DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

Andhra University, Visakhapatnam

M.Tech (Communication Systems), Two year (Four Semester)

For the admitted batch of 2007 - 2008 onwards

Semester – I

Subject code	*Subject title*	*Credits*	*Pds/week*		*Sessionals*	*Uni. Exam marks*	*Total*
			Theory	*Lab*			
MTCS-1	Communication Theory	4	4	-	30	70	100
MTCS-2	Communication Techniques	4	4	-	30	70	100
MTCS-3	Satellite Communication and Phased Arrays	4	4	-	30	70	100
MTCS-4	Digital signal processing	4	4	-	30	70	100
MTCS-5	Optical Fibers and Applications	4	4	-	30	70	100
MTCS-6	Elective –I	4	4	-	30	70	100
MTCS-7	Communication Engineering Lab	2	-	4	100	-	100
MTCS-8	Seminar - I	2	-	2	100	-	100
	Total	28	24	6			

Elective – I

a) EMI/EMC
b) Microwave Components and Networks
c) Advanced Microprocessors
d) Embedded Systems

Semester – II

Subject code	*Subject title*	*Credits*	*Pds/week*		*Sessionals*	*Uni. Exam marks*	*Total*
			Theory	Lab			
MTCS-9	RF and Microwave Engineering	4	4	-	30	70	100
MTCS-10	Cellular and Mobile Communications	4	4	-	30	70	100
MTCS-11	GPS and Applications	4	4	-	30	70	100
MTCS-12	Telecommunication Switching and Networks	4	4	-	30	70	100
MTCS-13	Elective - II	4	4	-	30	70	100
MTCS-14	Elective – III	4	4	-	30	70	100
MTCS-15	Signal Processing Lab	2	-	4	100	-	100
MTCS-16	Seminar - II	2	-	2	100	-	100
	Total	28	24	6			

Elective – II

a) Modeling and Simulation of Communication Systems
b) Modern Radar Systems
c) Digital Image Processing
d) VLSI Design

Elective - III

a) Application Specific Integrated Circuits (ASIC)
b) Multimedia Communication Systems
c) Wavelet Transforms and Its Applications
d) Statistical Signal Processing

Semester – III

Subject code	*Subject title*	*Credits*	*Sessionals*	*Uni. Exam marks*	*Total*
MTCS – 17	Thesis (Part I)	15	50	50	100

* Project work to be submitted before the end of 3rd Semester and it will be evaluated by a committee consisting of Chairman, Board of Studies, Head of the Department and thesis guide.

Semester – IV

Subject code	*Subject title*	*Credits*	*Sessionals*	*Uni. Exam marks*	*Total*
MTCS – 18	Thesis (Part II)	20	30	70	100

Thesis work is for a period of SIX months in Industry/Department. The students are required to submit their thesis two/three phases. Thesis is evaluated by a committee consisting of an external member from reputed institution, HOD, Chairman BOS and thesis Guide.

Syllabus for

M.Tech (Communication Systems) I Semester

Communication Theory

Credits : 4

Subject Code : MTCS – 1 **Max. Marks :** 70

I – Semester **Sessionals :** 30

UNIT – I

Review of Fourier Techniques in Communication (Including Hilbert transforms and representation of band pass signals). Probability and Random processes: Random variables, p.d.f and c.d.f- ,expected values: transformation of variables in one and two dimensions. Characterization of a random process: Stationarity; ensemble averages; systems with random signal excitation; Gaussian processes; electrical noise.

UNIT – II

Mathematical treatment of Linear (AM, DSB-SC, SSB and VSB) and exponential (PM and FM) modulation; spectra of angle modulated signals; Noise performance of linear and exponential modulated signals; PE and DE in FM.

UNIT-III

Sampling of low-pass and band-pass signals; quantization ; PAM, Bennet's formula; Log-PCM; base band digital communication; Nyquist pulse shaping, spectra analysis of some important line codes.

UNIT-IV

Representation of digital signal waveforms, Introduction to digital modulation schemes- ASK, PSK and FSK; Digital demodulation and the optimal receiver, performance of digital communication systems in the presence of noise, coherent quadrature modulation techniques.

UNIT-V

Binary hypothesis testing, Bayes, Minimax and Neyman-Pearson tests; Bayesean parameter estimation, MMSE, MMAE and MAP estimation procedures.

Textbook:

1. John G. Proakis and Masoud Salehi, "Communication Systems Engineering," Prentice-Hall, 2nd Edition, 2002.
2. Fundamentals of Communication Systems, Proakis and Salehi, Prentice Hall
3. Communication Systems, Stern & Mahmoud, Prentice Hall
4. M. Simon, S. Hinedi, and W. Lindsey, "Digital Communication Techniques," Prentice-Hall, 1995

Communication Techniques

Credits : 4

Subject Code : MTCS – 2 **Max. Marks :** 70

I – Semester **Sessionals :** 30

UNIT – I

Channel CODING:

Waveform coding and structured sequences-Types of error control, structured sequences, Linear block codes –soft/hard decision decoding of linear block codes – Non binary block codes and concatenated block codes – Polynomial representation of codes – Cyclic codes – Convolution codes – viterbi decoding algorithm – Reed Solomon codes – Turbo codes.

UNIT – II

BASEBAND SIGNALLING CONCEPTS:

Signaling formats – RZ/NRZ, Duobinary splitphase (Manchester) and high density bipolar coding – scrambling & unscrambling – channel equalization – tapped delay line and traversal filters.

UNIT – III

DIGITAL MODULATION SCHEMES:

Detection using matched filter – Optimum receivers for arbitrary binary signals and M'ary orthogonal signals – Analysis of coherent detection schemes for ASK, PSK and DPSK – M'ary signaling schemes – QPSK and QAM – MSK – Performance of the data transmission schemes under AWGN. Trellis coded Modulation.

UNIT – IV

SYNCHRONISATION:

Receiver synchronization, costas loop, symbol synchronization, synchronization with CPM – Data aided and Non aided synchronization- synchronization methods based on properties of wide sense cyclo-stationary random process – Carrier recovery circuits – Symbol clock estimation schemes.

UNIT – V

SPREAD SPECTRUM SYSTEMS:

PN sequences, DS spread spectrum systems; FH spread spectrum systems and performance of FHSS in AWGN – Synchronization – Jamming considerations – Commercial Applications – Cellular subsystems.

REFERENCES:

1. Bernard sklar, " Digital communications", Pearson Education Asia,2001.

2. Das,J Etal, " Principles of Digital Communications and Spread spectrum Systems", Willey Eastern Limited,1985.

3.Ziemer R E & Peterson R L, "Digital Communication and Spread spectrum Systems", McMillan publishing co.,1985.

4. Proakis J G, "Digital communications", McGraw Hill Inc,1983.

5. Haykin,Simon.S. ,"Digital communications", John Wiley & Sons, 1988

Satellite Communication and Phased Arrays

Credits : 4

Subject Code : MTCS – 3 **Max. Marks :** 70

I – Semester **Sessionals :** 30

UNIT - I

Introduction : Kepler's Laws of motion, Orbital aspects of Satellite Communications, Look Angle and Orbit determinations, Orbital effects in communication system Performance, Space craft subsystems, AOCS, TTC&M, Power system, Satellite transponder, spacecraft Antennas, Satellite Link Design-- System Noise temperature and G/T ratio - Design of downlink, Uplink - Design of satellite links for specified C/N, Implementation of error Detection on satellite links.

UNIT - II

Multiple Access: FDMA, TDMA, CDMA, SSMA- comparison of multiple access techniques, Practical Demand Access systems, Multiple Access With on board processing.

UNIT - III

Earth Station Technology: Earth Station Design, Design of Large Antennas, Tracking, Small earth station Antennas, Equipment for earth station; Satellite Packet Communications- Message transmission by FDMA: The M/G/1 Queue, Message transmission by TDMA - Pure ALOHA: Satellite packet switching - slotted ALOHA - Packet Reservation - Tree algorithm.

UNIT - IV

Very small Aperture Terminal Networks: VSAT Technologies - Network Configurations - Multi access and Networking Network Error Control - Polling VSAT Networks; Mobile Satellite Networks--Operating Environment - MSAT Network concept - CDMA MSAT Network-Statistics of mobile propagation.

UNIT - V

Phased Arrays in Radar and Communication Systems:

System requirements for radar and communication antennas, Array characterization for radar and communication systems, Fundamental results from array theory, Array size determination.

Text Books

1. Satellite Communications by T. Pratt and C.W. Bostian.

2. Digital Satellite Communication by Tri T. Ha (2 ed)

3. Phased Array Antenna Hand Book – Robert J. Mailloux, Artech House, Boston, London, 1994.

Reference:

1. Satellite Communications - by Dr. D.C. Agarwal

2. Electronic Communication Systems -by Tomasi. W

DIGITAL SIGNAL PROCESSING

Credits : 4

Subject Code : MTCS – 4 **Max. Marks :** 70

I – Semester **Sessionals :** 30

Common with M.E. (Electronic Instrumentation), Digital Signal Processing (MEI-1), M.Tech (R&M) Digital Signal Processing (MTRM-1)

Chapter – I : Advanced digital filter design techniques : Multiple band optimal FIR filters – design of filters with simultaneous constraints in time and frequency response, optimization methods for designing IIR filters, comparison of optimum FIR filters and delay equalized elliptic filters.

Chapter – II : Multirate DSP : The basic sample rate alteration – time – domain characterization, frequency – domain characterization : Cascade equivalences, filters in sampling rate alteration systems, digital filter banks and their analysis and applications, multi level filter banks, estimations of spectra from finite – duration observation of signals.

Chapter – III : linear prediction and optimum liner filters : forward and backward linear prediction, AR Lattice and ARMA lattice – ladder filters, Wieners filters for filtering on prediction.

Chapter – IV : DSP Algorithms : The Goertzel algorithm, the chirp – z transform algorithm the Levinson – Durbin algorithms, the Schur algorithm, and other algorithms, computations of the DFT, concept of tunable digital filters.

Chapter – V : 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.

Chapter – VI : Applications of DSP :

a) Speech : Model of speech production, speech analysis – synthesis system vocoder analyzers and synthesizers, linear prediction of speech.

b) DTMF System

Suggested 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

OPTICAL FIBERS AND APPLICATIONS

Credits : 4

Subject Code : MTCS – 5 **Max. Marks :** 70

I – Semester **Sessionals :** 30

Common with M.E. (Electronic Instrumentation), Optical Fibers and Applications (MEI-3), M.Tech (R&M) Optical Fibers and Applications (MTRM-3)

1. Optic Fiber Waveguides

   Step – Index Fiber, Graded – Index Fiber, Attenuation, Modes in Step-Index Fibers, Modes in Graded – Index Fibers, Pulse Distortion and Information Rate in Optic Fibers, Construction of Optic Fibers, Optic Fibers, Optic Fiber Cables,

2. Light Sources and Detectors

   Light-Emitting Diodes, Light-Emitting – Diodes Operating Characteristics, Laser Principles, Laser Diodes, Laser-Diode Operating Characteristics, Distributed – Feedback Laser Diode, Optical Amplifiers, Fiber Laser, Vertical-Cavity Surface-Emitting Laser Diodes

   Principles of Photodetection, Photomultiplier, Semiconductor Photodiode, PIN Photodiode, Avalanche Photodiode,

3. Couplers and Connectors

   Principles, Fiber end Preparation, Splices, Connectors, Source Coupling, Distribution Networks and Fiber Components, Distribution Networks, Directional Couplers, Star Couplers, Switches, Fiber Optical Isolator, Wavelength-Division Multiplexing, Fiber Bragg Gratings, Other Components : Attenuator, Circulator and Polarization Controller

4. Modulation, Noise and Detection

   Light-Emitting-Diode Modulation and Circuits, Laser-Diode Modulation and Circuits, Analog-Modulation Formats, Digital-Modulation Formats, Optic Heterodyne Receivers, Thermal and Shot Noise, Signal-to-Noise Ratio, Error Rates, Modal Noise, Amplifier Noise, Laser Noise, and Jitter, Additional Noise Contributors, receiver Circuit Design

5. System Design and Fiber Optical Applications

   Analog System Design, Digital System Design, Applications of Fiber Optics

Text Book : Fiber Optic Communications, Joseph. C. Palais, Pearson Education, Asia, 2002

Reference :

1. Fiber Optic Systems, John Powers, Irwin Publications, 1997

2. Optical Fiber Communication, Howes M.J., Morgen, D.V John Wiely

Elective I (a) : EMI / EMC

Credits : 4

Subject Code : MTCS – 6(a) **Max. Marks :** 70

I – Semester **Sessionals :** 30

Common with M.E. (Electronic Instrumentation), EMI / EMC (MEI-6a), M.Tech (R&M) EMI / EMC (MTRM-6a),

I. 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.

II. 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.

III. 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.

IV. Grounding, shielding, bonding and EMI filters :

Principles and types of grounding, shielding and bonding, characterization of filters, power lines filter design.

V. Cables, connectors, components and EMC standards :

EMI suppression cables, EMC connectors, EMC gaskets, Isolation transformers, optoisolators, 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, Modules 1 – 9.

References :

1. Introduction to Electromagnetic Compatibility, Ny, John Wiley, 1992, by C.R. Pal.

Elective I (b) : MICROWAVE COMPONENTS AND NETWORKS

Credits : 4

Subject Code : MTCS – 6(b) **Exam Marks :** 70

I – Semester **Sessionals :** 30

Common with M.Tech (R&M) Microwave Components and Networks (MTRM-5),

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.
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.
3. Microwave Semiconductor Devices
   Microwave bipolar transistor, FET, Principle of Operation and application of tunnel diode, Principle of operation of gunn diode, application of gunn diode advantages of gunn diode, salient features of IMATT and TRAPATT diodes, applications of IMATT and TRAPATT diodes, principle of operation of PIN diode, applications of PIN diode.
4. Scattering Matrix Parameters of microwave networks
   Definition of scattering matrix, characteristics of S-matrix, scattering matrix of a two-port network, salient features of S-matrix, salient features of multiport network, losses in microwave circuits, return loss, insertion loss, transmission loss, reflection loss, impedance matrix, short circuit admittance parameters of a π-network, S-matrix of series element in the transmission line, S-matrix for circulator, S-matrix for isolator, S-matrix for E-plane Tee junction, S-matrix for H-plane Tee junctions, S-matrix for directional coupler.
5. Microwave Passive components
   Rrectangular waveguides resonator isolator, types of attenuators, fixed attenuators, step attenuators, variable attenuators, salient features of directional coupler, parameters of directional coupler, coupling factor, directivity, applications of directional coupler.
6. Microwave Integrated Circuits
   Salient features of MICs, types of electronic circuits, monolithic microwave integrated circuits (MMICs), film integrated circuit, advantages of MMICs, Basic materials used in MMIC fabrication, examples, characteristics and properties of substrate, conductor, dielectric and resistive materials, MMIC fabrication techniques, diffusion and ion implantation, oxidation and film deposition, epitaxial growth, lithography, etching and photo resist, deposition methods, steps involved in the fabrication of MOSFET
7. Microwave measurements
   Measurement of VSWR, attenuation, dielectric constant, calibration of attenuator and

Textbooks

1. "Microwave Engineering" by Prof. GSN Raju, IK International Publishers, 2007
2. "Microwave Engineering" by P.A. Rizzi, PHI, 1999.
3. "Microwave Engineering : Non-reciprocal active and passive circuits" by Joseph Helszajin, McGraw Hill, 1992. .

Elective I (c) : ADVANCED MICROPROCESSOR

Credits : 4

Subject Code : MTCS – 6(c) **Exam Marks :** 70

I – Semester **Sessionals :** 30

UNIT – I

8086/8088 microprocessor : register organization of 8086,architecture, Physical memory organization, I/O addressing capability, Minimum mode and Maximum mode system and timings, addressing modes of 8086

UNIT – II

8086/8088 instruction set: Machine Language Instruction formats,Instruction set of 8086/8088,Assembler Directives and operators, Machine level programming, assembly language programming.

UNIT – III

Special architectural features and related programming : Stack structure of 8086, Interrupts and Interrupt service routines , Interrupt cycle of 8086/8088, Non maskable interrupts, maskable interrupt (INTR), Interrupt Programming, MACROS, Timing and Delay

UNIT – IV

80186 and 80286 16 bit microprocessors:80186/80188 architecture,Pin-out of 80186 microprocessor, Programming the 80186/80188 enhancements, 80186/80188 Timing (Read / Write cycles) ,80186 programmable interrupt controller and DMA Controller , Internal Architecture of 80286

UNIT – V

80386/80486 Microprocessors: Introduction to 80386 microprocessor, Special 80386 registers, Memory management, moving to protected mode,Virtual 8086 mode, Memory paging mechanism, Introduction to 80486 and Pentium Processor.

Text Books :

1. Advanced microprocessors and peripherals, A.K.Ray & K.M.Bhurchandi, Tata McGraw Hill publications co.ltd, New Delhi Twentieth reprint-2006
2. The INTEL Microprocessors , Barry B Bray,& C.R.Sarma, Pearson Education Ltd, New Delhi,First Indian reprint-2005

References:

1. The Intel microprocessors 8088/80186,80188,80286,80386, 80486,Pentium and Pentium- pro processor Architecture ,Programming and Interface by Barray B.Berry, 4th Edition, PHI
2. Microprocessors and interfacing Programming and Applications by Douglas V.Hall, Mc Graw Hill.
3. Microprocessors / Microcomputers Architecture , Software and Systems by A.J.Khambata, John Wiely & Sons.

Elective I (d) : EMBEDDED SYSTEMS

Credits : 4

Subject Code : MTCS – 6(d) **Exam Marks :** 70

I – Semester **Sessionals :** 30

1. Introduction to Embedded Systems : An embedded system – processor in the system – Hardware units – software embedded into a system – exemplary embedded systems – embedded system – on-chip and in VLSI circuit.
2. Processor and Memory Organization : structural units in a processor – processor selection for an embedded system – memory devices – memory selection for an embedded system – allocation of memory to program segments and blocks and memory map of a system – direct memory access – interfacing processor, memories and I/O devices.
3. Devices & Buses for Device Networks : I/O devices – timer & counting devices – serial communication using the 'I^2C', 'CAN' and advanced I/O buses between the networked multiple devices – host system or computer parallel communication between the networked I/O multiple devices using the ISA, PCI, PCI-X and advanced buses.
4. Device Drivers and Interrupts Servicing Mechanism : Device drivers – parallel port device drivers in a system – serial port device drivers in a system – device drivers for internal programmable timing devices – interrupt servicing mechanism – context and the periods for context switching, deadline and interrupt latency.
5. Programming Concepts and Embedded Programming in 'C' : Software programming in assembly language (ALP) and in high level language 'C' – 'C' program elements : Header and source files and preprocessor directives – program elements : macros and functions – data types, data structures, modifiers, statements, loops and pointers – Queues – stacks – lists and ordered lists – 'C' program compiler and cross compiler – optimisation of memory needs.
5. Program modeling concepts in single and multiprocessor systems software-development process : modeling processor for software analysis before software implementation – programming models for event controlled or response time constrained real time program – modeling of multiprocessor systems.

Text Books :

1. Embedded Systems : Architecture, programming and design by Raj Kamal, Tata McGraw Hill, 2003

References :

1. Embedded System Design : Real world design by Steve Heath, Butter – Worth Heinemann, Newton Mass, USA, May 2002.
2. An introduction to the design of small scale embedded systems with examples from PIC, 8051 and 68HC 05/08 Micro controllers by Tin Wilmshurst, Palgrave, Great Britain, 2001.
3. The 8051 microcontroller and embedded systems by M. Ate Mazidi and J.G. Mazidi, Pearson Education, 2002.

Syllabus for

M.Tech (Communication Systems) II Semester

RF AND MICROWAVE ENGINEERING

Credits : 4

Subject Code : MTCS – 9 **Max. Marks :** 70

II – Semester **Sessionals :** 30

Common with M.Tech (R&M) RF and Microwave Engineering (MTRM-10)

Chapter 1 : Introduction to RF and Microwave concepts and applications

Introduction, Reasons for using RF/Microwaves, RF/Microwave applications, Radio frequency waves, RF and Microwave circuit design, The unchanging fundamentals versus the ever-evolving structure, General active circuit block diagrams.

Chapter 2 : RF Electronics Concepts

Introduction, RF/Microwaves versus DC or low AC signals, EM spectrum, Wave length and frequency, Introduction to component basics, Resonant circuits, Analysis of a simple circuit in phasor domain, Impedance transformers, RF impedance matching, Three element matching.

Chapter 3 : Smith Chart and its Applications

Introduction, A valuable graphical aid the smith chart, Derivation of smith chart, Description of two types of smith charts, Smith charts circular scales, Smith charts radial scales, The normalized impedance-admittance (ZY) smith chart introduction, Applications of the smith chart, Distributed circuit applications, Lumped element circuit applications.

Chapter 4 : RF and Microwave Amplifiers Small and Large Signal Design

Introduction, Types of amplifiers, Small signal amplifiers, Design of different types of amplifiers, Multistage small signal amplifier design.

Introduction, High-power amplifiers, Large signal amplifier design, Microwave power combining/dividing techniques, Signal distortion due to inter modulation products, Multistage amplifiers, Large signal design

Chapter 5 : Radio Frequency and Microwave Oscillator Design

Introduction, Oscillator versus amplifier design, Oscillation conditions, Design of transistor oscillators, Generator-tuning networks.

Text Book :

"Radio Frequency and Microwave Electronics", by Mathew M. Radmanesh, Person Education Inc., New Delhi

References

"Microwave Engineering, Active and Non-reciprocal Circuits", by Joseph Helszain, McGraw Hill International Edition, 1992

CELLULAR AND MOBILE COMMUNICATIONS

Credits : 4

Subject Code : MTCS – 10 **Max. Marks :** 70

II – Semester **Sessionals :** 30

Common with M.Tech (R&M) Cellular and Mobile Communications (MTRM-11)

Unit -1 : Introduction to wireless communications , examples of wireless communication system , the Cellular concept and system design fundamentals , Frequency reuse, Channel assignment strategies , Handoff strategies , Interfearance and system capacity , Trunk and grade services , Methods for improving coverage and capacity in cellular system .

Unit-2: Multiple access techniques for wireless communications FDMA , TDMA , Spread spectrum techniques , SDMA , Packet Radio , CSMA , Capacity of cellular CDMA with multiple cells and capacity of SDMA.

Unit-3: Wireless systems and standards , AMPS , IS-94, GSM traffic, Examples of GSM cell , Frame structure of GSM cell, details of forward and reverse CDMA channels.

Unit-4: Personal access communication systems , Personal Mobile satellite communications , Integrating GEO, LEO, MEO Satellite and terrestrial mobile systems , Rake receiver and Advanced Rake receiver,

Unit-5: Mobile Radio propagation , Large scale path loss , Reflection , Diffraction , Scattering , Outdoor and Indoor propagation models , Small signal fading and multi path , measurement of small scale path loss , parameters of multi path channels , fading due to multi path , fading effect due to Doppler spread , small scale fading models , equalization , Diversity .

Recommended Books:

1.Wireless Communications Principles and Practice , Second Edition , THEODORE S.REPPAPORT .

2.Wireless Digital Communications , DR. KAMILO FEHER .

3.Electronic Communication system , WAYNE TOMASI.

4.Wireless Communications , SANJY SHARMA.

GLOBAL POSITIONING SYSTEM AND APPLICATIONS

Credits : 4

Subject Code : MTCS – 11 **Max. Marks :** 70

II – Semester **Sessionals :** 30

Common with M.E. (Electronic Instrumentation), Global Positioning System and Applications (MEI-13(c)), M.Tech (R&M) Global Positioning System and Applications (MTRM-14)

Unit I

Overview of GPS : Basic concept, system architecture, space segment, user segment, GPS aided Geo-augmented navigation (GAGAN) architecture.

Unit II

GPS Signals : Signal structure, anti spoofing (AS), selective availability, Difference between GPS and GALILEO satellite construction.

Unit III

GPS coordinate frames, Time references : Geodetic and Geo centric coordinate systems, ECEF coordinate world geodetic 1984 (WGS 84), GPS time.

Unit IV

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.

Unit V

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 :

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

TELECOMMUNICATION SWITCHING AND NETWORKS

Credits : 4

Subject Code : MTCS – 12 **Max. Marks :** 70

II – Semester **Sessionals :** 30

UNIT-I

Resource sharing and need for switching; Circuit switching, Store and forward switching, Packet switching, electronic space division switching, Need for networks, Two stage networks, Three stage networks and n-stage networks.

UNIT-II

Time division switching: Time switching, space switching, Three stage combination switching, n-stage combination switching; Traffic engineering: Hybrid switching, Two/Four wire transmission, Erlang formula and signaling.

UNIT-III

High speed digital access: DSL technology, Cable Modem, SONET.

UNIT-IV

Local area networks: Traditional ETHERNET, fast ETHERNET, Gigabit ETHERNET, Wireless LAN, Bluetooth, Connecting LAN's, Backbone networks.

UNIT-V

Integrated Services Digital Network: Network & protocol architecture, user network interfaces, signaling, inter networking, ISDN standards, expert systems in ISDN, Broadband ISDN.

Text Books:

1. Telecommunication Switching Systems and Networks- Thiagarajan Viswanathan, Prentice Hall, New Delhi, 2001.
2. Data Communications and Networking- B.A. Forouzan, Tata McGrawhill, Third Edn., 2004.

Elective II(a) : MODELLING AND SIMULATION OF COMMUNICATION SYSTEMS

Credits : 4

Subject Code : MTCS – 13(a) **Max. Marks :** 70

II – Semester **Sessionals :** 30

UNIT I

Simulation of Random Variables and Random Process:

Univariate and multi-variate models, Transformation of random variables, Bounds and approximation, Random process models-Markov AND ARMA sequences, Sampling rate for simulation, Computer generation and testing of random numbers.

UNIT II

Modeling of Communication Systems:

Information Sources, Formatting/Source Coding, Digital Waveforms, Line Coding, Channel Coding, Radio frequency and Optical Modulation, Demodulation and Detection, Filtering, Multiplexing/Multiple Access, Synchronization, Calibration of Simulations.

UNIT III

Communication Channels & Models:

Fading & Multipath Channels, Almost Free-Space Channels, Finite State Channel Models, Methodology for Simulating Communication Systems Operating over Fading Channels, Reference Models for Mobile Channels: GSM, UMTS-IMT-2000.

UNIT IV

Estimation of Parameters in Simulation:

Quality of an estimator, Estimating the Average Level of a Waveform, Estimating the Average power of a waveform, Estimating the Power Spectral Density of a process, Estimating the Delay and Phase.

UNIT V

Estimation of Performance Measures from Simulation:

Estimation of SNR, Performance Measures for Digital Systems, Importance sampling method, Efficient Simulation using Importance Sampling, Quasianalytical Estimation. Case Studies: 16-QAM Equalized Line of Sight Digital Radio Link, CDMA Cellular Radio System.

Text Book:

1. William H. Tranter, K. Sam Shanmugan, Theodore S. Rappaport, Kurt L. Kosbar, "Principles of Communication Systems Simulation with Wireless Applications", Prentice Hall PTR, 2002.
2. John G. Proakis, Masoud Salehi, Gerhard Bauch, Bill Stenquist, Tom Ziolkowski, "Contemporary Communication Systems Using MATLAB" Thomson-Engineering, 2 edition, 2002.

Reference books:

1. M.C. Jeruchim, Philip Balaban and K.Sam Shanmugam, "Simulation of Communication Systems, Modeling, Methodology and Techniques", Kluwer Academic/Plenum Publishers, New York, 2000.
2. C. Britton Rorabaugh, "Simulating Wireless Communication Systems: Practical Models In C++"Prentice Hall, 2004.

Elective II(b) : MODERN RADAR SYSTEMS

Credits : 4

Subject Code : MTCS – 13(b) **Max. Marks :** 70

II – Semester **Sessionals :** 30

Common with M.Tech (R&M), Modern Radar Systems (MTRM-4)

Fundamentals of Surveillance Radar and Design :

Bandwidth considerations, prf, Unambiguious range and velocity, Pulse length and Sampling, Radar Cross-section and Clutter.

Tracking Radar :

Tracking and Search Radars, Antenna beam shapes required, Radar guidance, Frequency agility, Importance of Monopulse Radar.

Radar waveform design :

Bandwidth and pulse duration requirements, Range and Doppler accuracy uncertainty relation, pulse compression and phase coding.

Principles of Secondary Surveillance Radar,

Radar studies of the atmosphere, OHR and Radar jamming, EC, ECC measures and stealth applications.

Text Books :

1. "Understanding of Radar Systems", Simon Kingsley and Shaun Quegan, McGraw Hill, 1993.
2. Radar Handbook by Skolnik.

Elective II(c) : DIGITAL IMAGE PROCESSING

Credits : 4

Subject Code : MTCS – 13(c) **Exam Marks :** 70

II – Semester **Sessionals :** 30

Common with M.E. (Electronic Instrumentation), Digital Image Processing (MEI-14(c)), M.Tech (R&M), Digital Image Processing (MTRM-13(c))

1. Digital Image Fundamentals
   An image model – sampling & quantization – basic relation between pixels : imaging geomentry.

2. Image Transforms

   Properties of 2-D fourier transforms, FFT algorithm and other separable image transforms, Walsh transforms, Hadamard, Cosine, Haar, Slant Transforms, RL Transforms and their properties.

3. Image Enhancement & Restoration
   Spatial domain methods, Frequency domain methods, Histogram Modification technique, Neighbourhood averaging, Median filtering, Low pass filtering, Averaging of Multiple Images, Image sharpening by differenctiation, High pass Filtering, Degradation model for Continuous functions, Discrete Formulation, Diagonalization of Circulant and Block – Circulant Matrices, Effects of Diagonalization, Constrained and unconstrained Restorations Inverse filtering, Wiener Filter, Constrained least Square Restoration.

4. Image Encoding
   Objective an subjective Fidelity Criteria, the encoding process, the Mapping, the Quantizer and the Coder, Contour Encoding, Run length Encoding, Image Encoding relative to a Fidelity Criterion, Differential Pulse Code Modulation, Transform Encoding.

5. Image Compression
   Fundamentals, Image compression models, error free compression, lossy compression, image compression standards.

6. Image Segmentation
   The detection of Discontinuities, Point Line and Edge Detections, Gradient Operators, Combined Detection, Thresholding.

7. Image Repres3entation
   Representation Schemes, Chain Codes, Polygon Approximation, Boundary Descriptors, Simple Descriptors, Shape Numbers, Fourier Descriptors.

8. Image Construction from Projections
   Radon Transforms, Convolution/filterback Projection.

Textbooks

1. Gonzalez RC & Woods RE, Digital Image Processing, Addison Wesley Publishing Company.
2. Jain AK, Fundamentals of Digital Image Processing, PHI
3. Rosefeld & Kak AC, Digital Picture Processing Academic Press Inc.

VLSI DESIGN

Subject Code: MTCS-12.d Max. Marks : 70
II- Semester Sessionals : 30

UNIT I

INTRODUCTION TO MOS DEVICE:MOS Transistor-First Glance at the MOS device MOS Transistor under static conditions-threshold voltage-Resistive operation-saturation region – channel length modulation-velocity saturation-Hot carrier effect-drain current Vs voltage charts – sub threshold conduction – equivalent resistance-MOS structure capacitance-Design A logic sates using NMOS and PMOS and CMOS devices-Stick Diagram.

UNIT II

ANALOG VLSI CIRCUITS:Continuous-Time Signal Processing: Primitive Analog Cells-Linear Voltage-Current Converters- MOS Multipliers- MOS Resistors- Winner-Take-All Circuits- Amplifier-Based Signal Processing. Low-Voltage Signal Processing: CMSO Operational Amplifier Design- Bipolar Operational Amplifier.

UNIT III

DESIGN OF COMBINATIONAL LOGIC GATES IN CMOS:Static CMOS design-complementary CMOS – static properties A complementary CMOS design-Power consumption in CMOS logic gates-dynamic or glitching transitions – Design techniques to reduce switching activity – Radioed logic-DC VSL - pass transistor logic – Differential pass transistor logic sizing of level restorer-sizing in pass transistor-Dynamic CMOS design-Basic principles - Domino logic-optimization of Domino logic-NPCMOS-How to choose a logic style -Designing logic for reduced supply voltages.

UNIT IV

CMOS SUB SYSTEM DESIGN:Data Path Operations : Addition/Subtraction- Parity Generators- Comparators- Zero/One Detectors- Binary Counters- ALUs- Multiplication-Shifters- Memory elements- control : Finite-State Machines- Control Logic Implementation.

UNIT V

LOGIC SYNTHESIS, SIMULATION AND TESTING:Basic features of VHDL language for behavioral modeling and simulation- summary of VHDL data types- Dataflow and structural modeling- VHDL and logic synthesis- types of simulation- boundary scan test- fault simulation- automatic test pattern generation.

TEXT BOOKS

1. Pucknell & Eshraghian : Basic VLSI Design, PHI, (3/e), 1996
2. Jan.M.Rabaey., Anitha Chandrakasan Borivoje Nikolic, “Digital Integrated Circuits” second Edition.
3. Neil H.E Weste and Kamran Eshraghian, "Principles of CMOS VLSI Design" , 2nd Edition, Addition Wesley, 1998
4. Mohammed Ismail, Terri Fiez, " Analog VLSI signal and Information Processing ", McGraw-Hill International Editons, 1994.

REFERENCE BOOKS

1. Jacob Backer, Harry W.Li and David E.Boyce, CMOS circuit Design , Layout and simulation, Prentice Hall of India, 1998

Elective III(a) : APPLICATION SPECIFIC INTEGRATED CIRCUITS (ASIC)

Credits : 4

Subject Code : MTCS – 14(a) **Max. Marks :** 70

II – Semester **Sessionals :** 30

Common with M.E. (Electronic Instrumentation), Application Specific Integrated Circuits (ASIC) (MEI-6(c)), M.Tech (R&M), Application Specific Integrated Circuits (ASIC) (MTRM-6(c))

1. Introduction to ASICs – Types of ASICs, Design flow, Economics of ASICs, ASIC cell libraries, CMOS Logic, CMOS design rules, Logic cells, I/O cells, cell compilers.
2. ASIC Library Design – Transistors as resistors, Transistor parasitic capacitance, Logical effort, Cell design, Programmable ASICs, Programmable ASIC logic cells, Programmable ASIC I/O cells, Programmable ASIC interconnect, Programmable ASIC design software.
3. Low-level design entry, Schematic entry, low-level design languages, PLA tools, EDIF, An overview of VHDL and verilog, Logic synthesis, Simulation.
4. ASIC construction, Floor planning and placement.
5. CMOS System Core Studies
   Dynamic Warp Processors : Introduction, The problem, the algorithm, a functional overview, detailed functional specification, structural floor plan, physical design, fabrication, Hierarchical layout and design of single chip 32 bit CPU : Introduction, Design methodology, Technology updatability and layout verification.
6. Practical Realities and Ground Rules
   Further thoughts on floor plans/layout, floor plan layout of the four bit processors, input/output (I/O) pads, "Real estate", further thoughts on system delays, ground rules for successful design, scaling of MOS circuits.

Textbooks

1. Application Specific Integrated Circuits by J.S. Smith, Addison Wesley, 1997.

Reference Books

1. Basic VLSI Design : Systems and Circuits, Doublas A. Puckness & Kamran Eshraghian, Prentice Hall of India Private Ltd., New Delhi, 1989.
2. Principles of CMOS VLSI Design : A system perspective, N. Westle & K. Eshraghian, Addition – Wesley Pub. Co. 1985.
3. Introduction to VLSI System, C. Mead & L. Canway, Addison Wesley Pub Co. 1990.
4. The Design & Analysis of VLSI Circuits, L.A. Glassey & D.W. Dobbephl, Addison Wesley Pub Co. 1985.
5. Introduction to NMOS & VLSI System Design, A. Mukharjee, Prentice Hall, 1986.
6. VLSI Design Techniques for analog and digital circuits, R.L. Geiger, P.E. Allen & N.R. Streder, McGraw Hill Int. 1990.
7. Digital Integrated Circuits, A Design Perspective, Jan A. Rabey, Prentice Hall of India Pvt. Ltd., 1997.
8. Application specific integrated circuits, J.S. Smith, Addison Wesley, 1997.

Elective III(b) : MULTIMEDIA COMMUNICATION SYSTEMS

Credits : 4

Subject Code : MTCS – 14(b) **Max. Marks :** 70

II – Semester **Sessionals :** 30

Unit I

Introduction: Introduction to Multimedia - Multimedia Authoring and Tools. Graphics and Image Data Representations - Color in Image and Video- fundamental Concepts in Video

Unit II

Audio Compression: Basic of Digital Audio - Basic Audio Compression Techniques - MPEG Audio compression

Unit III

Lossy and Lossless Compression: Lossless Compression Algorithms - Lossy Compression Algorithms - Image Compression Standards

Unit IV

Video Compression: Basic Video Compression techniques- MPEG Video Coding I: MPEG 1 and 2 - MPEG Video Coding II: MPEG 4, 7 and beyond

Unit V

Multimedia Networks: Computer and Multimedia Networks - Multimedia Network Communications and Applications- Wireless Networks- Content-Based Retrieval in Digital Libraries.

Text Books:

1. Ze-Nian Li and Mark S.Drew, "Fundamentals of Multimedia", Pearson Edition, 2004
2. Fred Halsall, "Multimedia Systems", Pearson 3rd Edition, 2005

Reference Book:

3. Khalid Sayood, "Introduction to Data Compression" Morgan Kauffmann Publishers, Inc. California, 2000.

Elective III(c) : WAVELET TRANSFORMS AND ITS APPLICATIONS

Credits : 4

Subject Code : MTCS – 14(c) **Max. Marks :** 70

II – Semester **Sessionals :** 30

Unit – 1:

Continuous And Discrete Wavelet Transform: Continuous time ;wavelets transform (CWT): Definition, CWT as a correlation, Constant Q factor filtering interpretation and time frequency resolution, CWT as an operator, Inverse CWT, Discrete Wavelet Transform: Approximations of vectors in Nested Linear Vector Subspaces – Multiresolution analysis (MRA) with examples.

Unit – II:

Orthonormal Wavelets And Filter Banks: Definition of an MRA- construction of a General Orthonormal MRA – Wavelet Basis for the MRA-Digital filtering Interpretation- Examples of orthonormal Basis – Generating Wavelets- Interpreting Orthonormal MRAs for Discrete – time Signals Miscellaneous Issues Related to PRQMF Filter Banks-Generating Scaling Functions and Wavelets from Filter Banks – Generating Scaling functions and Wavelets from Filter coefficients – Problems.

Unit – III:

Alternative Wavelet Transforms: Biorthogonal Wavelet Bases – Filtering Relations for Orthogonal Filters-Examples of Biorthogonal Scaling Functions and Wavelets-Two Dimensional Wavelets-Nonseperable Multidimensional Wavelets- Wavelet Packets – Transform Coding – DTWT for Image Compression – Audio Compression – Video Coding Using Multiresolution Techniques.

Unit – IV:

Applications of Wavelet Transforms: Wavelet Denoising – Speckle Removing – Edge Detection and Object Isolation - Image Fusion-Object Detection by Wavelet Transforms of Projections – Communication Applications – Scaling Functions as signaling pulses, Discrete Wavelet Multitone Modulation.

Unit – V:

Advanced Topics: Parseval's Identity for CWT Wavelet inner product as a projection operation CWT with an orthonormal basis for generating wavelet – A Trous algorithm-Regularity and Convergence – Daubechies Construction of Orthonormal Scaling Functions – Bandlimited Bi-orthogonal Decomposition – Design and Selection of Wavelets – Perfect Reconstruction Circular Convolution Filter Banks-Interpolators Matches to the Input Process – The Scaling Operation and Self-Similar Signals.

Text Book:

1. Raghuveer M. Rao and Ajit S. Bopardikar, "Wavelet Transforms – Introduction to Theory and Applications" Addison Wesley Pearson Education Asia, 2000.

Reference Book:

1. C.Sidney Burrus, Ramesh A Gopinath, and Haitao Guo, "Introduction to Wavelets and Wavelet Transforms, A Primer " PH International Editions, 1998.

Elective III(d) : STATISTICAL SIGNAL PROCESSING

Credits : 4

Subject Code : MTCS – 14(d) **Max. Marks :** 70

II – Semester **Sessionals :** 30

UNIT 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.

UNIT 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.

UNIT 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.

UNIT 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.

UNIT V

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.