ANIL NEERUKONDA INSTITUTE OF TECHNOLOGY & SCIENCES
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
M.Tech. (Communication Systems), Two year (Four Semester) Syllabus Scheme

SEMESTER – I

CODE	*SUBJECT NAME*	*Instruction periods per Week*				*MAX MARKS*		CREDITS
		LECTURE	*TUTORIAL*	*PRACTICAL*	*TOTAL*	*SESSIONAL MARKS*	*SEMESTER END MARKS*	
MTCS-1	Advanced Digital signal processing	4	1	-	5	40	60	4
MTCS-2	Digital Communication Techniques	4	1	-	5	40	60	4
MTCS-3	Satellite Communication and Phased arrays	4	1	-	5	40	60	4
MTCS-4	Optical Fiber Communications	4	1	-	5	40	60	4
MTCS-5	Core Elective –I	4	1	-	5	40	60	4
MTCS-6	Core Elective-II	4	1	-	5	40	60	4
MTCS-7	Communication Engineering Lab	-	-	3	3	50	50	2
MTCS-8	Seminar - I	-	-	2	2	100	-	2
	Total	24	6	5	35	390	410	28

Core Elective – I
a) Global Positioning System
b) Micro Controllers and Embedded Systems
c) Smart Antennas

Core Elective-II
a) Telecommunication Switching and Networks
b) Spread Spectrum Techniques & Multiple Access
c) Speech Signal Processing

SEMESTER – II

CODE	**SUBJECT NAME**	*Instruction periods per Week*				*MAX MARKS*		CREDITS
		LECTURE	*TUTORIAL*	*PRACTICAL*	*TOTAL*	*SESSIONAL MARKS*	*SEMESTER END MARKS*	
MTCS-9	Communication Networks	4	1	-	5	40	60	4
MTCS-10	Wireless Communications	4	1	-	5	40	60	4
MTCS-11	Multimedia and Communication Systems	4	1	-	5	40	60	4
MTCS-12	Elective - III	4	1	-	5	40	60	4
MTCS-13	Elective – IV	4	1	-	5	40	60	4
MTCS-	Elective – V	4	1	-	5	40	60	4

14								
MTCS-15	Signal Processing Lab	-	-	3	3	50	50	2
MTCS-16	Seminar - II	-	-	2	2	100	-	2
	Total	24	6	5	35	390	410	28

Core Elective-III
a) Software Defined Radio
b) Modern Radar Systems
c) Digital Image Processing

Core Elective- IV
a) RF and Microwave Engineering
b) Wavelet transforms and Its Applications
c) Modeling and Simulation of Communication Systems

Core Elective -V
a) Statistical Signal Processing
b) CPLD and FPGA Architecture and Applications
c) AD-HOC Networks

SEMESTER – III

CODE	**SUBJECT NAME**	*MAX MARKS*		CREDITS
		SESSIONAL MARKS	*SEMESTER END MARKS*	
MTCS – 17	MOOC	100	-	4
MTCS – 18	Thesis (Part I)	50	50	6
Total		150	50	10

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

CODE	**SUBJECT NAME**	*MAX MARKS*		CREDITS
		SESSIONAL MARKS	*SEMESTER END MARKS*	
MTCS – 19	Thesis (Part II)	50	50	14

Semester –IV project work will begin after completion of semester-III examination.
Thesis work is for a period of SIX months in Industry/Department. The students are required to submit their thesis two/three phases. Thesis will be evaluated by a committee consisting of an external member from reputed institution, HOD, Chairman BOS and thesis Guide.

MTCS-1 ADVANCED DIGITAL SIGNAL PROCESSING

Credits	Instruction periods per Week			Exam Hrs.	SESSIONAL MARKS	SEMESTER END MARKS	Total Marks
	LECTURE	TUTORIAL	PRACTICAL				
4	4	1	-	3	40	60	100

Pre-requisites: Prior to this, an apt knowledge of signal & systems and digital signal processsing subjects should be known.

Course Objectives:

At the end of this course, the students will be able to understand the:

a) Various optimization techniques used in designing the digital filters.
b) Sampling rate requirement in the digital signal applications
c) Need for prediction, filtering & smoothening of the signals to minimize the mean-square error(MSE).
d) Different DSP algorithms used for DFT computation procedures.
e) Applications of DSP in real time.

Unit– I: Advanced digital filter design techniques: Design of optimum equi-ripple FIR filters, Remez Algorithm, Parks-McClellan Algorithm, Differentiators, BPF, Hilbert transformer filters 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. **(12hrs)**

Unit – 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.**(10hrs)**

Unit – III: Linear prediction and optimum linear filters: forward and backward linear prediction, AR Lattice and ARMA lattice – ladder filters, Wieners filters for filtering on prediction. **(7hrs)**

Unit – IV: DSP Algorithms: Levinson – Durbin algorithm, the Schur algorithm, The Goertzel algorithm, the chirp – z transform algorithm, Bluestein algorithm, computations of the DFT, concept of tunable digital filters**.** **(8hrs)**

Unit – V: Applications of DSP: Speech Model of speech production, speech analysis – synthesis system vocoder analyzers and synthesizers, convolvers,Linear Prediction of speech, DTMF System, DTTR, MUSIC, TDM to FDM translator. **(8hrs)**

Course Outcomes:

a) Using filter optimization techniques students will be able to design a filter with Least Mean Square error.(UNIT-I)
b) Students will be able to solve research papers related to multirate signal processing— Data Acquisition, Bandwidth reduction in a system etc. (UNIT-II)
c) Apply methods for prediction of real world signals, based on signal modeling and advanced filtering techniques, such as Linear Predictive Filters and Optimal Linear Filters.(UNIT-I,III,V)
d) Apply fundamental principles, methodologies and techniques of the course to analyze and design various problems encountered in both academic research ,industry and R&D practice. (UNIT-IV)
e) This course is basis for understanding Adaptive signal processing, statistical signal processing and wavelet transform subjects.

Prescribed Text Books:

1. Lawrence R. Rabiner and Bernard Gold ,"Theory and applications of digital signal processing" PHI,4th edition.**(UNIT 1,5)**
2. J. G. Proakis and D. G. Manolakis, Introduction to Digital Signal Processing, 4td Edition. Prentice Hall, 1996, ISBN No. 0-13-373762-4. **(UNIT 2,3 4)**

References:

1. Multi Rate Systems and Filter Banks – P.P.Vaidyanathan – Prentice Hall,1st edition
2. DSP – A Practical Approach – Emmanuel C. Ifeacher, Barrie. W. Jervis, 2nd Ed., Prentice Hall.
3. Sanjit K. Mitra,"Digital Signal Processing, A Computer – Based approach,Tata Mc Graw-Hill, 1998,$th edition **(UNIT 2)**

MTCS2- DIGITAL COMMUNICATION TECHNIQUES

Credits	Instruction periods per Week			Exam Hrs.	SESSIONAL MARKS	SEMESTER END MARKS	Total Marks
	LECTURE	TUTORIAL	PRACTICAL				
4	4	1	-	3	40	60	100

Course Objectives

1. To enable student to Design a channel coder for different channels for obtaining optimum error probablitiy.

2. To enable student to analyze the synchronizing circuits for different modulation schemes.

3. To familiarize Student with the concepts of spread spectrum and jammer considerations

UNIT – I

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 – II

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

UNIT – III

CHANNEL CODING-II: Convolution codes Lattice type Trellis codes. Geometrically uniform trellis codes,– viterbi decoding algorithm. Decoding of modulation codes – Reed Solomon codes – Turbo codes(elementary treatment).

BASEBAND SIGNALLING CONCEPTS:

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

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.

Course Outcomes

After completion of this Course Student will be able to:

1. Simulate a digital communication System.
2. Design Linear Block coder with different Error correction capabilities.
3. Design a Convolution coder to obtain specific error probabilities.
4. Simulate different channel encoders.
5. Design a Synchronizing circuit for any digital modulation scheme under specified error rate.
6. Analyze the jamming to signal noise ratio for a jammer.

PRESCRIBED :

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

2.Fundamentals of Communication Systems, Proakis and Salehi, Prentice Hall

REFERENCES:

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

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

MTCS 3- SATELLITE COMMUNICATION AND PHASED ARRAYS

Course code	Credits	Periods			Exam Hours	Sessional Marks	Exam Marks	Total Marks
		Lectures	Tutorials	Practicals				
MTCS-3	4	3	1	-	3	40	60	100

Course Objectives:

1. To learn about the science behind the orbiting satellites, various multiplexing schemes and earth station parameters used for satellite communication.
2. In-depth understanding of specialist bodies of knowledge within the engineering discipline.
3. Application of established engineering methods to complex engineering problem solving.

Unit 1: **Orbits, Propagation impairments and space link:**

Introduction, Satellite orbits, Kepler's three laws, Orbital Elements, Eclipse effect, Orbit determination, Look angle determination. Satellite sub systems: Attitude and Orbital Control System (AOCS), Telemetry Tracking and Command (TT&C), Power System, Communications System, Satellite transponder, Space Craft Antennas, Frequency Reuse Antennas. Communication link design: Basic transmission theory, EIRP, Completion Link design with and without frequency reuse, System noise temperature G/T ratio, Noise figure and Noise temperature.

Unit 2: **Satellite Multiple Accesses**: **Satellite mobile and specialized services**

Frequency Division Multiple Access (FDMA),Intermodulation, Calculation of C/N, Time Division Multiple Access (TDMA),Satellite Switched TDMA, Demand Assignment Multiple Access (DAMA), CDMA Spread Spectrum Transmission and Reception.

Message Transmission by FDMA: M/G/1 Queue, Message Transmission by TDMA, PURE ALOHA, Satellite Packet Switching, Slotted Aloha, Packet Reservation, Tree Algorithm, VSAT Technologies, Network Configurations, Polling VSAT Networks, Mobile Satellite Networks, CDMA MSAT Network.

Unit 3: **Earth Station Technology**:

Transmitters, Receivers, Antennas, Tracking Systems, Transponders, Small earth station Antennas, Equipment for earth station, Lower Orbit Considerations, Coverage and frequency considerations, Direct broadcasting satellite Television and Radio, Satellite Navigation.

Unit 4**: Introduction of Phased Arrays**

System Requirements for Radar and Communication Antennas : Directive Properties of Arrays, Array Noise Characterization, The Receiving Antenna in a Polarized Plane Wave Field, System Considerations, Monopulse Beam Splitting.

Unit 5: **Phased Arrays in Radar and Communication Systems**:

Array Characterization for Radar and Communication Systems and Fundamental Results from Array Theory: Phase Scanning in One Dimension ($ø_o$=0), Two-Dimensional Scanning of Planar Arrays, Beam width and Directivity of Scanning Arrays, Array Size Determination: EIRP and G/T for Large, Two-Dimensional Passive or Active Arrays.

Course Outcomes:

On successful completion of this course, the student will be able to:

CO1: Architect appropriate technologies for implementation of specified satellite communication systems based on specify systems design for satellite communications

CO2: Analyze and evaluate a satellite link and suggest enhancements to improve the link performance

CO3: Exercise the following skills: project management, teamwork and leadership, technical communication, and self-directed and group learning.

CO4: Conduct further research on satellite communication systems engineering & on phased array antennas as per given specifications.

TEXT BOOKS:

1. Satellite Communications –Timothy Pratt, Charles Bostian, Jeremy Allnutt, 2nd Edition, 2003, John Wiley & Sons.
2. Digital Satellite Communications-Tri.T.Ha, 2nd Edition, 1990, Mc.Graw Hill.
3. Phased Array Antenna Hand Book – Robert J. Mailloux, Artech House, Boston, London, 1994.

REFERENCE BOOKS:

1. Satellite Communications - by Dr.D.C.Agarwal
2. Satellite Communications: Design Principles – M. Richcharia, 2nd Ed., BSP, 2003.
3. Fundamentals of Satellite Communications – K. N. Raja Rao, PHI, 2004.

MTCS-4 OPTICAL FIBER COMMUNICATIONS

Credits	Instruction periods per Week			Exam Hrs.	SESSIONAL MARKS	SEMESTER END MARKS	Total Marks
	LECTURE	TUTORIAL	PRACTICAL				
4	4	1	-	3	40	60	100

Course Objectives:

1. To expose the students to the modulation formats used in fiber optic communications
2. To impart the understanding and modeling of optical amplifiers
3. To understand the various multiplexing schemes
4. To understand the working of optical networks
5. To understand the nonlinear effects of optical communication systems

UNIT-I

Advanced Modulation Formats for Fiber Optic Communication Systems: Fiber Optic Coupler,
Coherent Optical Communication, BER performance, Differential Phase Modulation Schemes with Direct Detection

UNIT-II

Semiconductor optical amplifiers. EDFA and Raman amplifiers , Wideband Optical amplifiers, Amplifier Noise, Optical SNR, modeling and analysis. Analysis and digital transmission with high power fiber amplifiers

UNIT-III

Multichannel systems: WDM lightwave systems. TDM and code division multiplexing.
Advances in wavelength division multiplexing / demultiplexing technologies

UNIT-IV

SONET/SDH, ATM, IP, storage area networks, Wavelength routed networks, Next generation optical Internets

UNIT-V

Soliton systems: Nonlinear effects. Soliton – based communication. High speed and WDM soliton systems

Course Outcomes:

Upon successful completion of the course, students will be able to:

1. Compare the performances of modulation formats used in optical communications
2. Model and use optical amplifiers
3. Understand and apply the multiplexing technologies
4. Understand the operation of, and trends in, optical networks.
5. Exploit the nonlinear effects of fibers in Soliton based communications.

Text Books:

1.G.P.Agrawal, Fiber Optic Communication Systems (3/e), Wiley, 2002
2.M.Satish Kumar, Fundamentals of Optical Fiber Communication(2/e), PHI, 2014
3.C.S.Murthy & M.Gurusamy, WDM Optical Networks, PHI, 2002

References:

1.Gerd Keiser, Optical Fiber Communications(4/e), TMH, 2008
2.B.P.Pal , Guided Wave Optical Components and Devices, Elsevier , 2006
3.Keang P. Ho Phase-modulated Optical Communication Systems, Springer, 2005

MTCS-5 GLOBAL POSITIONING SYSTEM AND APPLICATIONS

Credits	Instruction periods per Week			Exam Hrs.	SESSIONAL MARKS	SEMESTER END MARKS	Total Marks
	LECTURE	TUTORIAL	PRACTICAL				
4	4	1	-	3	40	60	100

COURSE OBJECTIVES:

1. To enable student to understand the basic principle of GPS
2. To enable student to understand the difference between GPS, GALILEO and GLONASS
3. To familiarize the student with the concepts of different co-ordinates system used in GPS
4. To enable student to know about the effect of ionosphere and troposphere on GPS position determination

UNIT I

Introduction to 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, GALILEO and GLONASS satellite construction, GPS Receiver Concepts and main receiver components.

UNIT III

GPS coordinate frames & Time references: Geoid and Ellipsoid of rotation, Geodetic and Geo centric coordinate systems, ECEF coordinate world geodetic 1984 (WGS 84), GPS & GALILEO time.

UNIT IV

GPS orbits and position determination: GPS orbital parameters, GPS position determination, Positioning methods- point positioning, relative positioning, and description of receiver independent exchange format (RINEX).

UNIT V

GPS Errors & Future of GPS: GPS error sources- clock error, ionospheric error, tropospheric error, multipath, ionospheric error estimation using dual frequency GPS receiver, DGPS concepts, Future of GPS- Modernization plans of navigational satellites, Hardware and software improvements.

COURSE OUT COMES:

After learning this subject student can be able to

1. Understand basic concepts of GPS and its architecture (unit-1)
2. Describe the signal structure and can differentiate GPS &GALILEO time (unit-2)
3. Convert one co-ordinate frame into another (unit-3)
4. Determine the GPS user position (unit-4)
5. Calculate different error's in GPS and can design the system in GPS and can design the system with improved accuracy (unit-5)

PRESCRIBED :

1. B. Hoffman – Wellenhof, H. Liehtenegger and J. Collins, 'GPS – Theory and Practice', Springer – Wien, New York (2001).
2. G S RAO, Global Navigation Satellite Systems, McGraw-Hill publications, New Delhi, 2010

REFERENCES:

1. James Ba – Yen Tsui, 'Fundamentals of GPS receivers – A software approach', John Wiley & Sons (2001).
2. Gunter Seeber., Satellite Geodesy Foundations-Methods and Applications,2003.

MTCS-6 TELECOMMUNICATION SWITCHING AND NETWORKS

Credits	Instruction periods per Week			Exam hrs	Sessional Marks	Exam Marks	Total Marks
	Lectures	Tutorials	Practicals				
4	3	1	-----	3	40	60	100

Course Objectives

1. To understand the working principles of switching systems from manual and electromechanical systems to stored program control systems.
2. The students will be able to apply the knowledge and principles leant to analyze, design, install and manage typical wired and wireless communication systems and networks.

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.

Course Outcomes:

Students are able to

1: Explain the working principle of switching systems involved in telecommunication switching

2: Assess the need for voice digitization and T Carrier systems

3: Compare and analyze Line coding techniques and examine its error performance

4: Design multi stage switching structures involving time and space switching stages

5: Analyze basic telecommunication traffic theory

PRESCRIBED Text Books:

1. **Telecommunication Switching Systems and Networks- ThiagarajanViswanathan, Prentice Hall, New Delhi, 2001.**
2. **Data Communications and Networking- B.A. Forouzan, TataMcGrawhill, Third Edn., 2004.**

Reference:

1. **Telecommunication Switching,Traffic and Networks-Flood, Pearson Education India,2001**
2. **Telecommunication Switching and Networks-P.Gnanasivam, New Age International,2005.**

MTCS-9 COMMUNICATION NETWORKS

Credits	Instruction periods per Week			Exam Hrs.	SESSIONAL MARKS	SEMESTER END MARKS	Total Marks
	LECTURE	TUTORIAL	PRACTICAL				
4	4	1	-	3	40	60	100

Course Objectives:

1. Build an understanding of the fundamental concepts of computer networking.
2. Familiarize the student with the basic taxonomy and terminology of the computer networking area.
3. Introduce the student to advanced networking concepts, preparing the student for entry Advanced courses in computer networking.
4. Allow the student to gain expertise in some specific areas of networking such as the design and maintenance of individual networks.

Syllabus

Unit I: Virtual-Circuit Networks: Frame Relay and ATM (10hrs)

FRAME RELAY , Architecture , Frame Relay Layers , Extended Address , ATM , Design Goals , Problems, Architecture , Switching , ATM Layers , ATM Adaptation layers, ATM LANs ,ATM LAN Architecture. (Text Book 1&2)

Unit II: Peer – to – Peer Protocols (10hrs)

Peer – to- Peer Protocol & service models, ARQ protocols & reliable data transfer service, other Peer – to- Peer Protocols, process – to process delivery, user datagram protocol. (Text Book 1&2)

Unit III: Transmission control protocol/ Internet Protocol Networks (12hrs)

TCP/IP Architecture, internet protocol, IPv6, Transmission control protocol, Stream Control Transmission Protocol, forwarding, unicast routing protocols, multicast routing protocols. (Text Book 1)

Unit IV: Advanced Network Architectures (12hrs)

Architecture, web documents, HTTP, Integrated services in the internet, RSVP, differentiated services, network interconnection models, real-time transport protocols. (Text Book 1&2)

Unit V: Security Protocols (10hrs)

Symmetric-key & asymmetric –key cryptography, IP Security, Secure Socket Layer **/**Transport Layer Security, Pretty Good Privacy, Firewalls (Text Book 2)

Text Books:

1. Alberto Leon Gracia and Indra Widjaja, "Communication networks," Second Edition, Tata McGraw Hill, 2008.
2. Behrouza A. Forouzan," Data Communications and Networking", Fourth Edition, Tata McGraw Hill,

Reference Books:

1. Introduction to Data communications and Networking, W.Tomasi, Pearson education

Course Outcomes:

After completing this course the student must demonstrate the knowledge and ability to:

1. Independently understand basic computer network technology.
2. Understand and explain Data Communications System and its components.
3. Identify the different types of network topologies and protocols.
4. Enumerate the layers of the TCP/IP. Explain the function(s) of each Layer.
5. Familiarity with the basic protocols of computer networks, and how they can be secure in network design and implementation.

MTCS 10 WIRELESS COMMUNICATION SYSTEMS

Credits	Instruction periods per Week			Exam Hrs.	SESSIONAL MARKS	SEMESTER END MARKS	Total Marks
	LECTURE	TUTORIAL	PRACTICAL				
04	03	01	00	03	40	60	100

Course Objectives:

1. Understand the basic Propagation models
2. Able to analyze the capacity of wireless channels
3. Aable to understand the different Diversity and equalization techniques
4. Able to understand the basic concepts of MIMo Channel

Unit 1: Radio Wave Propagation

Free space propagation model- basic propagation mechanisms –reflection- ground reflection model-diffraction-scattering-practical link budget design-outdoor and indoor propagation models

Small scale fading and multipath: Small scale multipath propagation-Impulse response model of a mulitpath channel –small scale multipath measurements-parameters of mobile multipath channels - –types of small scale fading.

Unit 2: Capacity of Wireless Channels and Performance of digital modulation over wireless channels

Capacity of Flat Fading Channel- Channel Distribution Information known – Channel Side Information at Receiver – Channel Side Information at Transmitter and Receiver – Capacity with Receiver diversity – Capacity comparisons – Capacity of Frequency Selective Fading channels.

Error probability of M-ary PSK, M-ary QAM and M-ary FSK , MSK, GMSK, on AWGN channels- Fading– Outage Probability– Average Probability of Error –– Combined Outage and Average Error Probability.

Unit 3: Diversity

Realization of Independent Fading Paths – Receiver Diversity – Selection Combining – Threshold Combining – Maximal-Ratio Combining – Equal - Gain Combining – Transmitter Diversity – Channel known at Transmitter – Channel unknown at Transmitter – The Alamouti Scheme-basic concepts of RAKE receivers.

Unit 3: Equilization

Fundamentals of equalization ,Training A Generic Adaptive Equalizer,Equilizers in a Communications Receivers, Survey of Equilization Techniques, Linear Equilizers, NonLinear Equilization,Alogorithms for Adaptive Equilization , Fractionslly Spaced Equalizers

Unit 5: Multiple Access Techniques and MIMO and multicarrier modulation:

Frequency division multiple access-time division multiple access-spread spectrum multiples access-space division multiple access- packet radio.

Narrowband MIMO model-parallel decomposition of MIMO channel-MIMO channel capacity-MIMO diversity gain –data transmission using multiple carriers-multicarrier modulation with overlapping subchannels-mitigation of subcarrier fading-basic concepts of OFDM.

Text Books:

1. Andrea Goldsmith, "Wireless Communications," Cambridge University Press, 2005
2. T.S. Rappaport, "Wireless Communications," Pearson Education, 2003

Reference Books:

1. Raj Pandya, "Mobile and Personal Communication Systems and Services," Prentice Hall of India, 2002
2. William C.Y. Lee, "Wireless and Cellular Telecommunications," Third edition, Mc. Graw Hill, 2006.

COURSE OUTCOMES

After completing the Course , Students is able to

1. Analyze the propagation models of free space.
2. leads to current and upcoming wireless communications technologies for broadband wireless access network design and research.
3. Do research in system evaluation methods used in the design of communications network.

MTCS-11 Multimedia and communications systems

Course Objectives:

Credits	Instruction periods per Week			Exam Hrs.	SESSIONAL MARKS	SEMESTER END MARKS	Total Marks
	LECTURE	TUTORIAL	PRACTICAL				
4	4	1	--	3hrs	40	60	100

1. To understand the Multimedia Communication Models and to study the Multimedia Transport in Wireless Networks.
2. To solve the Security issues in multimedia networks and to explore real-time multimedia network applications.
3. To explore different network layer based application.
3. To understand the process of compressing and sending text, image, audio and video signals over networks.
4. To gain knowledge of various entertainment networks.

UNIT I: Multimedia communications (6hrs)

Introduction, multimedia networks, multimedia applications, Digitization principles, Text, Images, Video, Audio.

UNIT II: Text and Image Compression (15hrs)

Compression Principles, Text compression, Image compression.

UNIT III: Audio and Video Compression (15hrs)

DPCM, ADPCM, Adaptive predictive coding, Linear predictive coding, code-excited LPC, perceptual coding, MPEG audio coders, Dolby audio coders, video compression principles, H.261, H.263, MPEG, MPEG-1, MPEG-2, MPEG-4.

UNIT IV: Standards for multimedia communications (15hrs)

Reference Models, Standards related to interpersonal communications, Standards relating to interactive applications over the internet, standards for entertainment applications.

UNIT-V: Entertainment networks and internet applications (8hrs)

Cable TV networks, Satellite television networks, high-speed PSTN access technology, DNS, Email, FTP, TFTP, Internet telephony, SNMP.

Text Books:

1. Fred Halsall – Multimedia Communications, Pearson publication 2001.
2. Ze-Nian Li, Marks. Drew- Fundamentals of Multimedia, PHI publications 2004.

Course outcomes:

1. Deploy the right multimedia communication models.
2. Apply multimedia network applications with efficient routing techniques.
3. Solve the security threats in the multimedia networks.
4. Develop the real-time multimedia network applications.
5. Explore different entertainment networks.

MTCS-12 DIGITAL IMAGE PROCESSING

Credits	Instruction periods per Week			Exam Hrs.	SESSIONAL MARKS	SEMESTER END MARKS	Total Marks
	Lecture	Tutorial	Practical				
4	4	1	-	3	40	60	100

Course Objectives:

1. To learn Image Fundamentals and Processing Techniques
2. To be familiar with Image Transformations in Spatial Domain and Frequency Domain
3. To learn various Filters for Image Restoration
4. To study various Image Compression and Segmentation Techniques
5. To gain experience in applying image processing algorithms to real problems

UNIT I – DIGITAL IMAGE FUNDAMENTALS (8 hours)

Introduction – Origin –Steps in Digital Image Processing – Components; Elements of Visual Perception – Light and Electromagnetic Spectrum – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels.

UNIT II – IMAGE ENHANCEMENT (9 hours)

Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering–Smoothing and Sharpening Spatial Filtering – Frequency Domain: Introduction to Fourier Transform – Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters.

UNIT III –IMAGE RESTORATION (9 hours)

Noise models – Mean filters – Order Statistics – Adaptive filters – Band reject – Band pass – Notch – Optimum notch filtering – Inverse Filtering – Constrained Least Square Filtering – Wiener filtering.

UNIT IV –IMAGE COMPRESSION (9 hours)

Fundamentals – Image Compression models – Error Free Compression – Variable Length Coding –Bit – Plane Coding – Lossless Predictive Coding – Lossy Compression – Lossy Predictive Coding –Wavelet Coding – Compression Standards – JPEG2000.

UNIT V –IMAGE SEGMENTATION AND REPRESENTATION (10 hours)

Segmentation – Detection of Discontinuities – Edge Linking and Boundary detection – Region based segmentation; Representation – Boundary descriptors – Simple Descriptors – Shape numbers –Regional descriptors – Simple and Topological Descriptors – Introduction to Image Processing Toolbox – Practice of Image Processing Toolbox – Case studies–Various Image Processing Techniques.

Text books:

1. Rafael C. Gonzales, Richard E. Woods, "Digital Image Processing", Pearson Education, Third Edition, 2010.
2. Anil Jain K. "Fundamentals of Digital Image Processing", PHI Learning Pvt. Ltd., 2011.
3. Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, "Digital Image Processing Using MATLAB", Tata McGraw Hill Pvt. Ltd., Third Edition, 2011.

Reference books:

1. Rosefeld & Kak AC, Digital Picture Processing Academic Press Inc.
2. Sonka Milan, "Image Processing Analysis and Machine vision", Cengage Learning
3. William K. Pratt, "Digital Image Processing", Wiley India Pvt. Ltd.

Course Outcomes:

At the end of the course, the student will be able to:

1. Understand the basic concepts of two-dimensional signal acquisition, sampling, and quantization.
2. Apply 2D Fourier transform concepts for image enhancement.
3. Remove various noises present in an image using different filters.
4. Understand various coding techniques for image compression.
5. To use the techniques, skills, and modern engineering tools necessary for image processing applications.

MTCS-13 RF AND MICROWAVE ENGINEERING

Credits	Instruction periods per Week			Exam Hrs.	SESSIONAL MARKS	SEMESTER END MARKS	Total Marks
	LECTURE	TUTORIAL	PRACTICAL				
4	4	1	-	3	40	60	100

Course Objectives:
This course is intended to introduce to students:

(i) The concepts of scattering parameters signal flow graphs, and their applications in microwave circuit analysis and design .

(ii) Concepts of planar transmission lines, lumped/distributed circuit elements, impedance matching circuits, resonators, dividers, couplers, filters and duplexers.

Chapter 1 : Introduction to RF and Microwave concepts and applications (8hrs)

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 (10hrs)

Introduction, RF/Microwaves versus DC or low AC signals, EM spectrum, Wave length and frequency,
Circuit representation of two port RF/microwave networks. Basics of RF component, 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 (12hrs)

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 (18hrs)

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 (10hrs)

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

Course Outcomes:

1. Ability to apply knowledge of advanced principles to the analysis of engineering problems.
2. Ability to apply knowledge of advanced techniques to the design of communication engineering systems.
3. Ability to apply the appropriate industry practices, emerging technologies, state-of-
   the-art design techniques, software tools, and research methods of solving electrical
   engineering problems.
4. Ability to learn new subjects that are required to solve problems in industry without
   being dependent on a classroom environment.

MTCS-14 STATISTICAL SIGNAL PROCESSING

Credits	Instruction periods per Week			Exam Hrs.	SESSIONAL MARKS	SEMESTER END MARKS	Total Marks
	LECTURE	TUTORIAL	PRACTICAL				
04	3	1	0	3	40	60	100

Course Objectives:

1. To understand the fundamentals of Estimation Theory
2. To understand Deterministic Parameter Estimation
3. To understand Random Parameter Estimation:
4. To understand State Estimation
5. To understand the Fundamentals of Detection Theory

Syllabus

Unit-I. : Fundamentals of Estimation Theory (8 hrs)

Estimation in Signal Processing, Unbiased Estimators, Existence of the Minimum variance unbiased estimator. Finding Minimum variance unbiased Estimators, Cramer-Rao Lower Bound, Linear Model Examples, Sufficient Statistics, Using Sufficiency to find the MVU Estimator.

Unit-II. Deterministic Parameter Estimation (11 hrs)

The Least Squares Approach, Order- Recursive Least Squares, Definition of the BLUE, Finding the BLUE. Maximum Likelihood Estimation: Finding the MLE, Properties of the MLE , MLE for Transformed parameters, Numerical Determination of the MLE.

Unit-III. Random Parameter Estimation:
(10 hrs)

The Bayesian Philosophy: Prior Knowledge and Estimation, Choosing a Prior PDF, Bayesian linear model, Nuisance parameters,Bayesian Estimation for Deterministic parameters,Derivation of Conditional Gaussian PDF,Minimum Mean Square Error Estimator, Maximum a Posteriori Estimators.

Unit-IV. State Estimation:
(9 hrs)

Linear Minimum Mean Squared Error Estimation, Signal processing examples- Wiener Filtering,
Kalman Filters: Scalar Kalman Filter, Kalman versus Wiener Filters, Extended Kalman Filter.

Unit-V. Fundamentals of Detection Theory: (14 hrs)

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

Text books:

1. Steven M. Kay, "Fundamentals of Statistical Signal Processing Volume I Estimation Theory", Prentice Hall PTR, 1993. (UNIT- I, II, III & IV)
2. Steven M. Kay, "Fundamentals of Statistical Signal Processing Volume II Detection Theory", Prentice Hall PTR, 1998
   (UNIT- V)

Reference books:

1. M D Srinath, P K Rajasekaran, R Viswanathan, Introduction to Statistical Signal Processing with Applications, "Pearson"
2. Harry L. Van Trees, "Detection, Estimation and Modulation Theory, Part 1 and 2," John Wiley & Sons Inc. 1968.
3. Monson H. Hayes, "Statistical Digital Signal Processing and Modelling," John Wiley & Sons Inc., 1996.
4. Random Signals: Detection, Estimation and Data Analysis - K. Sam Shanmugan & A.M.
   Breipohl, Wiley India Pvt. Ltd, 2011.
5. *An Introduction to Signal Detection and Estimation*, Second Edition, by H. Vincent Poor. Springer Verlag, 1994
6. Decision and estimation theory. James L. Melsa, Davíd L. Cohn. McGraw-Hill, 1978

Course Outcomes:

At the end of the course, the student will be able to:

1. Learn about basic Estimation Methods: Maximum Likelihood Estimation, Maximum Aposteriori Estimation, Minimum Variance Unbiased Estimation, Minimum Mean Square Error Estimation, Linear Minimum Mean Square Error Estimation and Kalman Filtering
2. Learn about basic estimator properties such as Bias, Efficiency, Linearity
3. Learn Classical and Bayesian Estimation Approaches
4. Learn Basic Estimation Performance Bounds such as Cramer-Rao Bound
5. Gain ability to apply estimation methods to real engineering problems.
6. Able to analyze and design decision devices using Bayes' risk formulation
7. Able to analyze and design decision devices using the Neyman-Pearson criterion

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