JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.Tech (WIRELESS AND MOBILE COMMUNICATIONS)
COURSE STRUCTURE AND SYLLABUS

I Year – I Semester

Category	Course Title	Int. marks	Ext. marks	L	P	C
Core Course I	Advanced Data Communications	25	75	4	--	4
Core Course II	Coding Theory and Techniques	25	75	4	--	4
Core Course III	Spread Spectrum Communication	25	75	4	--	4
Core Elective I	Detection and Estimation Theory Random Processes and Time Series Analysis RF Circuit Design	25	75	4	--	4
Core Elective II	Voice Over Internet Protocol Queueing Theory and Applications GPS Applications	25	75	4	--	4
Open Elective I	Image and Video Processing Internetworking Advanced Digital Signal Processing	25	75	4	--	4
Laboratory I	Advanced Communications Lab	25	75	--	4	2
Seminar I	Seminar	50	--	--	4	2
Total Credits				**24**	**8**	**28**

I Year – II Semester

Category	Course Title	Int. marks	Ext. marks	L	P	C
Core Course IV	Advanced communications & Networks	25	75	4	--	4
Core Course V	Wireless Communications & Networks	25	75	4	--	4
Core Course VI	Wireless MIMO Communications	25	75	4	--	4
Core Elective III	Optical Communications Technology Wireless LANs and PANs Adhoc and Wireless Sensor Networks	25	75	4	--	4
Core Elective IV	Network Security and Cryptography Software Defined Radio 4G Technologies	25	75	4	--	4
Open Elective II	Embedded system Design Mobile Computing Technologies Scripting Languages	25	75	4	--	4
Laboratory II	Wireless Communications and Networks Lab	25	75	--	4	2
Seminar II	Seminar	50	--	--	4	2
Total Credits				**24**	**8**	**28**

II Year - I Semester

Course Title	Int. marks	Ext. marks	L	P	C
Comprehensive Viva-Voce	--	100	--	--	4
Project work Review I	50	--	--	24	12
Total Credits			--	24	**16**

II Year - II Semester

Course Title	Int. marks	Ext. marks	L	P	C
Project work Review II	50	--	--	8	4
Project Evaluation (Viva-Voce)	--	150	--	16	12
Total Credits			**--**	**24**	**16**

1

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech – I Year – I Sem. (WMC)

ADVANCED DATA COMMUNICATIONS

Unit I
Data Communications, Networks and Network Types, Internet History, Standards and Administration, Protocol Layering, TCP/IP protocol suite, OSI Model. Digital Data Transmission, DTE-DCE interface.
Data Link Layer
Introduction, Data Link Layer, Nodes and Links, Services, Categories of Links, sub layers,   Link Layer Addressing, Address Resolution Protocol.

Unit II
Error Detection and Correction: Types of Errors, Redundancy, detection versus correction, Coding Block Coding: Error Detection, Vertical redundancy cheeks, longitudinal redundancy cheeks, Error Correction, Error correction single bit, Hamming code.
Cyclic Codes: Cyclic Redundancy Check, Polynomials, Cyclic Code Encoder Using Polynomials, Cyclic Code Analysis, Advantage of Cyclic Codes, Checksum
Data Link Control: DLC Services, Data Link Layer Protocols, HDLC, Point to Point Protocol

Unit III
Switching: Introduction to Switching, Circuit Switched Networks, Packet Switching, Structure of switch
Multiplexing : Multiplexing, Frequency Division Multiplexing, Time Division Multiplexing.
Connecting devices: Passive Hubs, Repeaters, Active Hubs, Bridges, Two Layer Switches, Routers, Three Layer Switches, Gateway, Backbone Networks.
Wired LANS: Ethernet Protocol, Standard Ethernet, Fast Ethernet, Gigabit Ethernet, 10 Giga bit Ethernet

Unit IV
Media Access Control (MAC) Sub Layer
Random Access, ALOHA, Carrier Sense Multiple Access (CSMA), Carrier Sense Multiple Access with Collision Detection (CSMA/CD), Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA),Controlled Access- Reservation, Polling- Token Passing, Channelization - Frequency Division Multiple Access (FDMA), Time - Division Multiple Access (TDMA), Code - Division Multiple Access (CDMA).
Spectrum Spreading: Spread Spectrum-Frequency Hopping Spread Spectrum and Direct Sequence Spread Spectrum.

Unit V
Networks Layer: Packetizing, Routing and Forwarding, Packet Switching, Network Layer Performance, IPv4 Address, Address Space, Classful Addressing, Classless Addressing, Dynamic Host Configuration Protocol (DHCP), Network Address Resolution(NATF), Forwarding of IP Packets, Forwarding based on Destination Address, Forwarding based on Label, Routing as Packet Switches.
Unicast Routing : Introduction, **Routing Algorithms**-Distance Vector Routing, Link State Routing, Path Vector Routing, **Unicast Routing Protocols**- Routing Information Protocol(RIP), Open Short Path First Version 4.

TEXT BOOKS:
1.   Data Communications and Networking - B. A. Forouzan, 5th , 2013,TMH.
2.   Data and Computer Communications - William Stallings, 8th ed., 2007, PHI.
REFERENCE BOOKS:
1.   Data Communications and Computer Networks - Prakash C. Gupta, 2006, PHI.
2.   Data Communications and Networking - B. A. Forouzan, 2nd , 2013, TMH.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech – I Year – I Sem. (WMC)

CODING THEORY AND TECHNIQUES

UNIT – I:
Coding for Reliable Digital Transmission and storage
Mathematical model of Information, A Logarithmic Measure of Information, Average and Mutual Information and Entropy, Types of Errors, Error Control Strategies.
Linear Block Codes: Introduction to Linear Block Codes, Syndrome and Error Detection, Minimum Distance of a Block code, Error-Detecting and Error-correcting Capabilities of a Block code, Standard array and Syndrome Decoding, Probability of an undetected error for Linear Codes over a BSC, Hamming Codes. Applications of Block codes for Error control in data storage system

UNIT - II:
Cyclic Codes : Description, Generator and Parity-check Matrices, Encoding, Syndrome Computation and Error Detection, Decoding ,Cyclic Hamming Codes, Shortened cyclic codes, Error-trapping decoding for cyclic codes, Majority logic decoding for cyclic codes.

UNIT – III:
Convolutional Codes : Encoding of Convolutional Codes, Structural and Distance Properties, maximum likelihood decoding, Sequential decoding, Majority- logic decoding of Convolution codes. Application of Viterbi Decoding and Sequential Decoding, Applications of Convolutional codes in ARQ system.

UNIT – IV:
Turbo Codes
LDPC Codes- Codes based on sparse graphs, Decoding for binary erasure channel, Log-likelihood algebra, Brief propagation, Product codes, Iterative decoding of product codes, Concatenated convolutional codes- Parallel concatenation, The UMTS Turbo code, Serial concatenation, Parallel concatenation, Turbo decoding

UNIT - V:
Space-Time Codes
Introduction, Digital modulation schemes, Diversity, Orthogonal space- Time Block codes, Alamouti's schemes, Extension to more than Two Transmit Antennas, Simulation Results, Spatial Multiplexing : General Concept, Iterative APP Preprocessing and Per-layer Decoding, Linear Multilayer Detection, Original BLAST Detection, QL Decomposition and Interface Cancellation, Performance of Multi – Layer Detection Schemes, Unified Description by Linear Dispersion Codes.

TEXT BOOKS:
1. Error Control Coding- Fundamentals and Applications –Shu Lin, Daniel J.Costello,Jr, Prentice Hall, Inc.
2. Error Correcting Coding Theory-Man Young Rhee- 1989, McGraw-Hill

REFERENCE BOOKS:
1. Error Correcting Coding Theory-Man Young Rhee-1989,McGraw – Hill Publishing,19
2. Digital Communications-Fundamental and Application - Bernard Sklar, PE.
3. Digital Communications- John G. Proakis, 5th ed., 2008, TMH.
4. Introduction to Error Control Codes-Salvatore Gravano-oxford
5. Error Correction Coding – Mathematical Methods and Algorithms – Todd K.Moon, 2006, Wiley India.
6. Information Theory, Coding and Cryptography – Ranjan Bose, 2nd Edition, 2009, TMH.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech – I Year – I Sem. (WMC)

SPREAD SPECTRUM COMMUNICATION

UNIT -I:
Introduction to Spread Spectrum Systems: Fundamental Concepts of Spread Spectrum Systems, Pseudo Noise Sequences, Direct Sequence Spread Spectrum, Frequency Hop Spread Spectrum, Hybrid Direct Sequence Frequency Hop Spread Spectrum, Code Division Multiple Access.
Binary Shift Register Sequences for Spread Spectrum Systems:
Introduction, Definitions, Mathematical Background and Sequence Generator Fundamentals, Maximal Length Sequences, Gold Codes.

UNIT -II:
Code Tracking Loops: Introduction, Optimum Tracking of Wideband Signals, Base Band Delay-Lock Tracking Loop, Tau-Dither Non- Coherent Tracking Loop, Double Dither Non-Coherent Tracking Loop.

UNIT -III:
Initial Synchronization of the Receiver Spreading Code: Introduction, Problem Definition and the Optimum Synchronizer, Serial Search Synchronization Techniques, Synchronization using a Matched Filter, Synchronization by Estimated the Received Spreading Code.

UNIT -IV:
Cellular Code Division Multiple Access (CDMA) Principles: Introduction, Wide Band Mobile Channel, The Cellular CDMA System, Single User Receiver in a Multi User Channel, CDMA System Capacity,
Multi-User Detection in CDMA Cellular Radio: Optimal Multi-User Detection, Linear Suboptimal Detectors, Interference Combat Detection Schemes, Interference Cancellation Techniques.

UNIT -V:
Performance of Spread Spectrum Systems in Jamming Environments: Spread Spectrum Communication System Model, Performance of Spread Spectrum Systems without Coding.
Performance of Spread Spectrum Systems with Forward Error Correction: Elementary Block Coding Concepts, Optimum Decoding Rule, Calculation of Error Probability, Elementary Convolution Coding Concepts, Viterbi Algorithm, Decoding and Bit-Error Rate.

TEXT BOOKS:
1. Rodger E Ziemer, Roger L. Peterson and David E Borth - "Introduction to Spread Spectrum Communication- Pearson, 1st Edition, 1995.
2. Mosa Ali Abu-Rgheff – "Introduction to CDMA Wireless Communications." Elsevier Publications, 2008.

REFERENCE BOOKS:
1. George R. Cooper, Clare D. Mc Gillem - "Modern Communication and Spread Spectrum," McGraw Hill, 1986.
2. Andrew j. Viterbi - "CDMA: Principles of spread spectrum communication," Pearson Education, 1st Edition, 1995.
3. Kamilo Feher - "Wireless Digital Communications," PHI, 2009.
4. Andrew Richardson - "WCDMA Design Handbook," Cambridge University Press, 2005.
5. Steve Lee - Spread Spectrum CDMA, McGraw Hill, 2002.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech – I Year – I Sem. (WMC)

DETECTION AND ESTIMATION THEORY
(Core Elective –I**)**

UNIT –I:
Random Processes: Discrete Linear Models, Markov Sequences and Processes, Point Processes, and Gaussian Processes.

UNIT –II:
Detection Theory: Basic Detection Problem, Maximum A posteriori Decision Rule, Minimum Probability of Error Classifier, Bayes Decision Rule, Multiple-Class Problem (Bayes)- minimum probability error with and without equal a priori probabilities, Neyman-Pearson Classifier, General Calculation of Probability of Error, General Gaussian Problem, Composite Hypotheses.

UNIT –III:
Linear Minimum Mean-Square Error Filtering: Linear Minimum Mean Squared Error Estimators, Nonlinear Minimum Mean Squared Error Estimators. Innovations, Digital Wiener Filters with Stored Data, Real-time Digital Wiener Filters, Kalman Filters.

UNIT –IV:
Statistics: Measurements, Nonparametric Estimators of Probability Distribution and Density Functions, Point Estimators of Parameters, Measures of the Quality of Estimators, Introduction to Interval Estimates, Distribution of Estimators, Tests of Hypotheses, Simple Linear Regression, Multiple Linear Regression.

UNIT –V:
Estimating the Parameters of Random Processes from Data: Tests for Stationarity and Ergodicity, Model-free Estimation, Model-based Estimation of Autocorrelation Functions, Power Special Density Functions.

TEXT BOOKS:
1. Random Signals: Detection, Estimation and Data Analysis - K. Sam Shanmugan & A.M. Breipohl, Wiley India Pvt. Ltd, 2011.
2. Random Processes: Filtering, Estimation and Detection - Lonnie C. Ludeman, Wiley India Pvt. Ltd., 2010.

REFERENCE BOOKS:
1. Fundamentals of Statistical Signal Processing: Volume I Estimation Theory– Steven.M.Kay, Prentice Hall, USA, 1998.
2. Fundamentals of Statistical Signal Processing: Volume I Detection Theory– Steven.M.Kay, Prentice Hall, USA, 1998.
3. Introduction to Statistical Signal Processing with Applications - Srinath, Rajasekaran, Viswanathan, 2003, PHI.
4. Statistical Signal Processing: Detection, Estimation and Time Series Analysis – Louis L.Scharf, 1991, Addison Wesley.
5. Detection, Estimation and Modulation Theory: Part – I – Harry L. Van Trees, 2001, John Wiley & Sons, USA.
6. Signal Processing: Discrete Spectral Analysis – Detection & Estimation – Mischa Schwartz, Leonard Shaw, 1975, Mc Graw Hill.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech – I Year – I Sem. (WMC)

RANDOM PROCESSES AND TIME SERIES ANALYSIS
(Core Elective –I**)**

UNIT -I:
Stationary Random Processes from a Probability Point of View: Probability Density and Probability Distribution Functions of a Random Variable, Expected Value of Random Variable, Markov and Chebyshev Inequalities, Computer Methods for Generating Random Variables, Multidimensional Random variables, Chi-square tests of hypotheses concerning distribution.

UNIT -II:
Random Processes Analyzed in the Time Domain: Continuous and Discrete Time, Stationarity, Auto Covariance and Auto Correlation functions, Continuity, differentiation, Integrals of Random Processes.
Some special cases: The Poisson process, the Normal (Gaussian) Process.

UNIT -III:
Random Processes Analyzed in the Frequency Domain: The Fourier Transform, Spectral Density, The Cross Power Spectral Density.
Linear Systems with random input: Impulse response, Transfer function, the relation between the spectral density for the input and for the output

UNIT -IV:
Markov Chains: Markov Processes: Discrete time Markov chains, state transition probability matrix, n-step state transition probability, transition diagrams, classification of states, limiting state probabilities, Continuous-time Markov chains, Gambler's ruin as a Markov chains

UNIT -V:
Basic Queuing Theory: Elements of a Queueing System, Little's Formula, M/M/1, Queue- Delay Distribution in M/M/1 System, M/M/1 System with Finite Capacity, M/G/1 Queueing system- Residual Service Time, Mean Delay in M/G/1 Systems.

TEXT BOOKS:
1. Probability, Random Variables, and Random Signal Principles – Peebles, P. Z (1993)- Third edition or later – New York – McGraw-Hill
2. Fundamentals of Applied Probability and Random Processes – Oliver C. Ibe, Elsevier, 2009
3. Probability and Random Processes for Electrical Engineering - Alberto Leon-Garcia, 2nd Ed, Pearson

REFERENCE BOOKS:
1. Probability, Random Variables and Stochastic Processes – Athanasios Papoulis, S. Unnikrishna Pillai – TMH, 2008
2. Probability and Random Processes with Applications to Signal Processing – Henry Stark, John W. Woods, 3rd Edition, Pearson
3. Probability and Stochastic Processes – A Friendly Introduction for Electrical and Computer Engineers – Roy D. Yates, David J. Goodman

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech – I Year – I Sem. (WMC)

RF CIRCUIT DESIGN
(Core Elective –I**)**

UNIT -I:
Introduction to RF Electronics: The Electromagnetic Spectrum, units and Physical Constants, Microwave bands – RF behavior of Passive components: Tuned resonant circuits, Vectors, Inductors and Capacitors - Voltage and Current in capacitor circuits – Tuned RF / IF Transformers.

UNIT -II:
Transmission Line Analysis: Examples of transmission lines- Transmission line equations and Biasing- Micro Strip Transmission Lines- Special Termination Conditions- sourced and Loaded Transmission Lines.
Single And Multiport Networks: The Smith Chart, Interconnectivity networks, Network properties and Applications, Scattering Parameters.

UNIT- III:
Matching and Biasing Networks: Impedance matching using discrete components – Micro strip line matching networks, Amplifier classes of Operation and Biasing networks.
RF Passive & Active Components: Filter Basics – Lumped filter design – Distributed Filter Design – Diplexer Filters- Crystal and Saw filters- Active Filters - Tunable filters – Power Combiners / Dividers – Directional Couplers – Hybrid Couplers – Isolators. RF Diodes – BJTs- FETs- HEMTs and Models.

UNIT -IV:
RF Transistor Amplifier Design: Characteristics of Amplifiers - Amplifier Circuit Configurations, Amplifier Matching Basics, Distortion and noise products, Stability Considerations, Small Signal amplifier design, Power amplifier design, MMIC amplifiers, Broadband High Power multistage amplifiers, Low noise amplifiers, VGA Amplifiers.

UNIT -V:
Oscillators: Oscillator basics, Low phase noise oscillator design, High frequency Oscillator configuration, LC Oscillators, VCOs, Crystal Oscillators, PLL Synthesizer, and Direct Digital Synthesizer.
RF Mixers: Basic characteristics of a mixer - Active mixers- Image Reject and Harmonic mixers, Frequency domain considerations.

TEXT BOOKS:
1. RF Circuit design: Theory and applications by Reinhold Ludwing, Pavel Bretchko. Pearson Education Asia Publication,   New Delhi 2001.
2. Radio Frequency and Microwave Communication Circuits – Analysis and Design – Devendra K. Misra, Wiley Student Edition, John Wiley & Sons

REFERENCE BOOKS:
1. Radio frequency and microwave electronics illustrated Mathew M.Radmangh, 2001, PE Asia Publication.
2. RF Circuit Design – Christopher Bowick, Cheryl Aljuni and John Biyler, Elsevier Science, 2008.
3. Secrets of RF Design by Joseph Carr., 3rd Edition, Tab Electronics.
4. Complete Wireless Design by Cotter W. Sawyer, 2nd Edition, Mc-Graw Hill.
5. Practical RF Circuit Design for Modem Wireless Systems Vol.2 by Less Besser and Rowan Gilmore.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech – I Year – I Sem. (WMC)

VOICE OVER INTERNET PROTOCOL (VoIP)
(Core Elective –II**)**

UNIT –I:
Overview of IP Protocol Suite: The Internet Protocol, The Transmission Control Protocol(TCP), The User Datagram Protocol (UDP), The Real-time Transport Protocol (RTP), IP multicast, IP version 6 (IP v6), Interworking IPv4 and IPv6, The VoIP Market, VoIP Challenges.

UNIT -II:
H.323 and H.245 Standards: The H.323 Architecture, Call Signaling-Call Scenarios, H.245 Control Signaling Conference calls- The Decomposed Gateway.

UNIT –III:
The Session Initiation Protocol (SIP): SIP architecture- Overview of SIP Messaging Syntax- Examples of SIP Message sequences- Redirect Servers- Proxy Servers. The Session Description Protocol (SDP)- Usage of SDP With SIP.

UNIT -IV:
Quality of Service (QoS): Need for QOS – End-to-end QoS, Overview of QOS solutions- The Resource reservation Protocol (RSVP)- Diffserv- The Diffserv Architecture- Multi-protocol Label Switching (MPLS)- The MPLS Architecture- MPLS Traffic Engineering- Label Distribution Protocols and Constraint- Based Routing.

UNIT -V:
VoIP and SS7: The SS7 Protocol Suite- The Message Transfer Part (MTP), ISDN User Part (ISUP) and Signaling Connection Control Part (SCCP), SS7 Network Architecture- Signaling Points(SPs)- Single Transfer Point (STP), - Service Control Point(SCP)- Message Signal Units (MSUs)- SS7 Addressing, ISUP, Performance Requirements for SS7, Sigtran- Sigtran Architecture- SCTP- M3UA Operation- M2UA Operation- M2PA Operation- Interworking SS7 and VoIP Architectures- Interworking Soft switch and SS7- Interworking H.323 and SS7.

TEXT BOOK:
Carrier Grade Voice over IP – Daniel Collins, 2nd ed., TMH.

REFERENCE BOOKS:
1 Understanding Voice over IP Technology – Nicholas Wittenberg – Cengage, 1st Ed., 2010.
2 Voice Over WLANS – The Complete Guide – Michael, F. Finnevan, Elsevier, 2008.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech – I Year – I Sem. (WMC)

QUEUEING THEORY AND APPLICATIONS

(Core Elective –II**)**

Unit I
Review of probability, Stochastic Processes, random variables, distributions, generating functions; Poisson, Markov, renewal and semi-Markov processes, and Markov Chains, Birth-Death Process
Unit II
Basic Queueing Theory
An Introduction to Queues and Queueing Theory ,Characteristics of queueing systems, M/M/1 queuing system, Littles law, Reversibility and Burke's theorm, Markovian and non-Markovian queueing systems, embedded Markov chain applications to M/G/1, G/M/1 and related queueing systems;
Unit III
Queueing Networks
Fundamentals of Queueing Networks, Networks of queues, Open and Closed Queueing Networks, Open Networks of M/M/m type queues and Jackson's Theorem, MVA and Convolution Algorithm for Closed Networks, Approximate Models for Open and Closed Queueing Networks, Queues with vacations, priority queues, queues with modulated arrival process,
Unit IV
Discrete time queuing Systems-Introduction, Discrete time queuing systems, discrete time arrival process, Geome/Geom/m/N queuing system, Queuing on a Space division packet switch, Queuing on a single buffered banyan network
Unit V
Network traffic Modeling - Introduction, Continuous time models, Discrete time Models Solution methods, Burstiness , self similar traffic
Text books:
1. D. Gross and C. Harris, *Fundamentals of Queueing Theory, 3rd Edition,* Wiley, 1998. (WSE Edition, 2004).
2. . T.G. Robertazzi , Computer Networks and Systems - Queuei ng Theory and PeformanceEvaluaion, Springer 2000.

Reference Books:
1. L. Kleinrock, *Queueing Systems, Vol. 1: Theory,* Wiley, 1975.
2. E. Gelenbe and G. Pujolle, *Introduction to Queueing Networks, 2nd Edition,* Wiley, 1998.
3. J. Medhi, *Stochastic Models in Queueing Theory, 2nd Edition,* Academic Press, 2003. (Elsevier India Edition, 2006).
4. L. Kl ei nrock, Queuei ng Systems Vol ume 1 :Theory, Wi l ey 1975.
5. R. Nelson, *Probability, Stochastic Processes, and Queueing Theory: The Mathematics of Computer Performance Modelling,* Springer, 1995.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech – I Year – I Sem. (WMC)

GPS AND APPLICATIONS
(Core Elective –II**)**

UNIT I
INTRODUCTION

Basic concept, system architecture, GPS and GLONASS Overview, Satellite Navigation, Time and GPS, User position and velocity calculations, GPS, Satellite Constellation, Operation Segment, User receiving Equipment, Space Segment Phased development, GPS aided Geoaugmented navigation (GAGAN) architecture.

UNIT II
SIGNAL CHARACTERISTICS

GPS signal components, purpose, properties and power level, signal acquisition and tracking , Navigation information extraction, pseudorange estimation, frequency estimation, GPS satellite position calculation, Signal structure, anti spoofing (AS), selective availability, Difference between GPS and GALILEO satellite construction.

UNIT III,
GPS RECEIVERS & DATA ERRORS

Receiver Architecture, receiver design options, Antenna design, GPS error sources, SA errors, propagation errors, ionospheric error, tropospheric error, multipath, ionospheric error, estimation using dual frequency GPS receiver, Methods of multipath mitigation, Ephemeris data errors, clock errors.

UNIT IV
DIFFERENTIAL GPS

Introduction, LADGPS, WADGPS, Wide Area Augmentation systems , GEO Uplink subsystem , GEO downlink systems , Geo Orbit determination , Geometric analysis , covariance analysis , GPS /INS Integration Architectures

UNIT V
GPS APPLICATIONS

GPS in surveying, Mapping and Geographical Information System, Precision approach Aircraft landing system, Military and Space application, intelligent transportation system.
GPS orbital parameters, description of receiver independent exchange format (RINEX) , Observation data and navigation message data parameters, GPS position determination, least squares method

TEXT BOOKS
1. Mohinder S.Grewal, Lawrence R.Weill, Angus P.Andrews, "*Global positioning systems , Inertial Navigation and Integration*", John Wiley & sons, 2007.
2. *Global* Navigation Satellite *System*, Gottapu Sasibhuhsana Rao , McGraw-Hill Education, 2010.

REFERENCES

1. E.D.Kaplan, Christopher J. Hegarty, "*Understanding GPS Principles and Applications*", Artech House Boston 2005.

10

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech – I Year – I Sem. (WMC)

IMAGE AND VIDEO PROCESSING
(OPEN ELECTIVE - I)

UNIT –I:
Fundamentals of Image Processing and Image Transforms: Basic steps of Image Processing System Sampling and Quantization of an image, Basic relationship between pixels.
Image Segmentation: Segmentation concepts, Point, Line and Edge Detection, Thresholding, Region based segmentation.

UNIT –II:
Image Enhancement: Spatial domain methods: Histogram processing, Fundamentals of Spatial filtering, Smoothing spatial filters, Sharpening spatial filters.
Frequency domain methods: Basics of filtering in frequency domain, image smoothing, image sharpening, Selective filtering.

UNIT –III:
Image Compression: Image compression fundamentals - Coding   Redundancy, Spatial and Temporal redundancy, Compression models: Lossy & Lossless, Huffman coding, , Bit plane coding, Transform coding, Predictive coding, Wavelet coding, Lossy Predictive coding, JPEG Standards.

UNIT -IV:
Basic Steps of Video Processing: Analog Video, Digital Video. Time-Varying Image Formation models: Three-Dimensional Motion Models, Geometric Image Formation, Photometric Image Formation, Sampling of Video signals, Filtering operations.

UNIT –V:
2-D Motion Estimation: Optical flow, General Methodologies, Pixel Based Motion Estimation, Block-Matching Algorithm, Mesh based Motion Estimation, Global Motion Estimation, Region based Motion Estimation, Multi resolution motion estimation, Waveform based coding, Block based transform coding, Predictive coding, Application of motion estimation in Video coding.

TEXT BOOKS:
1. Digital Image Processing – Gonzaleze and Woods, 3rd Ed., Pearson.
2. Video Processing and Communication – Yao Wang, Joem Ostermann and Ya–quin Zhang. 1st Ed., PH Int.

REFRENCE BOOKS:
1. Digital Image Processing and Analysis-Human and Computer Vision Application with CVIP Tools – Scotte Umbaugh, 2nd Ed, CRC Press, 2011.
2. Digital Video Processing – M. Tekalp, Prentice Hall International.
3. Digital Image Processing – S.Jayaraman, S.Esakkirajan, T.Veera Kumar – TMH, 2009.
4. Multidimentional Signal, Image and Video Processing and Coding – John Woods, 2nd Ed, Elsevier.
5. Digital Image Processing with MATLAB and Labview – Vipula Singh, Elsevier.
6. Video Demystified – A Hand Book for the Digital Engineer – Keith Jack, 5th Ed., Elsevier.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech – I Year – I Sem. (WMC)

INTERNETWORKING
(Open Elective –I**)**

UNIT -I:
Internetworking Concepts: Principles of Internetworking, Connectionless Internetworking, Application level Interconnections, Network level Interconnection, Properties of the Internet, Internet Architecture, Wired LANS, Wireless LANs, Point-to-Point WANs, Switched WANs, Connecting Devices, TCP/IP Protocol Suite.
IP Address: Classful Addressing: Introduction, Classful Addressing, Other Issues, Sub-netting and Super-netting
Classless Addressing: Variable length Blocks, Sub-netting, Address Allocation. Delivery, Forwarding, and Routing of IP Packets: Delivery, Forwarding, Routing, Structure of Router.
ARP and RARP: ARP, ARP Package, RARP.

UNIT -II:
Internet Protocol (IP): Datagram, Fragmentation, Options, Checksum, IP V.6.
Transmission Control Protocol (TCP): TCP Services, TCP Features, Segment, A TCP Connection, State Transition Diagram, Flow Control, Error Control, Congestion Control, TCP Times.
Stream Control Transmission Protocol (SCTP): SCTP Services, SCTP Features, Packet Format, Flow Control, Error Control, Congestion Control.
Mobile IP: Addressing, Agents, Three Phases, Inefficiency in Mobile IP.
Classical TCP Improvements: Indirect TCP, Snooping TCP, Mobile TCP, Fast Retransmit/ Fast Recovery, Transmission/ Time Out Freezing, Selective Retransmission, Transaction Oriented TCP.

UNIT -III:
Unicast Routing Protocols (RIP, OSPF, and BGP: Intra and Inter-domain Routing, Distance Vector Routing, RIP, Link State Routing, OSPF, Path Vector Routing, BGP.
Multicasting and Multicast Routing Protocols: Unicast - Multicast- Broadcast, Multicast Applications, Multicast Routing, Multicast Link State Routing: MOSPF, Multicast Distance Vector: DVMRP.

UNIT -IV:
Domain Name System (DNS): Name Space, Domain Name Space, Distribution of Name Space, and DNS in the internet.
Remote Login TELNET: Concept, Network Virtual Terminal (NVT).
File Transfer FTP and TFTP: File Transfer Protocol (FTP).
Electronic Mail: SMTP and POP.
Network Management-SNMP: Concept, Management Components, World Wide Web- HTTP Architecture.

UNIT -V:
Multimedia: Digitizing Audio and Video, Network security, security in the internet firewalls. Audio and Video Compression, Streaming Stored Audio/Video, Streaming Live Audio/Video, Real-Time Interactive Audio/Video, RTP, RTCP, Voice Over IP. Network Security, Security in the Internet, Firewalls.

TEXT BOOKS:
1.   TCP/IP Protocol Suite- Behrouz A. Forouzan, Third Edition, TMH
2.   Internetworking with TCP/IP Comer 6th Edition PHI, Volume -1.

REFERENCE BOOKS:
1.   Mobile Communications, Jochen Schiller, 2nd edition, Pearson Education 2003.
2.   Data Communications & Networking – B.A. Forouzan – 4nd Edition – TMH
3.   High Speed Networks and Internets- William Stallings, Pearson Education, 2002.
4.   Data and Computer Communications, William Stallings, 7th Edition., PEI.
5.   The Internet and Its Protocols – Adrin Farrel, Elsevier, 2005.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech – I Year – I Sem. (WMC)

ADVANCED DIGITAL SIGNAL PROCESSING
(OPEN ELECTIVE - I)

UNIT –I:
Review of DFT, FFT, IIR Filters and FIR Filters:
Multi Rate Signal Processing: Introduction, Decimation by a factor D, Interpolation by a factor I, Sampling rate conversion by a rational factor I/D, Multistage Implementation of Sampling Rate Conversion, Filter design & Implementation for sampling rate conversion.

UNIT –II:
Applications of Multi Rate Signal Processing: Design of Phase Shifters, Interfacing of Digital Systems with Different Sampling Rates, Implementation of Narrow Band Low Pass Filters, Implementation of Digital Filter Banks, Subband Coding of Speech Signals, Quadrature Mirror Filters, Transmultiplexers, Over Sampling A/D and D/A Conversion.

UNIT -III:
Non-Parametric Methods of Power Spectral Estimation: of spectra from finite duration observation of signals, Non-parametric Methods: Bartlett, Welch & Blackman-Tukey methods, Comparison of all Non-Parametric methods

UNIT –IV:
Implementation of Digital Filters: Introduction to filter structures (IIR & FIR), Frequency sampling structures of FIR, Lattice structures, Forward prediction error, Backward prediction error, Reflection coefficients for lattice realization, Implementation of lattice structures for IIR filters, Advantages of lattice structures.

UNIT –V:
Parametric Methods of Power Spectrum Estimation: Autocorrelation & Its Properties, Relation between auto correlation & model parameters, AR Models - Yule-Walker & Burg Methods, MA & ARMA models for power spectrum estimation, Finite word length effect in IIR digital Filters – Finite word-length effects in FFT algorithms.

TEXT BOOKS:
1. Digital Signal Processing: Principles, Algorithms & Applications - J.G.Proakis & D. G. Manolakis, 4th Ed., PHI.
2. Discrete Time Signal Processing - Alan V Oppenheim & R. W Schaffer, PHI.
3. DSP – A Practical Approach – Emmanuel C. Ifeacher, Barrie. W. Jervis, 2 ed., Pearson Education.

REFERENCE BOOKS:
1. Modern Spectral Estimation: Theory & Application – S. M .Kay, 1988, PHI.
2. Multi Rate Systems and Filter Banks – P.P.Vaidyanathan – Pearson Education.
3. Digital Signal Processing – S.Salivahanan, A.Vallavaraj, C.Gnanapriya, 2000,TMH.
4. Digital Spectral Analysis – Jr. Marple

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech – I Year – I Sem. (WMC)

ADVANCED COMMUNICATIONS LAB

Note:
  A. Minimum of 10 Experiments have to be conducted
  B. All Experiments may be Simulated using MATLAB and to be verified using related training kits.

1. Determination of output of convolutional Encoder for a given sequence
2. Determination of output of convolutional Decoder for a given sequence
3. Efficiency of DS Spread- Spectrum Technique
4. Simulation of Frequency Hopping (FH) Spread- Spectrum
5. Implementation of Matched Filters.
6. Optimum receiver for the AWGN channel.
7. Measurement of effect of Inter Symbol Interference..
8. Simulation of PSK system with M=4
9. Simulation of DPSK system with M=4
10. Design of FSK system
11. BPSK Modulation and Demodulation techniques
12. QPSK Modulation and Demodulation techniques
13. DQPSK Modulation and Demodulation techniques
14. 8-QAM Modulation and Demodulation techniques
15. OFDM Transceiver design
16. Performance evaluation of simulated CDMA system