knowledge and Estimation, Choosing a prior PDF, Properties of the Gaussian PDF, Bayesian Linear Model, Nuisance Parameters, Bayesian Estimation for Deterministic Parameters, Derivation of Conditional Gaussian PDF.

Module -IV

Statistical Decision Theory: Neyman - Pearson Theorem, Receiver Operating Characteristics, Irrelevant Data, Minimum Probability of Error, Bayes Risk, Multiple Hypothesis Testing -Composite Hypothesis Testing, Composite Hypothesis Testing Approaches, Performance of GLRT, Multiple Hypothesis Testing.

Deterministic Signals, Matched Filters, Generalized Matched Filters, Multiple Signals, Linear Model, Signal Processing Examples, Random Signals, Estimator Correlator, Linear Model, Estimator Correlator for Large Data Records, General Gaussian Detection, Signal Processing Example.

Text Book:

1. Steven M. Kay, “Fundamentals of Statistical Signal Processing Volume I Estimation Theory”, Prentice Hall PTR, 1993.

2. Steven M. Kay, “Fundamentals of Statistical Signal Processing Volume II Detection Theory”, Prentice Hall PTR, 1998.

Reference Book:

1. Monson H. Hayes, “Statistical Digital Signal Processing and Modeling”, Wiley, 1996

CSPE 1105 MICROWAVE AND RADAR ENGINEERING (3-1-0)

MODULE 1:

Introduction to microwaves and applications, advantages of microwaves, EM spectrum domain, electric and magnetic fields static electric and magnetic fields, time varying electric and magnetic fields, electromagnetic field equations, maxwell’s equations for time-varying fields, meaning of maxwell’s equations, characteristics of free space, power flow by microwaves, expression for propagation constant of a microwave in conductive medium, microwave applications, relation between dB, dBm, dBμ.

MODULE 2:

Microwave Tubes Limitation of conventional tubes, microwave tubes, velocity modulation, method of producing the velocity modulation, principle of operation of two cavity klystron, reflex klystron principle of operation, velocity modulation in reflex klystron, applegate diagram with gap voltage for a reflex klystron. Principle of operation of magnetron, hull cutoff

condition, advantages of slow wave devices, principle of operation of TWT.

MODULE – 3

The radar equation in terms of the key radar parameters and target-radar cross section. False alarm, minimum detectable signal, Receiver noise and the SNR. Probabilities of detection and False alarm, integration of radar pulses, radar cross section of targets; complex targets, transmitted power, prf, antenna parameters, beam shape, cosecant-squared antenna pattern; basic ideas on system losses

MTI and pulse doppler radar, delay line canceller, doppler effect on blind speeds in MTI, staggered prf. doppler filter banks, digital MTI processing, Limitations to MTI performance MTI from a moving platform (AMTI), pulse doppler radar, FM-CW radar for range and velocity determination, SLAR & SAR

Module – 4

Tracking with radar, monopulse tracking, amplitude comparison monopulse, phase-comparison monopulse, conical scan and sequential lobing, Glint (example from a simple target model) tracking in range. Target acquisition, servo system tracking in doppler, track with scan (limited sector scan), Automatic tracking with surveillance Radars.

Textbooks :

1 ."Microwave Engineering" by Prof. GSN Raju, IK International Publishers, 2007

2. "Microwave Engineering" by P.A. Rizzi, PHI, 1999.

3. Introduction to Radar system (3rd Edition); Merrill L. Skolnik Tata McGraw Hill publishing ltd.

Reference books

Ridenour, L. N. Radar System Engineering, MIT radiation laboratory series, Vol. I & II,
New York: Mc Graw Hill 1047.

2. Krous, J. D. Antennas, 2nd Edition. Mc Graw Hill, 1988

3. Nathanson, F. E. Radar Design Principle, 2nd Edition, Mc Graw Hill, 1991 (N.Y.)

4. Barton, D. K. Modern Radar System Analysis, Norwood, MA: Ar.Tech House, 1988

CSPR 1107 ADVANCE COMMUNICATION SYSTEMS LAB – 1 (0-0-3)

The following Experiments to be performed using LABVIEW S/W:

1. To study various window types (Hanning, Hamming, Blackman, Kaiser).
2. To study DFT and determine its response(DFT coefficients & phase) for different type of signals.
3. To study FIR filter with different topology and to study its response.
4. To study different modulation techniques (ASK, PSK, FSK, QPSK).

Experiments performed using closed loop learning process- Multisim.

5. TDM-PAM : Modulation and Demodulation.
6. Operation of a PCM encoder and decoder.
7. Light detectors and characteristics, Application of a LED/ LASER source to send data and recovery using photo detectors.
8. Frequency multiplier using phase locked loop.

To study / Plot the sensitivity characteristics of AM radio receivers

SECOND SEMESTER

MTCS 1201 WIRELESS AND MOBILE COMMUNICATION (3-1-0)

MODULE 1: Introduction to wireless Mobile communications, personal Communication services (PCS): PCS architecture, Mobility, Types of mobile wireless services/ systems. Cellular, WLL, Paging, Satellite systems, Standard management, Networks signalling. Global system for Mobile communication (GSM) system overview: GSM Architecture, Mobility Management, Network signalling. Future trends in personal wireless systems.

MODULE 2: Cellular concept and system design fundamentals. Cellular concept and frequency reuse, Multiple Access schemes, channel assignment and handoff, Interference and system capacity, Trunking and Erlang capacity calculations; cellular concept, spectral efficiency; design parameters at base station: antenna configurations, noise power and field strength; design parameters at mobile unit: directional antennas and diversity schemes: frequency dependency; noise; antenna connections; field component diversity antennas; signalling and channel access; word-error-rate, channel assignment.

MODULE 3: History and evolution of mobile radio systems; General Packet Radio Services (GPRS): GPRS Architecture, GPRS network nodes. Mobile data communication WLANs (Wireless LANs) IEEE 802.11 standard, Mobile IP. Wireless Application Protocol (WAP): The mobile Internet standard, WAP Gateway and Protocols, Wireless Mark-up language (WML). Third Generation (3G) Mobile services: Introduction to International Mobile Telecommunications 2000 (IMT 2000) vision , Wideband code division Multiple Access(W-CDMA), and CDMA 2000, Quality of services in 3G.

MODULE 4: Wireless local loop (WLL) : Introduction to WLL Architecture , WLL technologies. Global Mobile Satellite systems: case studies of IRIDIUM and Global star systems. Bluetooth technology and WI-Max.

Text Books:

1. 'Wireless and mobile networks Architecture" by Yi-Bing Lin & Imrich chlamatac, John Wiley & sons, 2001.
2. " Mobile & personnel communication systems and services," by Raj Pandya, Pretice Hall India, 2001.
3. " Wireless communication –Principles and Practices," 2nd Ed, Theodore S, Rappaport, Pearson Education Pvt.Ltd, 2003.
4. "Mobile Comminications," Jochen Schilles, Pearson Education Pvt.Ltd.2002.
5. "The Wireless Application Protocol" Singhal Bridgman et.al., Pearson Education,2004.

Reference books:

1. "Principles of Mobile Computing" 2nd Edition, Hensmann, Merk & Stobes, Springer, International Edition,2003.
2. AdHoc Wireless Networks: Architecture and Protocols, I/e Authors; C.Siva Ram Murthy, B.S.Manoj.
3. Modern wireless communications, I/e Authors; Simon Haykin, Michael Moher.
4. " Mobile Computing'" Talukdar & Yaragal TMH, 2005.
5. "3G Wireless Networks", Smith & Collins, TMH, 2007.

MTCS 1202 MODERN DIGITAL COMMUNICATION TECHNIQUES

Module 1: (12 hrs)

Deterministic & Random Signal Analysis

Bandpass & Lowpass Signals, Lowpass Equivalent of Bandpass Signals, Energy Considerations, Lowpass Equivalent of a Bandpass System. Vector Space Concepts, Signal Space Concepts, Orthogonal Expansions of Signals, Gram-Schmidt Procedure. Bounds on Tail Probabilities, Limit Theorems for Sum of Random Variables. Complex Random Vectors. WSS Random Process, Cyclostationary Random Process, Proper and Circular Random Process, Markov Chains. Sampling Theorem for Band-limited Random Process, The Karhunen-Loeve Expansion. Banpass and Lowpass Random Processes.

Module 2: (18 hrs)

Digital Modulation Scheme

Representation of Digitally Modulated Signals, Memoryless Modulation Methods; Pulse Amplitude Modulation, Phase Modulation, Quadrature Amplitude Modulation, Multidimensional Signaling. Signaling Schemes With Memory; Continuous-Phase Frequency-Shift Keying, Continuous-Phase Modulation. Power Spectrum of Digitally Modulated Signals; Power Spectral Density of a Digitally Modulated Signal With Memory, Power Spectral Density of Linearly Modulated Signals, Power Spectral Density of Digitally Modulated Signals With Finite Memory, Power Spectral Density of Modulated Schemes With a Markov Structure, Power Spectral Density of CPFSK and CPM Signals.

Optimum Receivers for AWGN Channels

Waveform and Vector Channel Models; Optimum Detection for a General Vector Channel. Waveform and Vector AWGN Channels; Optimal Detection for the Vector AWGN Channel, Implementation of the Optima Receiver for the AWGN Channels. Optimal Detection and Error Probability for ASK, PAM,PSK AND QAM Signaling. [

Carrier and Symbol Synchronization

Signal Parameter Estimation; The Likelyhood Function, Carrier Recovery and Symbol Synchronization in Signal Demodulation. Carrier Phase Estimation; Maximum Likelyhood Carrier Phase Estimation, The Phase-Locked Loop, Effect of Additive Noise in the Phase Estimate. Symbol Timing Estimation; Maximum Likelyhood Timing Estimation.

Module 3: (15 hrs)

Digital Communication Through Band-Limited Channels

Characterization of Band-Limited Channels. Signal Design for Band-Limited Channels; Design of Band-Limited Signals for No Intersymbol Interference-The Nyquist Criterion, Optimum Maximum-Likelihood Receiver.

Multichannel and Multicarrier Systems

Multichannel Digital Communications in AWGN Channels; Binary Signals, M-ary Orthogonal Signals. Multicarrier Communications; Single Carrier verses Multicarrier Modulation, Capacity of a Nonideal Linear Filter Channel, OFDM, Modulation & Demodulation in an OFDM, An FFT Algorithm Implementation of an OFDM System.

Spread Spectrum Signals for Digital Communication

Model of Spread spectrum Digital Communication System. Direct Sequence Spread Spectrum Signals; Error Rate Performance of the Decoder, Some Applications of DS Spread Spectrum Signals. Frequency-Hopped Spread-Spectrum Signals; Performance of FH Spread Spectrum Signals in an AWGN Channel, A CDMA System Based on FH Spread Spectrum Signals.

Text Book

1. John G. Proakis and Masoud Salehi, ***Digital Communication***, McGraw-Hill, 5th Edition

Reference Books

1. Simon Haykin, ***Digital Communication***, Willy
2. Tube & Schilling, ***Principle of Communication***, PHI

MTCS 1203 DIGITAL INTEGRATED CIRCUIT DESIGN (3-1-0)

MODULE – I (11 hours)

Introduction, Design Metrics and Manufacturing Process:

A Historical Perspective, Issues in Digital Integrated Circuit Design, Quality Metrics of a Digital Design, Introduction to Manufacturing Process, Manufacturing CMOS Integrated Circuits, Design Rules – The Contract between Designer and Process Engineer, Packaging Integrated Circuits

The Devices:

Introduction, The Diode, The MOS(FET) Transistor, The Wire, Interconnect Parameters – Capacitance, Resistance, and Inductance, Electrical Wire Models, SPICE Wire Models

The CMOS Inverters and CMOS Logic Gates – the Static View:

Introduction to CMOS Inverter, The Static CMOS Inverter – An Intuitive Perspective, Evaluating the Robustness of the CMOS Inverter, Introduction to Static CMOS Design, Complementary CMOS, Ratioed Logic, Pass-Transistor Logic

CMOS Inverter – the Dynamic View:

Performance of CMOS Inverter: The Dynamic Behavior, Power, Energy, and Energy-Delay, Perspective: Technology Scaling and its Impact on the Inverter Metrics

MODULE – II (11 hours)

Dynamic CMOS Logic, Timing Metrics:

Dynamic CMOS Design, CMOS Logic Design Perspectives, Timing Metrics: Timing Metrics for Sequential Circuits, Classification of Memory Elements

Static and Dynamic Sequential Circuits:

Static Latches and Registers, Dynamic Latches and Registers, Alternative Register Styles: Pulse Registers and Sense-Amplifier Based Registers, Pipelining: An Approach to Optimize Sequential Circuits – Latch Vs Register-Based Pipelines and NORA-CMOS – A Logic Style for Pipelined Structures, Nonbistable Sequential Circuits

Coping with Interconnect:

Introduction, Capacitive Parasitics, Resistive Parasitics, Inductive Parasitics, Advanced Interconnect Techniques, Networks-on-a-Chip

Timing Issues in Digital Circuits:

Introduction, Timing Classification of Digital Systems, Synchronous Design – An In-depth Perspective, Self-Timed Circuit Design, Synchronisers and Arbiters, Clock Synthesis and Synchronisation Using a Phase-Locked Loop, Future Directions and Perspectives

MODULE – III (12 hours)

Designing Arithmetic Building Blocks:

Introduction, Datapaths in Digital Processor Architecture, The Adder, The Multiplier, The Shifter,

Other Arithmetic Operators, Power and Speed Trade-off's in Datapath Structures, Perspective: Design as a Trade-off

Designing Memory and Array Structures:

Introduction, The Memory Core, Memory Peripheral Circuitry, Memory Reliability and Yield, Power Dissipation in Memories, Case Studies in Memory Design: The PLA, A 4-Mbit SRAM and A 1-Gbit NAND Flash memory, Perspective: Semiconductor Memory Trends and Evolution

Validation and Test of Manufactured Circuits:

Introduction, Test Procedure, Design for Testability, Test Pattern Generation

Textbooks:

1. Jan M. Rabaey, Anantha Chandrakasan, Borivoje Nikolic, ***Digital Integrated Circuits*** – A Design Perspective**,** 2nd edn., Pearson Education, 2003. ISBN: 8178089912.

Recommended Reading:

2. K. Eshraghian, and N.H.E. Weste, Principles of CMOS VLSI Design – a Systems Perspective, 2nd edn., Addison Wesley, 1993.
3. Wayne Wolf,***Modern VLSI Design System–on–Chip Design***, 3rd edn,Pearson Ed, 2003.
4. M. Michael Vai, ***VLSI Design***, CRC Press, 2001.
5. John P. Uyemura, ***CMOS Logic Circuit Design***, Springer (Kluwer Academic Pub), 2001. 6.Ken Martin, ***Digital Integrated Circuit Design***, Oxford University Press, 2000.

EMI / EMC (3-1-0)

MODULE 1: (10 HOURS)

Introduction, Natural and Nuclear sources of EMI / EMC: Electromagnetic environment, History, Concepts, Practical experiences and concerns, frequency spectrum conservations. An overview of EMI / EMC, Natural and Nuclear sources of EMI. EMI from apparatus, circuits and open area test sites - Electromagnetic emissions, noise from relays and switches, non-linearities in circuits, passive intermodulation, cross talk in transmission lines, transients in power supply lines, electromagnetic interference (EMI). Open area test sites and measurements.

MODULE 2 : (10 HOURS)

Radiated and conducted interference measurements and ESD : Anechoic chamber, TEM cell, GH TEM Cell, characterization of conduction currents / voltages, conducted EM noise on power lines, conducted EMI from equipment, Immunity to conducted EMI detectors and measurements. ESD, Electrical fast transients / bursts, electrical surges.

MODULE 3 (10 HOURS):

Grounding, shielding, bonding and EMI filters : Principles and types of grounding, shielding and bonding, characterization of filters, power lines filter design. Cables, connectors, components and EMC standards - EMI suppression cables, EMC connectors, EMC gaskets, Isolation transformers, opto isolators, National / International EMC standards.

Text Books :

1. Engineering Electromagnetic Compatibility by Dr. V.P. Kodali, IEEE Publication, Printed in India by S. Chand & Co. Ltd., New Delhi, 2000.

2. Electromagnetic Interference and Compatibility IMPACT series, IIT – Delhi,

EMBEDDED SYSTEM DESIGN (3 – 0 – 0)

MODULE – I (11 hours)

Introduction to Embedded Computing: Terms and scope, Application areas, Growing importance of embedded systems.

Specifications: Requirements, Models of computation, State Charts: Modeling of hierarchy, Timers, Edge labels and State Charts semantics, Evaluation and extensions, General

language characteristics: Synchronous and asynchronous languages, Process concepts, Synchronization and communication, Specifying timing, Using non-standard I/O devices, SDL, Petri nets: Introduction, Condition/event nets, Place/transition nets, Predicate/transition nets, Evaluation, Message Sequence Charts, UML, Process networks: Task graphs, Asynchronous message passing, Synchronous message passing, Java, VHDL: Introduction, Entities and architectures, Multi-valued logic and IEEE 1164, VHDL processes and simulation semantics, System C, Verilog and System Verilog, Spec C, Additional languages, Levels of hardware modelling, Language comparison, Dependability requirements.

MODULE – II (11 hours)

Embedded System Hardware: Introduction, Input: Sensors, Sample-and-hold circuits, A/D-converters, Communication: Requirements, Electrical robustness, Guaranteeing real-time behaviour, Examples, Processing units: Application-Specific Circuits (ASICs), Processors, Reconfigurable Logic, Memories, Output: D/A-converters, Actuators.

Standard Software: Embedded Operating Systems, Middleware, and Scheduling: Prediction of execution times, Scheduling in real-time systems: Classification of scheduling algorithms, Aperiodic scheduling, Periodic scheduling, Resource access protocols, Embedded operating systems: General requirements, Real-time operating systems, Middleware: Real-time data bases, Access to remote objects

MODULE – III (12 hours)

Implementing Embedded Systems: Hardware/Software Co-design: Task level concurrency management, High-level optimizations: Floating-point to fixed-point conversion, Simple loop transformations, Loop tiling/blocking, Loop splitting, Array folding, Hardware/software partitioning: Introduction, COOL, Compilers for embedded systems: Introduction, Energy-aware compilation, Compilation for digital signal processors, Compilation for multimedia processors, Compilation for VLIW processors, Compilation for network processors Compiler generation, retargetable compilers and design space exploration, Voltage Scaling and Power Management: Dynamic Voltage Scaling, Dynamic power management (DPM), Actual design flows and tools: SpecC methodology, IMEC tool flow, The COSYMA design flow, Ptolemy II, he OCTOPUS design flow.

Validation: Introduction, Simulation, Rapid prototyping and emulation, Test: Scope, Design for testability and Self-test programs, Fault simulation, Fault injection, Risk- and dependability analysis, Formal verification.

Textbooks:

1. Peter Marwedel, ***Embedded System Design***, Springer, 2006 http://ls12-www.cs.uni-dortmund.de/~marwedel/kluwer-es-book/

Recommended Reading:

1. Wayne Wolf, ***Computers as Components***, Morgan Kaufmann, 2001
http://www.ee.princeton.edu/~wolf/embedded-book

2. G. De Micheli, Rolf Ernst and Wayne Wolf, eds, ***Readings in Hardware/Software Co-Design***, Morgan Kaufmann, ***Systems-on-Silicon Series Embedded***
3. Frank Vahid and Tony D. Givargis, ***System Design: A Unified Hardware/Software Introduction***, Addison Wesley, 2002.
4. Michael Barr, ***Programming Embedded Systems in C and C++***, O'Reilly, 1999.
5. David E. Simon, ***An Embedded Software Primer***, Addison Wesley, 1999.
6. Jack Ganssle, The Art of Designing Embedded Systems, Newnes, 2000.
7. K. Short, Embedded Microprocessor System Design, Prentice Hall, 1998.
C. Baron, J. Geffroy and G. Motet, Embedded System Applications, Kluwer, 1997.

NANOTECHNOLOGY AND APPLICATIONS (3-1-0)

MODULE - I

INTRODUCTION : Nano and nature, Our technologies and the starting of Nano;

FULLERENES: Introduction, Discovery and Early years (in brief); Optical properties and some unusual properties of fullerenes.

MODULE - II

INVESTIGATION & EXPERIMENTAL METHODS : Introduction, Electron Microscopies, Scanning Electron Microscope (main points), Transmission Electron Microscope, Image Collection in Electron Microscopes, Scanning Tunneling Microscopy, Atomic Force Microscopy, Scanning Probe Lithography, Optical microscopies - Confocal microscopy, Scanning nearfield optical microscopy; X-ray Diffraction [the main points of the above mentioned experimental methods].

MODULE – III

CARBON NANOTUBES : Introduction and basic structure, Electrical Properties, vibrational properties, Mechanical properties; **Applications** – field emission and shielding, computers, fuel cells, catalysis, mechanical reinforcement.

MODULE - VI

APPLICATIONS :

Nanosensors : Introduction, nanosensor, Nanosensors based on optical properties, Electrochemical sensors, Sensors based on physical properties, Nanbiosensors, smart dust – sensors of the future; Nanotribology – Introduction, Nanotribometer; Nanomedicine – Introduction, Nanoshells, Nanopores, Tectodendrimers; Nanotechnology in Diagnostic applications.

TEXT BOOKS :

Nano: The Essentials – Understanding Nano Science and Nanotechnology by T. Pradeep; Tata Mc.Graw Hill.

2. Introduction to Nanotechnology, by Charles Poole and Frank Owens, Wiley India, 2007.

REFERENCE BOOKS :

1. Nanoelectronics and Nanosystems: From Transistors to Molecular and Quantum Devices, by Karl
Goser, K. Glosekotter, J. Dienstuhl, Springer, third reprint 2009. (for detailed study)
2. Nanotechnology and Nano Electronics – Materials, devices and measurement Techniques by W.R.
Fahrner; Springer. (for detailed study)
3. K.E. Drexler, “Nano Systems”, Wiley, (1992).

NETWORK ROUTING ALGORITHM (3-1-0)

MODULE - I

CIRCUIT SWITCHING NETWORKS (7 Hour)

AT &T’s dynamic Routing Network, Routing in Telephone Network – Dynamic Non Hierachical Routing – Trunk Status Map Routing – Real Time Network Routing, Dynamic Alternative Routing – Distributed Adaptive Dynamic Routing – Optimized Dynamic Routing.

MODULE - II

PACKET SWITCHING NETWORKS(8 Hour) Distance vector routing, Link state Routing, Inter domain routing – Classless Interdomain Routing (CIDR), Interior Gateway Routing Protocols (IGRP) – Routing Information Protocol (RIP), Open Shortest Path First (OSPF), Exterior Gateway Routing Protocol(EGRP) – Border Gateway Protocol (BGP), Apple talk routing & SNA Routing .

MODULE - II

PACKET SWITCHING NETWORKS(8 Hour) Distance vector routing, Link state Routing, Inter domain routing – Classless Interdomain Routing (CIDR), Interior Gateway Routing Protocols (IGRP) – Routing Information Protocol (RIP), Open Shortest Path First (OSPF), Exterior Gateway Routing Protocol(EGRP) – Border Gateway Protocol (BGP), Apple talk routing & SNA Routing .

MODULE – III HIGH SPEED NETWORKS (10 Hour)

Routing in optical networks – The Optical Layer, Node Designs, Network design and operation, Optical layer cost tradeoffs, Routing and wavelength assignment, Architectural variations.

Routing in ATM networks – ATM address structure, ATM Routing, PNNI protocol, PNNI signaling protocol Routing in PLANET networks &Deflection Routing.

operation, Optical layer cost tradeoffs, Routing and wavelength assignment, Architectural variations.

MODULE - IV MOBILE NETWORKS (15 Hour)

MOBILE NETWORKS (15 Hour)

Routing in cellular radio mobile communication networks – Mobile Network Architecture, Mobility management in cellular systems, Connectionless Data service for cellular systems, Mobility and Routing in Cellular Digital Packet Data (CDPD) network, Packet radio Routing – DARPA packet radio network, Routing algorithms for small, medium, large sized packet radio networks.

MOBILE AD-HOC NETWORKS(MANET)

Internet based mobile ad-hoc networking, communication strategies, routing algorithms – Table –Driven routing - Destination sequenced Distance Vector(DSDV), Source initiated on-demand routing - Dynamic source Routing (DSR), Ad-hoc On demand Distance Vector(AODV), Hierarchical based routing – Cluster head Gateway Switch Routing (CGSR) & Temporarily-Ordered Routing algorithm (TORA), Quality of service.

References:

1. M.Steen Strub, "**Routing in Communication networks**", Prentice Hall International, New York,1995
2. William Stallings, "**High speed Networks TCP/IP and ATM Design Principles**", Prentice Hall International,New York,1998.
3. Behrouz A Forouzan, "**Data Communication and Networking (3/e)**", TMH, 2004.
4. William Stallings, "**ISDN and Broadband ISDN with Frame Relay and ATM** ", PHI, New Delhi, 2004.
5. Mohammad Ilyas, "**The Handbook of Ad hoc Wireless Networks**", CRC Press, 2002.
6. Vijay K.Garg, "**Wireless Network Evolution: 2G to 3G**", Pearson Education, New Delhi, India, 2003.
7. Rajiv Ramaswami and Kumar N. Sivarajan, "**Optical Networks**", Morgan Kaufmann Publishers, 1998.

8. Sumit Kasera and Pankaj Sethi, "**ATM Networks**", Tata McGraw-Hill Publishing Company Limited, New Delhi. 2001
9. "**Internetworking Tecnologies Handbook**", 4th Edition, Cisco Systems, ILSG Cisco Systems, 2003.

10. IEEE Journal on Selected areas in Communications, Special issue on Wireless Ad hoc Networks, Vol 17,No.8,1999
11. Scott.M., Corson, Joseph.P. Macker, Gregory.H.Cirincione,IEEE Internet Computing Vl.3,No.4,Jul-Aug 1999
12. Alder.M.. Scheideler.Ch.Annual ACM Symposium on Parallel Algorithms and Architectures, ACM, New York 1998.
13. http://www.cisco.com/univercd/cc/td/doc/cisintwk/ito_doc/
14. http://www.moment.cs.ucsb.edu

ADAPTIVE SIGNAL PROCESSING (3 – 0 – 0)

MODULE – I (11 hours)

Adaptive System

Definition and Characteristics, Areas of Application, Example of an Adaptive System, Adaptive Linear Combiner, The Performance Function, Gradient and Minimum Mean-Square Error, Alternative Expression of the Gradient, Decorrelation of Error and Input Components.

Winer Filter

Linear Optimum Filtering, Principle of Orthogonality, Minimum Mean Square Error, Winer-Hopf Equation, Error Performance Surface

Linear Prediction

Forward Linear Prediction, Backward Linear Prediction, Properties of Prediction Error Filters.

MODULE – II (11 hours)

Method of Steepest Descent

Basic Idea of Steepest-Descent Algorithm, Steepest-Descent Algorithm Applied to Winer Filter, Stability of Steepest-Descent Algorithm, Limitations of Steepest-Descent Algorithm.

Least-Mean Square Adaptive Filter

Overview, LMS Adaptation Algorithm, Application, Comparison of LMS With Steepest-Descent Algorithm

Normalized Least-Mean Square Adaptive Filter

Normalized LMS Filter as the Solution to Constrained Optimization Problem, Stability of the NLMS

MODULE – III (11 hours)

Frequency-Domain and Subband Adaptive Filters Block Adaptive Filters.

RLS Adaptive Filters

Statement of Linear Least-Square Estimation Problem, Matrix Inversion Lemma, The Exponentially Weighted RLS Algorithm.

Kalman Filter

Recursive Minimum Mean-Square Estimation For Scalar Random Variable, Kalman Filtering Problem, Initial Conditions, Summary of Kalman Filter.

Textbooks:

1.Bernard Widrow and Samuel D. Stearns, ***Adaptive Signal Processing***, Pearson Education.
2.Simon Haykin, ***Adaptive Filter Theory***, 4th Edn. Pearson Education.

Reference Books:

1. Theory and Design of Adaptive Filters, - J.R. Treichler, C.R. Johnson Jr. and M.G. Larimore, PHI.
2. Adaptive Filters, - C.F.N. Cowan and P.M. Grant, Prentice Hall.

GLOBAL POSITIONING SYSTEM AND APPLICATIONS

MODULE 1:

Overview of GPS : Basic concept, system architecture, space segment, user segment, GPS aided Geo-augmented navigation (GAGAN) architecture. GPS Signals: Signal structure, anti-spoofing (AS), selective availability, Difference between GPS and GALILEO satellite construction.

MODULE 2:

GPS coordinate frames, Time references : Geodetic and Geo centric coordinate systems, ECEF coordinate world geodetic 1984 (WGS 84), GPS time. GPS orbits and satellite position determination : GPS orbital parameters, description of receiver. independent exchange format (RINEX) – Observation data and navigation message data parameters, GPS position determination.

MODULE 3:

GPS Errors: GPS error sources – clock error, ionospheric error, tropospheric error, multipath, ionospheric error estimation using dual frequency GPS receiver.

Textbooks :

1. B. Hoffman – Wellenhof, H. Liehtenegger and J. Collins, 'GPS – Theory and Practice', Springer – Wien, New York (2001).

Reference Books :

1. James Ba – Yen Tsui, 'Fundamentals of GPS receivers – A software approach', John Wiley & Sons (2001).

Course : M.Tech(Communication System) 2nd semester

ADVANCED COMMUNICATIONS LABORATORY-2 2credit [0-0-3]

*Experiments involving Communication, Image Processing and Speech Processing using MATLAB and LabVIEW.

Design and Simulation of

1. TDMA (Time Division Multiple Access) technique using LabVIEW.
2. CDMA (Code Division Multiple Access) technique using LabVIEW.
3. Costas loop for Carrier recovery.
4. TDMA (Time Davison Multiple Access) technique.
5. CDMA (Code Division Multiple Access) technique.
6. Effect of Sampling and Quantization of Digital Image.
7. Various Transforms (Fourier, Walsh, Hadamad, Hartley).

8. Multicarrier CDMA system for single user in presence of frequency selective fading channel.
9. Wavelet method of de-noising in signals and image.
10. Echo cancellation in speech signal using NLMS.
11. Filters using LMS Algorithm

THIRD SEMESTER

MTCS 2101 Telecommunication Switching & Networks (3-1-0)

MODULE – I (16 hours)

Introduction

Evolution, simple telephone communication, basis of switching system, telecommunication networks.

Electronic space division switching

Stored program control, centralized and distributed SPC, software architecture, application software, enhanced software, two and three stage networks.

Time Division Switching

Basic time division space switching, basic time division time switching, time multiplexed space and time switching, combination switching, three-stage combination switching.

MODULE – II (12 hours)

Traffic Engineering

Network traffic load and parameters, Grade of service, modelling switching systems, incoming traffic, blocking models and loss estimates.

Telephone Networks

Subscriber loop systems, switching hierarchy and routing, transmission plan, transmission systems, signalling techniques

MODULE – III (12 hours)

Data Networks

Data transmission in PSTN, switching techniques, Data communication architecture, link-to-link layers, end-to-end layers, satellite based data networks, LAN, MAN, Fibre optic networks, an overview of data network standards

Integrated Service Digital Network, motivation, new services, transmission channels, signalling, service characterization, ISDN standards, broad band ISDN, voice data integration.

Textbooks:

1.*Thiagarajan Viswanathan,* ***Telecommunication Switching Systems and Networks*** *by, PHI Learning Pvt. Ltd., New Delhi.*

2.Alberto Leon-Gracia and Indra Widjaja, ***Communication Networks****, Tata McGraw Hill Education Pvt. Ltd., New Delhi.*

WAVELETS AND MULTI-RESOLUTION PROCESSING 3-1-0

MODULE – 1:

INTRODUCTION

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

MODULE - 2:

MULTI-RESOLUTION ANALYSIS

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

CONTINUOUS WAVELET TRANSFORM

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

MODULE – 3:

DISCRETE WAVELET TRANSFORM

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

Lifting Scheme: Wavelet Transform using Polyphase matrix Factorization – Geometrical foundations of lifting scheme – Lifting Scheme in Z – domine.

MODULE – 4:

APPLICATIONS

Signal Compression – Image Compression techniques: EZW-SPHIT Coding – Image denoising techniques: Noise estimation –Shrinkage rules – Shrinkage Functions – Edge detection and Object Isolation, Image Fusion, and Object detection. Curve and surface editing – Variational modelling and finite element method using wavelets.

REFERENCES

1. Rao R.M. and A. S. Bopardikar, "Wavelet Transforms: Introduction to theory and Applications", Pearson eduction Asia Ltd., 2000.

2. K.P. Soman and K.I. Ramachandran, "Insight into Wavelets – From Theory to practice", Prentice-Hall, 2004.

3. Strang G, Nguyen T, "Wavelets and Filter Banks", Wellesley Cambridge Press, 1996.

4. Vetterli M, Kovacevic J, "Wavelets and Sub-band Coding", Prentice-Hall, 1995.

5. Mallt S, "Wavelet Signal Processing", Academic Press, 1996.

SPEECH AND AUDIO SIGNAL PROCESSING 3-1-0

MODULE – 1:

MECHANICS OF SPEECH

Speech production mechanism – Nature of Speech Signal – Discrete time modelling of Speech production – Representation of Speech signals – Classification of Speech sounds – Phones – Phonemes – Phonetic and Phonemic alphabets – Articulatory features.

Music Production – Auditory perception – Anatomical pathways from the ear of the perception of sound – Peripheral auditory system – Psycho acoustics

MODULE – 2:

TIME DOMINE METHODS FOR SPEECH PROCESSING

Time domain parameters of Speech signals – Methods for extracting the parameters Energy, Average Magnitude – zero crossing rate – Silence Discrimination using ZCR and Energy – Short Time Auto Correlation Function – Pitch period estimation using Auto Correlation Function.

FREQUENCY DOMINE METHODS FOR SPEECH PROCESSING

Short Time Fourier Analysis – Filter bank analysis – Formant extraction – Pitch extraction – Analysis by Synthesis – Analysis synthesis systems – Phase vecoder – Channel vecoder. Homomorphic speech analysis – Cepstral analysis of speech – Formant and Pitch estimation – Homomorphic vecoders.

MODULE – 3:

LINEAR PREDICTIVE ANALYSIS OF SPEECH

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

MODULE – 4:

APPLICATION OF SPEECH & AUDIO SIGNAL PROCESSING

Algorithms: Spectral estimation, Dynamic Time warping, Hidden Markov Model – Music Analysis – Pitch Detection – feature Analysis for Recognition – Music synthesis – Automatic Speech Recognition – Feature extraction for ASR – Deterministic sequence recognition – Statistical Sequence recognition – ASR systems – Speaker identification and verification – Voice response system – Speech synthesis: Text to Speech, Voice over IP.

REFERENCES

1. Ben Gold and Nelson Morgon, "Speech and Audio Processing", John Wiley and Sons Inc, Singapore, 2004

2. L.R. Rabiner and R.W. Schaffer, "Digital Processing of Speech Signals", Prentice-Hall, 1978.

3. Quatteri, "Dicrete-time Speech Signal Processing", Prentice-Hall, 2001.

DIGITAL COMMUNICATION RECEIVERS 3-1-0

MODULE – 1:

REVIEW OF DIGITAL COMMUNICATION TECHNIQUES

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

OPTIMUM RECEIVERS FOR AWGN CHANNEL

Correlation demodulator, matched filter, maximum likelihood sequence detector, Optimum receiver for CPM signals, M-ary orthogonal signals, envelop detectors for M-ary and correlated binary signals.

MODULE – 2:

RECEIVERS FOR FADING CHANNELS

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

MODULE – 3:

SYNCHRONIZATION TECHNIQUES

Carrier and Symbol synchronization, carrier phase estimation – PLL, Decision directed loops, symbol timing estimation, maximum likelihood and non-decision directed timing estimation, joint estimation.

MODULE – 4:
ADAPTIVE EQUALIZATION
Zero forcing algorithm, LMS algorithm, Adaptive decision – Feedback equalizer, and equalization of Trellis-coded signals, Kalman algorithm, blind equalizers, and stochastic gradient algorithm, Echo cancellation.
REFERENCES
1. Heinrich Meyer, Mare Moeneclay and Stefan A. Fetchtel, “Digital Communcation Recivers”, Vol I & II, John Wiely, New York, 1997.
2. Jhon G. Proakis, “Digital Communication”, 4th ed., McGraw Hill, New York, 2001.
3. E.A. Lee and D.G. Messerchmitt, “Digital Communication”, 2nd ed., Allied Publishers, New delhi, 1994.
4. Simon Marvin, “Digital Communication Over Fading Channel; An unified approach to perform Analysis”, John Wiely, New York, 2000.
5. Bernard Sklar, “Digital Communication Fundamentals and applications”, Prentice-Hall, 1998.

CSPE 2104 VIDEO PROCESSING AND COMMUNICATION

MODULE-1(18 HOURS)

Fundamentals Of Digital Image, Digital image and video fundamentals and formats, 2-D and 3-D sampling and aliasing, 2-D/3-D filtering, image decimation/interpolation, multi-resolution representations, edge detection, image enhancement, noise filtering,

MODULE-2(18 HOURS)

İmage restoration, algorithms for 2-D motion estimation, change detection, motion-compensated filtering, frame rate conversion, deinterlacing, video resolution enhancement, lossless image compression including entropy coding,

MODULE-3(14 HOURS)

Lossy image compression, video compression techniques, and international standards for image and video compression (JPEG, JPEG 2000, MPEG1/2/4, H.264, SVC).

Reference Books

1) Multidimensional Signal, Image and Video Processing and Coding, J. W. Woods, Academic Press, 2006. ISBN 0-12-088516-6
2) Video Processing and Communications, Y. Wang, J. Ostermann, and Y.-Q. Zhang, Prentice Hall, 2002. ISBN 0-13-017547-1

3) Digital Video Processing, A. M. Tekalp, Prentice Hall, 1995. ISBN 0-13-190075-7

4) Handbook of Image and Video Processing, Ed. Al Bovik, Academic Press, 2000. ISBN 0-12-119790-5

5) Digital Image Processing, Gonzalez and Woods, Addison-Wesley, 2001. ISBN 0201-18075-8