Kalinga University Atal Nagar (C.G.)

SCHEME OF EXAMINATION

& SYLLABUS

of

M.Tech
Electronics & Telecommunication
(Communication System)

UNDER

Faculty of Engineering and Technology

w.e.f. Session 2021-22

Kalinga University, Raipur
Master of Technology (M.Tech) Electronics & Telecommunication
(Communication System)
(2 yrs Programme)w.e.f 2021-22Session

M.Tech Electronics & Communication (Communication System)					
Semester - I					
Code No.	Paper	Credits	End Semester Exam	Internal Marks	Total Marks
METCS101	Modern Digital Communication Techniques	4	100	50	150
METCS102	Communication Hardware Design Using VHDL	4	100	50	150
METCS103	High Performance Communication Network	4	100	50	150
METCS104	Microwave and Radar Communication	4	100	50	150
Refer Below Elective – I		4	100	50	150
METCS105A	Applied Mathematics for Electronics Engineer				
METCS105B	Satellite Communication				
METCS105C	Digital System Design				
METCS106-P	VHDL Design Lab	1	30	20	50
METCS107-P	Modern Digital Communication Lab	1	30	20	50
	Total	**22**	**560**	**290**	**850**
Semester - II					
Code No.	Paper	Credits	End Semester Exam	Internal Marks	Total Marks
METCS201	Secure Communication	4	100	50	150
METCS202	Advanced Mobile Communication	4	100	50	150
METCS203	Digital Communication Receivers	4	100	50	150
METCS204	Embedded Technology in Communication	4	100	50	150
Refer Below Elective – II		4	100	50	150
METCS205A	Advanced Digital Signal Processing & Application				
METCS205B	Microwave Integrated Circuits				
METCS205C	Optical communication System				
METCS206-P	Embedded Technology in Communication Systems Laboratory	1	30	20	50
METCS207-P	Signal Processing Lab	1	30	20	50
	Total	**22**	**560**	**290**	**850**

Code No.	Paper	Credits	End Semester Exam	Internal Marks	Total Marks
Semester - III					
METCS301	Broadband Communication	4	100	50	150
METCS302	Communication & Research Methodology	4	100	50	150
Refer Below Elective – III		4	100	50	150
METCS303A	Electromagnetic Interference and Electromagnetic Compatibility				
METCS303B	Soft Computing				
METCS303C	Global Tracking & Positioning System				
METCS304	Preliminary work on Dissertation	9	100	50	150
METCS305	Seminar Based on Dissertation	1	100	50	150
	Total	**22**	**500**	**250**	**750**

Code No.	Paper	Credits	End Semester Exam	Internal Marks	Total Marks
Semester - IV					
METCS401	Dissertation	18	300	200	500
`	**Total**	**18**	**300**	**200**	**500**

SEMSTER-1

METCS101

Modern Digital Communication Techniques

Unit 1
Introduction : Baseband Demodulation /Detection Signal and Noise, Detection of Binary Signals in Gaussian Noise, Inter Symbol Interference, Equalization. Functional Architecture Coded And Encoded Digital Communication System Architecture, Types of Networks And Services , Performance Criterion And Link Budgets.

Unit 2
Digital Modulations: PSD , DTA Pulse Stream, M-Ary Markov Source, Convolutionally Coded Modulation, Continuous Phase Modulation (CPM) , Scalar And Vector Communications Over Memory Less Channel , Scalar Receiver, BER Performance , Detection Criterion.

Unit 3
Coherent And Non-Coherent Communication With Waveforms: Optical Receiver In WGN, MF Receiver, Matrix Generation, Colored GN, Whitening Approach , Inphase And Quadrature Phase Modem, Non- Coherent Receivers, Random Phase Channel, Optimum And Suboptimum M-FSK, Performance Of Non- Coherent Receivers In Random Phase Channel, Optimum Receivers In Rayleigh And Rician Channels, M-Ary Symbol Error Probability.

Unit 4
Band Limited Channels: Optimum Pulse Shape Design, Optimum Demodulations Of Digital Signals In The Presence of ISI And AWGN , Equalization Techniques, Diminishing And Detection –Q Modulation , QAM , QPSK, QBM, CPM , FSK, MSK.

Unit 5
Coded digital communication: Architecture , Interfacing , Detailing, Synchronization , Block Coded Digital Communication System , Performance , Types of Binary Block Codes , Shanon Channel Coding Theorem , Linear Block Codes, Conventional Coded Digital Communication System, Representation of Convolution Codes, Decoding , Problems of Decreasing Errors, Sequencing And Threshold Decoding. Coding and Interleaving Applied to the Compact Disc Digital Audio System, Turbo Codes.

Text Books
     1.   M.K. Simon , S.M. Hinedi and W.C. Lindsey, " Digital Communication Techniques" :
Signaling and detection, Prentice Hall India, New Delhi, 1995.
     2.   Simon Haykin, " Digital Communications" , John Wiley and sons , 1998.

Reference Books
     1.   Wayne Tomasi, "Advanced Electronic Communication Systems", 4 th Edition, Oxford
        University Press,1998.
     2.   B.P. Lathi, " Modern Digital and Analog Communication Systems" 3 rd edition Oxford
        University Press ,1998.
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Communication Hardware Design Using VHDL

Unit 1
Design Concepts: Digital Hardware, Design Process, Design of Digital Hardware, Programmable Logic devices (PLA, PAL, CPLD, FPGA)

Unit 2
Hardware Modeling: Introduction, Hardware Modeling Languages, Abstract Models, compilation and behavioral optimization, perspectives.

Unit 3
Digital Circuits Design: Multiplexes, Decoders, Encoders, Code Converters, Arithmetic Comparison Circuit, VHDL for Combinational Circuits: Assignment Statement, Selected Signal Assignment, Conditional Signal Assignment, Generate Statement, Concurrent and Sequential Statement assignment statement, Process Statement, Case Statement. Flip- Flops, Registers and Counters.

Unit 4
Sequential Circuit Design: Basic Design Steps, State assignment problem, Mealy State Model, Design of FSM, Asynchronous Behavior, Analysis of Asynchronous Circuits, State Reduction, State Assignment Problem

Unit 5
Simulation of Communication Ckt. : Design of FSK Modulator , Simulation of FSK Modulator , Design of FSK Demodulator , Simulation of FSK Demodulator, Design and Simulation of Filters

Text Books
1) Fundamentals of Digital Logic with VHDL Design: Brown Vranesic, TMH Publication.
2) Synthesis and Optimization of Digital Circuits: Giovanni De Micheli, TMH Publication.

Reference Books
1) Circuit Design with VHDL Prdroni PHI Publication 2) VHDL Primer   Bhaskar   PHI Publication

2) Digital Design and Implementation with Field Programmable   Devices, ZainalabedinNavabi, Kluwer Academic Publishers.

High Performance Communication Network

Unit 1
BASICS OF NETWORKS: Telephone , computer, Cable television and Wireless networks, working principles, Digitization: Service Integration network services and layered architecture traffic characterization and QOS, network services: network elements and network mechanisms

Unit 2
PACKET SWITCHED NETWORKS : 0SI and IP Model, Different Layers, Performance issues of flow control protocols Packet Switching :Optimum packet size, Routing Strategies LAN Protocols; Ethernet (IEEE 802.3); token ring (l EEE 802.5),FDDI, DQDB, SMDS ,Frame relay

Unit 3
INTERNET AND TCP/IP NETWORKS: Overview; Internet protocol; TCP and VDP; performance of TCP/IP networks: SONET; DWDM, Fiber to home, DSL Intelligent networks. CATV.

Unit 4
ATM AND WIRELESS NETWORKS : Main features-addressing, signaling and routing: ATM header structure-adaptation layer, management and control; B-ISDN, interworking with ATM, Wireless networks: Spread spectrum LANs, IR LANs

Unit 5
OPTICAL NETWORKS AND SWITCHING : Optical links- WDM systems. Optical LAN's, optical paths and networks; TDS and SDS: Distributed, shared input and output buffers

System Security Intruders: Intruders, Intrusion Detection, Password Management. Firewalls: The Need for Firewalls, Firewall Characteristics, Types of Firewalls, Firewall Basing, Firewall Location and Configurations.

Text Books

Jean Warland and PravinVaraiya, " High Performance Communication Networks", 2 nd edition, Harcourt and Morgan Kauffman , London, 2000. WilliumStalling , " Data and computer Communication"

Referance Books
1) Leon Gracia, Widjaja, " Communication Networks", Tata McGraw-Hill, New Delhi, 2000
2) SumitKasera , Pankaj Sethi, " ATM Networks" , Tata McGraw-Hill, New Delhi, 2000

Microwave and Radar Communication

UNIT 1
Industrial Microwaves & Component: Microwave Waveguide Components: Attenuators, phase shifters, matched loads, detectors and mounts, slotted-sections, E-plane tee, H-plane tee, hybrid tees, directional douplers, tuners, circulators and isolators; Signal generators: Fixed frequency, sweep frequency and synthesized frequency oscillators; Microwave in process control instrumentation;

UNIT 2
Microwave Measurement Techniques: Noise sources and noise meters used in microwave measurements; Frequency meters and VSWR meters; Measurements of frequency, attenuation, VSWR and impedance; Cavity measurements: Q -factor, bandwidth; Cavity and Waveguide methods; Measurements of power Calorimetric and Microwave bridges; Principles of time domain and frequency domain reflectometry, spectrum analyser and network analyser; Measurement of Scattering parameters of passive and active devices.

UNIT 3
Microwave Devices and Amplifiers: Microwave Transistor; Microwave Tunnel Diode; Varacter Diode; Schottky Diode; MESFET: Principle of operation, equivalent circuit, cut off frequency, power frequency limitations; Charge Coupled Devices (CCD); Transferred Electron Devices: Gunn Diode, LSA Diode, modes of operation, Microwave Generation and Amplification; Avalanche Effect Devices: Read diode,carrier current and external current; IMPATT diodes. Klystron: Velocity modulation process, bunching process, output power and beam loading; Reflex Klystron: power output and efficiency; Traveling Wave Tubes; Magnetron.

UNIT 4
MTI Radar, transmitter and receiver: Oscillator amplifier, mixer, displays, duplexer, matched filter, receiver, correlation, detection, constant falls alarm rate, receiver, protector, selectivity, time control., Introduction , Operation of MTI Radar , MTI Receiver With Delay Line , Cnceler Range Gated, Doppler Filter, Digital Signal Processing, MTI For A Moving Platform , Limitations of MTI Platform .

UNIT 5
Aircraft homing system and instrument loading system: Introduction, Switched cardiod homing system, four course radio range, omnidirectional ranges, tactical air navigation, instrument landing aids, ground controlled approach, radio altimeter, microwave landing system, advantages of MLS.

Textbooks

1. Introduction to radar system. MERRICC, I-SKOC, NIK, TMH.
2 .Microwave Devices & Circuits Liao, Samuel Y. PHI

Reference Books
1. Passive Rf& Microwave Integrated Circuits Maloratsky, Leo G, Elsevier
2. Recent Advances In Microwaves &Lightwaves   E.K. Sharma New Age

Applied Mathematics for Electronics Engineer

Unit 1

LINEAR ALGEBRA Vector space, Linear Transformation, Elementary canonical forms, The rational and Jordan form, Inner product space, Operators on inner product spaces.

Unit 2

SPECIAL FUNCTIONS Series solutions-Bessel's equation-Bessel Functions-Legendre's equation-Legendre polynomials-Rodrigue's formula-Recurrence relations-generating functions and orthogonal property for Bessel functions of the first kind – Legendre polynomials.

Unit 3

THE WAVE EQUATIONS Solution of initial and boundary value problems - Characteristics – D' Alembert's solution - Significance of characteristic curves - Laplace transform solutions for displacement in along string - a long string its weight - a bar with prescribed force on one end free vibrations of a string.

Unit 4

WAVELETS Wavelet definition, examples for wavelets, wavelet transform, comparison of WT and FT, continuous wavelet transform properties of CWT. Discrete wavelet transforms.

Unit 5

PROBABILITY AND RANDOM VARIABLES Probability concepts – Random variables, Moment generating function – standard distributions – Two dimensional random variables – Transformation of Random variables – Correlation – Regression system –queuing applications.

Text Books

1. K. Hoffman and R. Kunze "Introduction to Linear Algebra", Prentice-Hall, 1996, 2/e.

Reference Books

1. Grewal B.S. "Higher Engineering Mathematics", Khanna Publishers 34th Edition

2. Wavelet Transforms "Introduction to Theory and Applications", Rao R.M, and Bopardikar A.S., Pearson Education (Singapore Pvt. Ltd., Third Indian Print, 2002).

METCS105B

Satellite Communication

UNIT – 1
ORBITAL DYNAMICS AND LAUNCHING MECHANISM: Growth of satellite communication, Keplar's laws, Newton's Gravitational Law, Different orbits of satellite, Frequency Coordination and regulatory services, Look angle, orbital disturbances, Launch vehicles and propulsion mechanism, orbital effects on communication system performance.

UNIT – II
SPACE SEGMENT: Satellite subsystems, Station keeping, attitude control, stabilization techniques, atmospheric losses, satellite link design, C/N ratio of the link, G/T of earth station, overall system temperature.

UNIT – III
MODULATION – MULTIPLEXING – MULTIACCESS: Telephone channel, Analog FM Transmission, Satellite- Television signal, Digital signals, Digital modulation, error control coding, satellite access: FDMA – TDMA – CDMA

UNIT – IV
EARTH SEGMENT: Different types of earth stations: TVRO – SMATV – CATV – Transmit-receiver earth stations- antennas – tracking systems – terrestrial interface – Test methods – different types of interferences – interference specifications and protection ratio.

UNIT – V
SATELLITE APPLICATIONS: Intelsat series – INSAT series – satellite navigation and the global positioning system, VSAT, mobile satellite services, IMMERSAT, DTH, Email, Video conferencing – Internet connectivity.

Text Books:

1. Dennis Roddy," Satellite Communication", Third Edition, McGraw Hill , 2001.
2. Wilbur L. Pritchard, Henri G.Suyderhoud, Robert A. Nelson," Satellite Communication Systems Engineering", Second Edition, Pearson Education, 1993.

Reference Books:

1. Timothy Pratt, Charles Bostian, Jeremy Allnutt, " Satellite Communications", Second Edition John Wiley & Sons., 2003.
2. Bruce R.Elbert, "The Satellite Communication Applications Handbook", Second Edition, Artech House Inc, Boston London, 2004.
3. Brij N. Agrawal, " Design of Geosynchronous Sapcecraft", Prentice Hall Inc.1986.
4. M.Richharia," Satellite Communication Systems- Design Principles", Second Edition Macmillan Press Ltd, 1999.
5. Tri T. Ha, " Digital Communications ", Second Edition , Mc Graw Hill Publishing Edition, 1990.

METCS105C

Digital System Design

Unit 1
The General Purpose Machine, Languages and Digital Logic The General Purpose Machine, User's View, The Machine/Assembly Language Programmer's View The Computer Architect's View, The Computer System Logic Designer's View, Classification of Computers and Their Instructions,Computer Instruction Sets,Informal Description of the Simple RISE Computer, SRC , Formal Description of SRC Using Register Transfer Notation, RTN , Describing Addressing Modes with RTN ,Register Transfers and Logic Circuits: From Behavior to Hardware

Unit 2
Processor Design The Design Process, AI-Bus Microarchitecture for the SRC, Data Path Implementation, Logic Design for the I-Bus SRC, The Control Unit, The 2- and 3·Bus Processor Designs, The Machine Reset, Machine Exceptions, Pipelining, Instruction-Level Parallelism, Microprogramming

Unit 3
Computer Arithmetic and the Arithmetic Unit Number Systems and Radix Conversion, Fixed-Point Arithmetic, Seminumeric Aspects of ALU Design, Floating-Point Arithmetic

Unit 4
Memory System Design The Components of the Memory System, RAM Structure, The Logic Designer's Perspective, Memory Boards and Modules, Two-Level Memory Hierarchy, The Cache Virtual Memory, The Memory Subsystem in the Computer

Unit 5
Input and Output The I/O Subsystem, Programmed I/O, I/O Interrupts, Direct Memory Access (DMA) , I/O Data Format Change and Error Control.

Text Books
> Computer Systems Design and Architecture Vincent P. Heuring& H. Jordan Pearson Education
> Computer organization & Architecture Stallings Pearson Education

Referances
- o Digital System Design & Microprocessors Hayes, John P Tmh Digital System (Principles & Applications) R.J. tocci - P.H.I.
- o Computer System Architecture, By Morris Mano, Prentice-Hall of India.

VHDL Design Lab

List of Experiments (to be performed at least 10 experiments)

1)   To design and simulate the basic gates
2)   Designing of the combinational blocks a) Mux b) Encoders c) Decoders
3)   Designing and simulation of Code converters
4)   Designing, simulation and implementation 9-bit parity generator/checker
5)   Designing, simulation and implementation Flip-Flops
6)   Designing and simulation of Registers
7)   Designing and simulation of Counters
8)   FSM modeling (Design Sequence Detector "101")
9)   Designing, simulation and implementation of ROM
10)   Designing, simulation and implementation of RAM
11)   Designing, simulation and implementation of FIFO
12)   Design, simulation and implementation of ALU
13)   Designing and simulation of Filter
14)   Designing and simulation of FSK modulator and Demodulator
15)   Designing and simulation of PN generator.

List of Equipments/Machine Required:
1) Computer System with Pentium 4 processor, 512MB Ram
2) EDA tools: 1) FPGA implementation kit 2) CPLD implementation kit
3) Xilinx project navigator
4) Active HDL 6.2
5) Modelsim

Recommended Books:
1) Fundamentals of Digital Logic with VHDL Design: Brown Vranesic, TMH Publication.
2) Circuit Design with VHDL Prdroni PHI Publication 3) VHDL Primer   Bhaskar   PHI
Publication

Modern Digital Communication Lab

List of Experiments (to be performed at least 10 experiments)

i.   To generate various signals used in digital communications
ii.   To find correlation autocorrelation between various signals
iii.   To find convolution of signals and simulate response of LTI system
iv.   To write different algorithms of FFT
v.   To design IIR and FIR digital filters
vi.   To use raised cosine filters for pulse shaping
vii.   To source code using DPCM, Huffman etc.
viii.   To channel code and verify Shannon's channel capacity
ix.   To modulate signals using ASK, PSK, MSK etc in presence of AWGN
x.   To study and simulate the effects of equalization
xi.   To model a channel with power of transmission and fading perspectives
xii.   Study of various antenna signal and polar plot xiii. Study of frequency response of various signals using spectrum Analyzer
xiii. Study of Code division multiple access
xiv. Study GSM communication technology

List of Equipments/Machine Required:

i.   Mat lab 7.0
ii.   Computer System (PIV with 256 MB Ram)
iii.   CDMA trainer
iv.   GSM trainer
v.   Spectrum Analyzer

Recommended Books:

1. M.K. Simon, S.M. Hinedi and W.C. Lindsey, " Digital Communication Techniques": Signalingand detection, Prentice Hall India, New Delhi, 1995.
2. Simon Haykin, " Digital Communications" , John Wiley and sons , 1998.

Semester - II
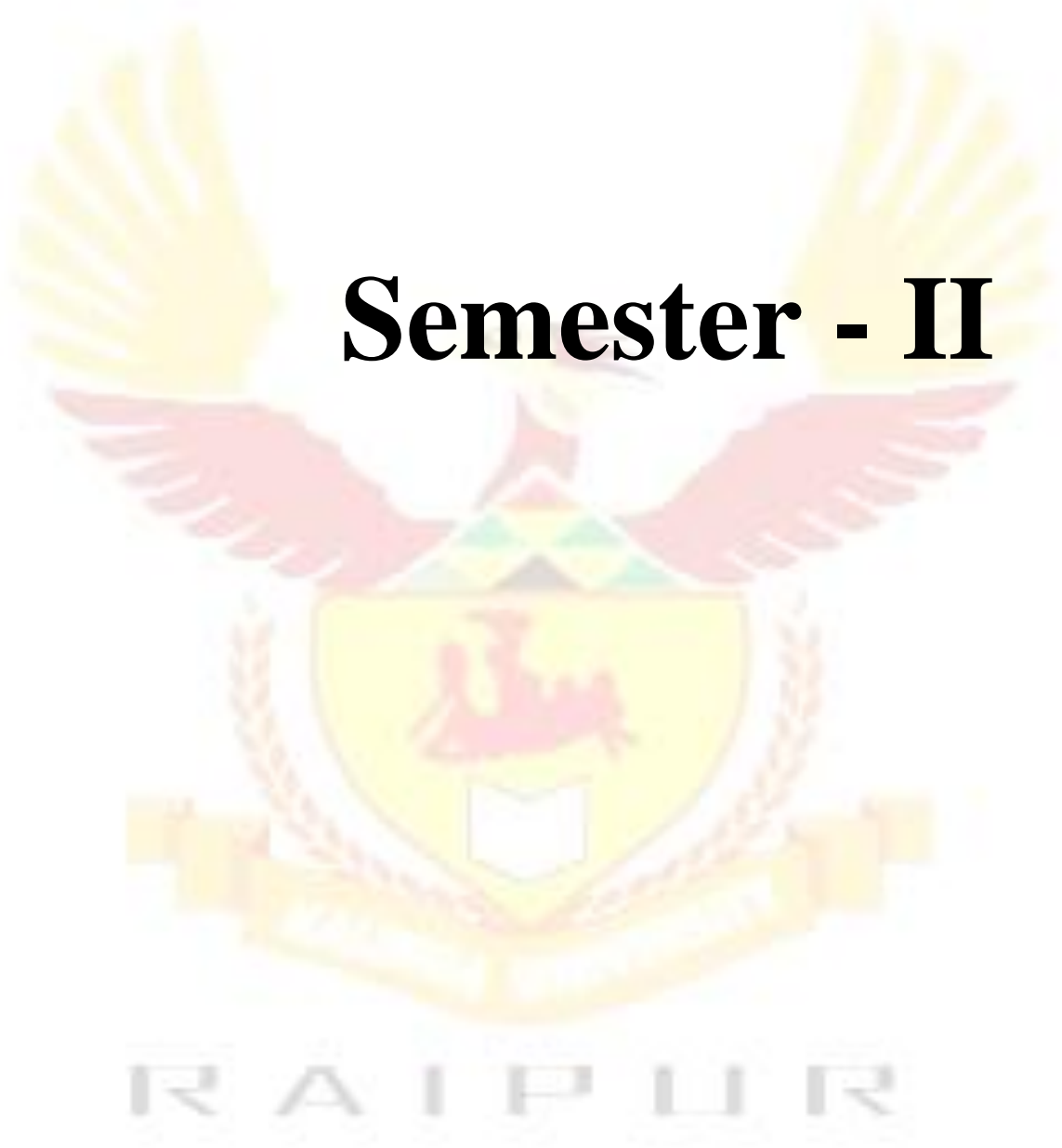
Secure Communication

UNIT – I
CONVENTIONAL ENCRYPTION: Introduction, Conventional Encryption model, Stenography, Data Encryption, Standard block cipher, Encryption algorithms, confidentially key distribution.

UNIT – II
PUBLIC KEY ENCRYPTION AND HASHING: Principles of public key cryptosystems, RSA algorithm, Diffie- Hellman key Exchange, Elliptic curve cryptology, message authentication and Hash function, Hash and Mac algorithms, Digital signatures.

UNIT – III
IP SECURITY: IP Security Overview, IP Security Architecture, authentication Header, Security payload, Security associations, Key Management.

UNIT – IV
WEB SECURITY: Web security requirement, secure sockets layer, transport layer security, secure electronic transaction, dual signature.

UNIT – V
SYSTEM SECURITY: Intruders, Viruses, Worms, Firewall design, Trusted systems, antivirus techniques, digital immune systems

Textbooks:
1. William Stallings,"Cryptography and Network Security", 2nd Edition, Prentice hall of India, New Delhi, 1999
2. Baidwin R and Rivest.R, "The RC5-CBC,TC5-CBC-PAD and RC5-CT5 algorithms, RFC2040'

Reference Books:

1 Cryptography & Network Security W.stallings PHI
2 Applied Cryptography Schneier, Bruce   John Wiley

Advanced Mobile Communication

Unit 1

Introduction to wireless mobile communications: History & Evolution Of Mobile Radio Systems. Types Of Mobile Wireless Services / Systems- Cellular, WLL, Paging, Satellite Systems, Standards, Future Trends In Personal Wireless Systems.

ADVANCED MOBILE COMMUNICATION STANDARDS IEEE 802.11 WLAN standard and its variants – PHY layer technologies – MAC mechanism – Security, Qos and handover Issues – IEEE 802.15 WPAN standard – Bluetooth Architecture and Protocol stack – IEEE 802.16 Wireless broadband access standard – PHY and MAC layer overviews – WiMAX network architecture – Initialization and handover procedures.

Unit 2

Cellular Concept And System Design Fundamentals: Cellular Concept And Frequency Reuse, Multiple Schemes, Channel Assignment And Handoff, Interference And System Capacity, Trunking And Erlang Capacity Calculations.

Unit 3

Mobile Radio Propagation Radio Wave Propagation Issues In Personal Wireless Systems, Propagation Models, Multipath Fading And Base Band Impulse Respond Models, Parameters Of Mobile Multipath Channels, Antenna Systems In Mobile Radio.

Unit 4

Modulation And Signal Processing: Analog And Digital Modulation Techniques- Performance Of Various Modulation Techniques, Spectral Efficiency, Error Rate, Power Amplification, Equalizing Rake Receiver Concepts, Diversity And Space Time Processing, Speech Coding Channel Coding.

Unit 5

System Example and Design Issues: Multiple access techniques –FDMA, TDMA and CDMA Systems, Operational Systems, Wireless Networking, Design Issues In Personal Wireless Systems.

Text Books

K.Feher "Wireless digital Communication " PHI New Delhi1995. T.S. Rappaport, " Wireless Digital Communication: Principles and Practices" PHI NJ 1996.

Reference Books

W.CY. Lee, " Mobile Communications Engineering: Theory and appliocations, 2nd edition" MC-Graw Hill New York 1990. Schiller " Mobile communications" Peason Education Asia Ltd. 2000.

METCS203

Digital Communication Receivers

UNIT – I
REVIEW OF DIGITAL COMMUNICATION TECHNIQUE Baseband and band-pass communication, signal space representation, linear and nonlinear modulation techniques and spectral characteristics of digital modulation
Detection of Binary Signal in Gaussian Noise: Detection of Binary signal in Gaussian Noise: Maximum Likelihood Receiver Structure, The Matched Filter, Correlation Realization of Matched Filter, Optimum error performance, Error performance of Binary Signaling.

UNIT – II
Coherent and Noncoherent Detection: Coherent Detection: Coherent Detection of PSK, Sampled Matched Filter, Coherent Detection of Multiphase Shift Keying, Coherent Detection of FSK. Noncoherent Detection: Detection of Differential PSK, Binary Differential PSK example, Noncoherent Detection of FSK, Required Tone Spacing for Noncoherent Orthogonal FSK.

UNIT – III
Waveform Coding: Waveform Coding and Structured Sequences: Antipodal and Orthogonal Signals, M-ary Signaling, Waveform Coding. Error-Detecting and Correcting Capability: Weight and Distance of Binary vectors, Minimum Distance of a Linear code, Error Detection and Correction, Convolutional Encoding, Reed-Solomon Codes.

UNIT – IV
Channel Coding: Adaptive Predictions: Forward Prediction, Synthesis/Analysis Coding, Block Coding: Vector Quantizing, Transform Coding: Quantization for Transform Coding, Subband Coding, Source coding for Digital Data.

UNIT – V
Microwave Receiver: Block Diagram of a Digital Transceiver, Bandwidth-Efficient Digital Radio System: 8-phase 8-PSK System, Quadrature Amplitude Modulated M=16-state Radio System, Filtering Requirement in Digital Radio System, Radio System Performance Design Guidelines, Performance characteristics of Typical M-ary PSK and QAM Microwave System

Text Books:

1. Digital Communications, 2nd Ed, Bernard Sklar, Pearson Education, 2001.
2. Digital \Communication Microwave Applications By KamiloFeher, PHI, 1987.

Reference Books:

1. Digital Communication, Prokis, John G. Tata McGraw Hill.
2. .Digital Communication Technique, Signal Design & Detection By Simon, Marvin K, Hinedi,Sami M & Lindsey, William C, PHI.

Embedded Technology in Communication

UNIT – I

Microcontrollers: Brief review of the 8 bit microcontroller 8051 - Programming , CPU Block diagram, Memory Organization, SFR s ,Ports and Interfacing -Introduction to a 16 bit micro controller 80186 High Speed Input, High Speed Output, Interrupts, ADC, PWM, Timers, Watch Dog Timer, Serial Port, I/O Port

UNIT – II

Introduction to Embedded Systems: Characteristics of Embedded systems , Software embedded into a system .-General ideas of Processor and Memory organization - Processor and memory selection ,Interfacing to Memory and I/O devices- Devices and Buses- Device Drivers and Interrupt Servicing mechanisms

UNIT – III

Inter-process Communication and Synchronization of Processes ,Tasks and Threads: Multiple Processes in an Application - Data sharing by multiple tasks and routines- Inter Process Communication

UNIT – IV

Real Time Operating Systems: Task And Task States, Tasks And Data, Concepts Of Semaphores, Shared Data, Inter process Communication, Signal Function, Semaphore Functions, Message Queue Functions, Mailbox Functions, Pipe Functions, Operating System Services, Process Management, Timer Function, Event Function, Memory Management, Device File And IO Subsystems Management, Interrupts Routines In RTOS Environment, basic Design using an RTOS, RTOS Task scheduling models, interrupt latency and response times of the tasks.

UNIT – V

ARM processor/PIC microcontroller: ARM controller Architecture, Memory Organization, Pipeline And Cache Concepts, ARM (32 Bit) Architecture Instruction Set And Assembly Language Programming - ARM Instructions Set And THUMB Instruction Set, Switching Between ARM And THUMB Instructions.
Architecture ,Memory Organization , Addressing Modes ,Instruction Set ,PIC Programming In Assembly & C ,I/O Port, Data Conversion, RAM & ROM Allocation, Timer Programming, MPLAB. Peripherals Of PIC Microcontroller: Timers, Interrupts, I/O Ports- I 2C Bus-A/D Converter, UART, CCP Modules, ADC, DAC And Sensor Interfacing, Flash And EEPROM Memories.

Text Books:
1. Ajay V. Deshmukh , " Microcontrollers -Theory and Applications", Tata Mc Graw Hill Publications
2. Rajkamal; "Embedded Systems Architecture; Programming and Design"; Tata McGraw Hill Publications.

Reference Books:

1. Programming and Customizing the 8051 microcontroller, 1st Edition; by: Predko, Myke; McGraw Hill International
2. 8051 microcontroller: Architecture, Programming & Applications, 1st Edition; by: Ayala, Kenneth J
3. Real-Time Systems - Jane Liu, PH 2000
4. Real-Time Systems Design and Analysis : An Engineer's Handbook: Phillip A Laplante
5. Structured Development for Real - Time Systems V1 : Introduction and Tools: Ward, Paul T & Mellor, Stephen J Embedded Software Primer - Simon, David E.

METCS205A

Advanced Digital Signal Processing & Application

UNIT – I
Discrete Random Signal Processing : Review of Discrete time signals and systems and frequency analysis of discrete time linear time invariant systems. Discrete time systems, analysis of discrete time linear invariant systems, implementation of discrete time systems, correlation of discrete time systems,ztransforms, linear time invariant systems as frequency selective filters. SamplingThe Discrete Fourier transforms its properties and applications. Frequency domain sampling, properties of DFT, linear filtering methods based on DFT, Frequency analysis of signals using the DFT,Radix-2 decimation in time domain and decimation in frequency domain algorithms.

UNIT – II
Spectrum Estimation: Non-Parametric   Methods –Co-Relation Method- Co-Variance Estimator- Performance Analysis Of Estimators- Unbiased, Consistent Estimators – Periodogram Estimator- Barlett Spectrum Estimation- Welch Estimation – Model Based Approach-Ar,Ma,Arma Signal Modeling – Parameter Estimation Using Yule –Walker Method.

UNIT – III
Adaptive Filters: FIR Adaptive Filters- Newton's Steepest Decent Method-Adaptive Filter Based On Steepest Decent Method- Widrow Hoff LMS –Adaptive Algorithm-Adaptive Channel Equalization- Adaptive Echo Chancellor- Adaptive Noise Cancellation-RLS Adaptive Filters- Exponentially Weighted RLS Sliding Window RLS –Simplified IIR LMS Adaptive Filter.

UNIT – IV
Multirate Digital Signal Processing : Mathematical Description Of Change Of Sampling Rate- Introduction And Decimation- Continuous Time Model – Direct Digital Domain Approach – Decimation By An Integer Factor – Interpolation By An Integer Factor- Single And Multistage Realization- Ploy Phase Realization- Application To Sub Band Coding – Wavelet Transform And Filter Bank Implementation of Wavelet Expansion of Signals.

UNIT – V
Digital signal Processors: Introduction To Programmable Dsps, Multiplier And Multiplier Accumulator (MAC), Modified Bus Structures And Memory Access Schemes In P- Dsps. Multiple Access Memory. Multi Ported Memory. VLIW Architecture , Pipelining , Special Addressing Modes In P-Dsps, On-Chip Peripherals. Architecture Of TMS320C50X, TMS320C50X Assembly Language Instructions & Programming. Introduction About Other DSP Processors.

Text Books:
1. Monson H. Hayes, " Statistical Digital Signal Processing and Modeling " , John Wiley and Sons, Inc. New York, 1996.
2. Sopocles J. Orfanidis, " Optimum Signal Processing" , Mc Graw Hill, 1990

Reference Books:

1. John G. Prokias ,Dimitris G. Manolakis , " Digital Signal Processing" , Prentice Hall ofIndia, 1995.
2. B. V enkataramani , M. Bhaskar, " Digital Signal Processor – Architecture ,Programming & Applications" Tata Mc Graw Hill 2003.
3. K. Padmnabhan, S. Awasthi, R. Vijayrajeshwaran, " A Practical Approach to Digital Signal Processing "

METCS205B

Microwave Integrated Circuits

UNIT – I
MICROSTRIPS LINES, DESIGN, ANALYSIS: Introduction, types of MICs and their technology, Propagating models, Analysis of MIC by conformal transformation, Numerical analysis, Hybrid mode analysis. losses in Microstrip, Introduction to slot line and coplanar wave guide

UNIT – II
COUPLED MICROSTRIP,DIRECTIONAL COUPLERS AND LUMPED ELEMENTS FOR MICS: Introduction to coupled Microstrip, Even and odd mode analysis, Directional couplers, branch line couplers, Design and Fabrication of Lumped elements for MICs, Comparison with distributed circuits

UNIT –III
NON-RECIPROCAL COMPONENTS AND ACTIVE DEVICES FOR MICS: Ferromagnetic substrates and inserts, Microstrip circulators, Phase shifters, Microwave transistors, Parametric diodes and Amplifiers, PIN diodes, Transferred electron devices, IMPATT, BARITT, Avalanche diodes, Microwave transistors circuits.

UNIT – IV
MICROSTRIP CIRCUIOT DESIGN AND APPLICATIONS: Introduction, Impedance transformers, Filters, High power circuits, Low power circuits, MICs in satellite and Radar.

UNIT – V
MMIC TECHNOLOGY: Fabrication process of MMIC, Hybrid MICs, Configuration, Dielectric substances, thick and thin film technology, Testing methods, Encapsulation and mounting of Devices.

References:

1. Hoffman R.K."HandBook of Microwave intergrated circuits",Artech House,Boston,1987.
2. Gupta .K.C and AmarjitSingh,"MicrowaveIntergratedcircuits"JohnWiley,New York,1975.

METCS205C

Optical communication System

UNIT – I
Fiber Optic Guides: Light Wave Generation Systems, System Components , Optical Fibers, SI,GI-Fibers, Modes, Dispersion in Fibers, Limitations Due To Dispersion, Fiber Loss, Non-Linear Effects, Dispersion Shifted And Dispersion Flattened Fibers.

UNIT – II
Optical Transmitters And Receivers: Basic Concepts, LED's Structures Spectral Distribution, Semiconductor Lasers, Gain Coefficients, Modes, SLM And STM Operation, Transmitter Design, Receiver PIN And APD Diodes Design , Noise Sensitivity And Degradation, Receiver Amplifier Design.

UNIT – III
Light Wave System: Coherent, Homodyne And Heterodyne Keying Formats, BER In Synchronous – And Asynchronous- Receivers, Sensitivity Degradation, System Performance, Multichannel, WDM, Multiple Access Networks, WDM Components, TDM, Subcarrier And Code Division Multiplexing.

UNIT – IV
Amplifiers: Basic Concepts , Semiconductor Laser Amplifiers, Raman   - And   Brillouin- Fiber Amplifiers, Erbium Doped – Fiber Amplifiers, Pumping Phenomenon, Lan And Cascaded In –Line Amplifiers. Fiber Optic Network- Architecture , Management And Future Of Fiber Optic Network.

UNIT – V
Dispersion compensation: Limitations, Post- And Pre- Compensation Techniques, Equalizing Filters , Fiber Based Gratings, Broad Band Compensation, Soliton Communication System, Fiber Soliton, Soliton Based Communication System Design , High Capacity And WDM Soliton System. Isolators , Circulator And Attenuator , Optical Switches And Modules.

Text Books:
1. G.P. Agrawal, " Fiber Optic Communication Systems" , 2nd Edition, John Wiley & Sons. New-York, 1997.
2. Optical Fiber CommunacationKeiser,gerdMgh

Reference Books:
1. Franz and Jain , " Optical Communication System", Narosa Publications, New Delhi, 1995.
2. G. Keiser, " Optical Fiber Communication" ,   Systems and Components , Narosaublications, New Delhi, 2000.

Embedded Technology in Communication Systems Laboratory

List of experiments to be performed:

(i)   Create ,compile and test a program to print a string a message on standard output device
(ii)   Create a program to print powers of 2 from 20 to 212 \
(iii)   Write a program tht continuously reads Port A and provides output to port B
(iv)   Use External Hard ware Interrupt to print a message to the standard output devices each time an interrupt occurs . Also print number of time interrupt occur
(v)   Create a program that will turn on an LED when falling edge occur on external interrupt 0 and turn it off when rising edge occour on external interrupt 1
(vi)   Create a programme that will demonstrate how watchdog timer resets the processor if programme hangs up to infinite loop
(vii)   Create a programme that will read the data on all 8 bits of port B swap the nibble of data and send it to port A
(viii) Create a simulated engine speed monitor that will light a LED if the motor speed drops below 200rpm and another LED if motor speed exceed 500 rpm and light another LED if motor speed between 200 to 500 rpm
(ix)   Create a programme to output the ASCII character G every 50 msec via USART at 9600 baud rate
(x)   Write a microcontroller 8051 program to add two floating-point numbers.
(xi)   Write a microcontroller 8051 program to multiply two floating-point numbers.
(xii)   Write a microcontroller 8051 program that generates 2kHz square wave on pin P1.0, 2.5 kHz on pin P1.2 and 25 Hz on pin P1.3.
(xiii) Write a microcontroller 8051 program for counter 1 in mode 2 to count the pulses and display the state o the TL1 count on P2. Assume that the clock pulses are fed to pin T1.
(xiv)   Write a microcontroller 8051 program to transfer word "COMMUNICATION" serially at 4800 baud and one stop bit, to the com port of PC continuously.
(xv)   Write a microcontroller 8051 program to receive bytes of data serially, and put them in P1. Set the baud rate at 2400 baud, 8-bit data, and 1 stop bit. Assume crystal frequency to be 11.0592 MHz.

Recommended Books:

1. Embedded C Programming and the Microchip by PIC Barneet , Cox ,O'cull Thomson publication
2   Embedded system by Raj Kamal TMH

List of Equipments/Machine Required :

1. MATLAB Software with Simulink
2. Emulation software with Cross C complier

Signal Processing Lab

List of Practical

1. To Generate the following waveforms a: Unitstep Sequence b. Ramp Sequence c. Exponcial Sequence d. Sine Sequence e. Sine Sequence
2. Program for linear convolution
3. Program of computing circular convolution.
4. Program for computing cross correlation of the given sequence.
5. Program for design of Butter worth LPF.
6. Program for the design of FIR, LP, HP, BP and BS Filters using Rectangular Window.
7. Program for estimating PSD of Two sinusoid Plus noise.
8. Program for Drawn Sampling a Sinusoidal sequence by a faster M.
9. Cancellation of echo produced on the telephone base band channel (Simulation).
10. Program for the solution of normal equation using Levinson-Durbin Algorithms.
11. Study of DSP Processor. (Texas Instrument)
12. To observe the effect of interpolation and decimation on the spectrum of a signal   (DSP Works Software)
13. To Generate and amplitude modulation Signal and observe the presence of sideband in its spectrum. (DSP works software)
14. To Demonstrate Spectral Leakage.
15. Program for partial fraction decomposition of a rational transfer function.

Recommended Books:
1. DSP – S Salivaliaran, A Vallavraj, C,TATA MECGRAW HILL.
2. Digital Signal Processors   Architehure, Programming and Application- B Venkatramani, M Bhaskar, TATA MECGRAW HILL.
3. dsp – a Handson approach – Charles schuler, Mahesh chugani, TATA MECGRAW HILL

List of Equipments/Machine Required :
1. MATLAB Software with DSP Toolbox.
2. DSPworks Signal grneration and Analysis Software.
3. TMS 320C6** service starter Kits with Code composer Studio.

Semester - III

METCS301
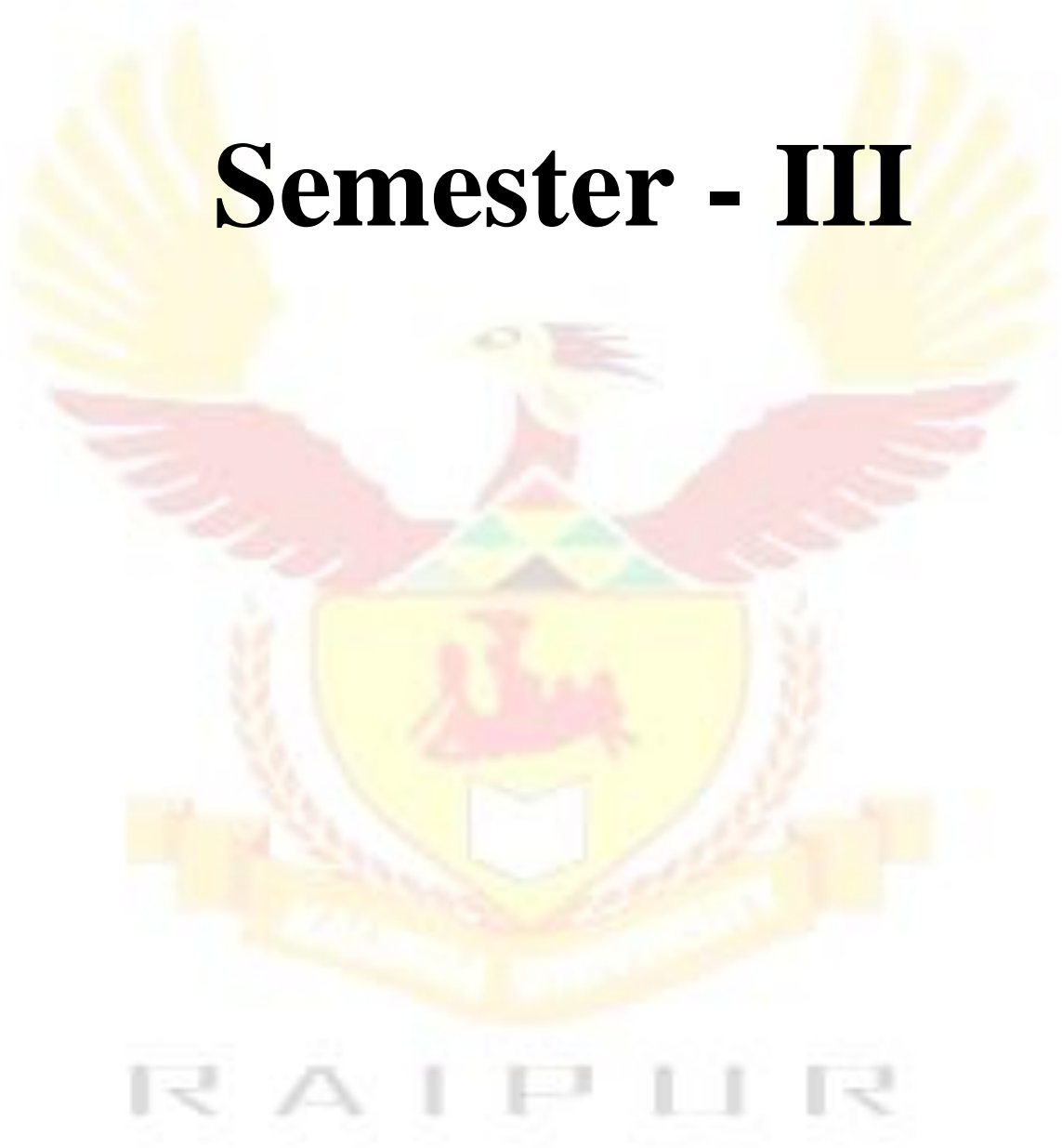
Broadband Communication

Unit –I
Frame Relays: Frame Relay Protocols and Services: Background, Frame Mode Protocol Architecture, Frame Mode Call Control
X.25, Frame relay, X.25 v/s Frame relaying, Frame mode protocol architecture, Frame relay and Frame switching, Frame mode call control, Call control protocol, DLCI, Bearer capability, Link layer core parameters, LAPF.
Frame Relay Congestion Control: Congestion In Frame Relay Networks Approaches To Congestion Control, Traffic Rate Management, Explicit Congestion Avoidance, Implicit Congestion Control.

Unit -II
ISDN Integration of Transmission and Switching, Analog and Digital switching, Principles of ISDN, User interface, Architecture, ISDN standards, I-series recommendations.

Unit -III
ISDN: interface and Functions – Transmission structure, User network interface, ISDN protocol architecture, ISDN connections, Addressing, Interlocking, B-ISDN architecture and standards

Unit -IV
B-ISDN Services – Conversational, Messaging, Retrieval, Distribution, Business and Residential requirements. B-ISDN protocols User plane, Control plane. Physical layer, Line coding, Transmission structure, SONET- Requirement, Signal Hierarchy, System Hierarchy.

Unit –V
ATM – Overview, Virtual channels, Virtual paths, VP and VC switching, ATM Cells, Header format, Generic flow control, Header error control, Transmission of ATM cells, Adaptation layer, AAL services and protocols. ATM switching – ATM switching building blocks, ATM cell processing in a Switch, Matrix type switch, Input, Output buffering, Central buffering, Performance aspects of buffering switching networks.

Tex Book

1. ISDN and Broadband ISDN with Frame Relay and ATM William Stallings, Prentice-Hall, 4^t edition
2. Understanding SONET/SDH and ATM, Kartalapoulos PHI Publication

References
1. Atm Networks Kasera, Sumit T Mh
2. Isdn And Broadband Isdn With Frame Relay And Atm ,W.stallings   P. E. A.
3. Broadband Bible, Gaskin, James E, Wiley

Communication and Research Methodology

Unit 1

Concepts of Communications: Definition, Forms of Communication, Objectives of Communication, Characteristics of Communication, Process of Communication, Communication, Roadblocks, Role of Verbal and Non-verbal Symbols in Communication, Barriers to Effective Communication, Overcoming Communication Barriers.

Nonverbal communication: Body Language, Gestures, Postures, Facial Expressions, Dress codes; the Cross Cultural Dimensions of Business Communication; Listening and Speaking, techniques of electing response, probing questions, Observation. Business and social etiquettes;

Listening Skills: Definition, Anatomy of poor Listening, Features of a good Listener, Role Play, Group Discussion and Interviews, Meetings: Ways and Means of conducting meetings effectively, Mock Meetings and Interviews

Unit 2

Reading and language skills: The reading process, purpose, different kinds of texts, reference material, scientific and technical texts, active and passive reading, strategies - vocabulary skills, eye reading and visual perception, prediction techniques, scanning skills, distinguishing facts and opinions, drawing inferences and conclusions, comprehension of technical material - scientific and technical texts, instructions and technical manuals, graphic information.

Forms of Communication in Written mode: Basics Body language of Business Letters and Memos, Tone of writing, Enquiries, orders and replying to them, sales letters, Job applications and resume, E-mail: How to make smart e-mail, Writing Business Reports and Proposals, Practice for Writing.

Unit 3

Referencing and Writing skills: Business letters: Enquiries, Circulars, Quotations, Orders, Acknowledgments, Executions, Complaints, Claims and adjustments, Collection letter, Banking correspondence, Agency correspondence, Bad news and persuading letters, Sales letters, Job application letters - Biodata, Covering Letter, Interview Letters, Letter of Reference, Memos, minutes, Circulars & notices.

Types of Business Reports - Format, Choice of vocabulary, coherence and cohesion, paragraph writing, organization reports by individual, Report by committee.

Unit 4

Introduction to Research and Research Design: Nature and scope of research, information based decision making and source of knowledge. The research process; basic approaches and terminologies used in research. Defining research question and framing of hypotheses, preparing a research plan, qualitative and quantitative research designs, Experimentation, Observational studies, Exploring secondary data.

Measurement and Scaling, Data Source and Data Collection Field research: primary data collection from observations, surveys and experimentation. Measurement and scaling; commonly used scales in reliability and validity of scales. Designing instrument for data collection; testing the instrument, data collection process, Sampling methods and procedures and sample size decisions.

Unit 5

Data Analysis and Presentation Editing and coding of data, tabulation, graphic presentation of data, cross tabulation, Testing of hypotheses; type I and II errors, one tailed and two tailed tests of significance, Parametric and nonparametric tests for Univariate and Bivariate data. Tests of association; simple linear regression and other non parametric tests.

Technical Writing: Technical Proposal writing: Definition, Purpose, types, characteristics, Elements of structure, style and appearance, evaluation, exercises, Research report writing, Proposal writing, referencing, forms of reports, bibliography, etc. Research paper, Dissertation, and Thesis, Instruction Manuals, Type of instructions, Writing Instructions, Technical Descriptions, Process descriptions, Guidelines for Writing Good Descriptions.

Text Books:
1. Lesikar, R. V. &Flatley, Basic Business Communication Skills for Empowering the Internet Generation. TMH.

2. Meenakshi Raman, Sangeeta Sharma, Technical Communications, Oxford Latest Edition.
3. D. K. Bhattacharyya, Research Methodology, Excel Books 2nd Edition.
 Reference Books:
1. Bowman, J.P. &Branchaw, P.P. Business Communications, Process to Product Dryden Press, Chicago.
2. M Ashraf Rizvi, Effective Technical Communication, Tata McGraw Hill.
3. E. H. McGrath, Basic Managerial Skills, Prentice hall India
4. Sajitha, Technical Writing, Himalaya Latest Edition

Electromagnetic Interference and Electromagnetic Compatibility

UNIT – I
Introduction to EMC: Aspects of EMC and history, Different regulatory forums, Requirements for electronic systems. Commercial and military requirements. Examples of the difficulty in meeting regulatory norms.

UNIT – II
EMC design aspects: Non-ideal behavior of wires, concept of partial inductance, PCB Lands, Effect of component leads, resistors, capacitors inductors. Effect of Electromechanical devices and digital circuit devices.

UNIT – III
Radiated emission and susceptibility: Differential mode and common mode currents, emission models, current probes, shielded cables and surface transfer impedance, antenna measurements. Experimental results.

UNIT – IV
Conducted emission and susceptibility: The line impedance stabilization network (LISN), Effect of power supply filter elements on differential and common mode currents. Effect of SMPS on conducted emission.

UNIT – V
Cross Talk and Electrostatic discharge: Three conductor lines and crosstalk, time and frequency domain cross talk. Lumped circuit approximate models. Effects of ESD. Mitigation design techniques. Hardware and software immunity.

Text Books:
1. Clayton R. Paul; 'Introduction to electromagnetic compatibility'. John Willey & Sons Inc.1992
2. Mark I. Montrose, Edward M. Nakauchi, 'Testing for EMC Compliance'. John Willey & Sons Inc-IEEE series.2004

Reference Books:
1. Bruce Aarchambeault, Colin Brench, Omar Ramahi, 'EMI/EMC Computational Modeling
2. Handbook'. Springer.2001

Soft Computing

UNIT – I
Introduction : What is Soft Computing? Difference between Hard and Soft computing, Requirement of Soft computing, Major Areas of Soft Computing, Applications of Soft Computing. Differences between AI and Soft Computing
ARTIFICIAL NEURALS: Basic-concepts-single layer perception-Multi layer perception-Supervised and un supervised learning back propagation networks, Application.

UNIT – II
FUZZY SYSTEMS: Fuzzy sets and Fuzzy reasoning-Fuzzy matrices-Fuzzy functions-decomposition-Fuzzy automata and languages-Fuzzy control methods-Fuzzy decision making, Applications.

UNIT – III
NEURO-FUZZY MODELLING: Adaptive networks based Fuzzy interfaces-Classification and Representation trees-Data dustemp algorithm –Rule base structure identification-Neuro-Fuzzy controls.

UNIT – IV
GENETIC ALGORITHM: History of Genetic Algorithms (GA), Working Principle, Various Encoding methods, Fitness function, GA Operators- Reproduction, Crossover, Mutation, Convergence of GA, Bit wise operation in GA, Multi-level Optimization.,
Hybrid Systems: Sequential Hybrid Systems, Auxiliary Hybrid Systems, Embedded Hybrid Systems, Neuro-Fuzzy Hybrid Systems, Neuro-Genetic Hybrid Systems, Fuzzy-Genetic Hybrid Systems. Application

UNIT – V
SOFT COMPUTING AND CONVENTIONAL AI: AI Search algorithm-Predicate calculus rules of interface - Semantic networks-frames-objects-Hybrid models applications.

Text Boos:
1) Nih.J.Ndssen Artificial Intelligence,Harcourt Asia Ltd.,Singapore,1998.
2) LaureneFauseett:Fundamentals of Neural Networks.prentice Hall India,New Delhi,1994

Reference Books:
1) Timothy J.Ross:Fuzzy Logic Engineering Applications.McGraw Hill,NewYork,1997.
2) George J.Klir and Bo Yuan,Fuzzy Sets and Fuzzy Logic,Prentice Hall Inc.,New Jersey,1995
3) Jang J.S.R.,Sun C.T and Mizutami E - Neuro Fuzzy and Soft computing Prentice hall New Jersey,1998

METCS303C

Global Tracking & Positioning System

UNIT – I
INTRODUCTION: Satellites, Introduction to Tracking and GPS System, Applications of Satellite and GPS for 3D position, Velocity, determination as function of time, Interdisciplinary applications(eg,.Crystal dynamics, gravity field mapping, reference frame, atmospheric occultation)Basic concepts of GPS. Space segment, Control segment, user segment, History of GPS constellation, GPS measurement characteristics, selective availability(AS), antispoofing (AS).

UNIT – II
ORBITS AND REFERENCE SYSTEMS: Basics of Satellite orbits and reference systems-Two-body problem, orbit elements, timer system and timer transfer using GPS, coordinate systems, GPS Orbit design, orbit determination problem, tracking networks, GPS force and measurement models for orbit determination, orbit broadcast ephemeris, precise GPS ephemeris. Tracking problems.

UNIT – III
GPS MEASUREMENTS: GPS Observable-Measurement types(C/A Code,P-code,L1 and L2 frequencies for navigation, pseudo ranges),atmospheric delays (tropospheric and ionospheric) data format (RINEX), data combination(narrow/wide lane combinations, ionosphere-free combinations, single, double, triple differences), undifferenced models, carrier phase Vs Integrated Doppler, integer biases, cycle slips, clock error.

UNIT – IV
PROCESSING TECHNIQUES: Pseudo range and carrier phase processing, ambiguity removal, Least square methods for state parameter determination, relation positioning, dilution of precision.

UNIT – V
GPS APPLICATIONS: Surveying, Geophysics, Geodsey, airborne GPS, Ground-transportation, Spaceborne GPS orbit determination, attitude control, meteorological and climate research using GPS.

Text Books:

1. B.Hoffman - Wellenhof,H.Lichtenegger and J.Collins,"GPS: Theory and Practice ".4th revised edition, Springer, New york,1997
2. B.Parkinson,J.Spilker,Jr.(Eds),"GPS:Theory and Applications",Vol.I& Vol.II,AIAA,370 L'Enfant Promenade SW,Washington,DC20024,1996

Reference Books:

1. A.Kleusberg and P.Teunisen(Eds),GPS for Geodesy,Springer-Verlag,Berlin,1996
2. A.Leick,"GPS Satelite Surveying",2nd edition, John Wiley & Sons,NewYork,1

Preliminary work on Dissertation

The student will submit a synopsis at the beginning of the semester for approval from the departmental committee in a specified format. The student will have to present the progress of the work through seminars and progress reports.

Seminar Based on Dissertation

The student will deliver a seminar on the topic chosen by him and approved by Departmental committee for evaluation at the end of semester.

Semester – IV

Dissertation

The student will submit a detailed Project Report on the topic approved by Departmental committee in a specified format and will also deliver a Presentation on the topic chosen at the end of semester.