SAGI RAMA KRISHNAM RAJU ENGINEERING COLLEGE (AUTONOMOUS)
(Affiliated to JNTUK, Kakinada), (Recognised by AICTE, New Delhi)
Accredited by NAAC with 'A' Grade
Recognised as Scientific and Industrial Research Organisation
CHINNA AMIRAM (P.O):: BHIMAVARAM :: W.G.Dt., A.P., INDIA :: PIN: 534 204

SCHEME OF INSTRUCTION & EXAMINATION

(Regulation R17)

M.TECH (COMMUNICATION SYSTEMS)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

(With effect from **2017-2018** Admitted Batch onwards**)**
Under Choice Based Credit System

I-SEMESTER

Code No.	Name of the Subject	Credits	Lec-ture Hrs	Tutorial Hrs	Lab Hrs	Contact Hrs/ Week	Internal Marks	External Marks	Total Marks
M17 CS 1101	Detection & Estimation Theory	3	3	1	--	4	30	70	100
M17 CS 1102	Digital Data Communications	3	3	1	--	4	30	70	100
M17 CS 1103	Coding Theory & Applications	3	3	1	--	4	30	70	100
M17 CS 1104	Advanced Digital Signal Processing	3	3	1	--	4	30	70	100
#ELE-1	Elective-I	3	3	1	--	4	30	70	100
#ELE-2	Elective-II	3	3	1	--	4	30	70	100
M17 CS 1111	Optical & Data Communications Laboratory	2	--	--	3	3	50	50	100
Total		**20**	**18**	**6**	**3**	**27**	**230**	**470**	**700**

	Course Code	Course
#ELE-1	M17 CS1105	Radar Signal Processing
	M17 CS 1106	Optical Communication Technology
	M17 CS 1107	Advanced Computer Networks
#ELE-2	M17 CS 1108	Wireless LANs and PANs
	M17 CS1109	Mobile Computing Technologies
	M17 CS 1110	Network Security & Cryptography

Code: M17 CS 1101

DETECTION & ESTIMATION THEORY

Lecture	**: 3 Periods**	**Int.Marks**	**: 30**
Tutorial	**: 1 Period.**	**Ext. Marks**	**: 70**
Exam	**: 3 Hrs.**	**Credits**	**: 3**

COURSE OBJECTIVES:

1. To enable the students to acquire the fundamental concepts of Signal Detection and Estimation
2. To get familiarize with different Hypotheses in detection and estimation problems
3. To introduce the methods of Detection and estimation of signals in white and non-white Gaussian noise.
4. To familiarize with the detection of random signals.
5. To enable the students to understand the time varying waveform detection and its estimation

COURSE OUTCOMES:

Students would be able to

1. Understand the basic concepts of signal detection and estimation
2. Understand different hypotheses in detection and estimation problems
3. Understand the conceptual basics of detection and estimation of signals in white and non-white Gaussian noise
4. Understand the detection of random signals
5. Understand the time varying waveform detection and its estimation
6. Appreciate the need for estimation techniques in Communication and Signal Processing problems and acquire expertise in Classical and Bayesian estimation techniques for parameters and signals, and Detection of signals in the presence of white Gaussian noise.
7. Conduct in-depth analysis of estimation problems and apply suitable estimation and detection techniques that meet the constraints of the problem such as performance, bandwidth and power overheads and computational complexity

SYLLABUS

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 Hypothese

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, McGraw Hill.

Code: M17 CS 1102

DIGITAL DATA COMMUNICATIONS

Lecture	**: 3 Periods**	**Int.Marks**	**: 30**
Tutorial	**: 1 Period.**	**Ext. Marks**	**: 70**
Exam	**: 3 Hrs.**	**Credits**	**: 3**

COURSE OBJECTIVES:

1. Provide comprehensive coverage of digital data communication principles andterminology.
2. Provide an understanding of the standard architectural structure of computer networks and protocols.
3. Provide an in-depth understanding of the Physical Layer and Data Link Layer modeling and engineering.
4. Study a comprehensive coverage of physical and logical network topologies.

COURSE OUTCOMES:

1. Understand the basic concepts of LAN and WAN technologies and topologies.
2. Demonstrate an understanding of the elements of a protocol, and the concept of layering.
3. Recognize the importance of networking standards, and their regulatory committees.
4. Develop an understanding of the seven layers of the OSI model.
5. Understand signals and signal encoding methods to communication service methods and data transmission modes.
6. Demonstrate an understanding of basic concepts of error detection and correction at the data link layer and below.
7. Develop an understanding of Data Link Layer protocols and technologies.
8. Demonstrate an understanding of the differences between circuit switching and packet switching.

SYLLABUS

UNIT -I:

Digital Modulation Schemes:

BPSK, QPSK, 8PSK, 16PSK, 8QAM, 16QAM, DPSK – Methods, Band Width Efficiency, Carrier Recovery, Clock Recovery.

UNIT -II:

Basic Concepts of Data Communications, Interfaces and Modems:

Data Communication Networks, Protocols and Standards, UART, USB, Line Configuration, Topology, Transmission Modes, Digital Data Transmission, DTE-DCE interface, Categories of Networks – TCP/IP Protocol suite and Comparison with OSI model.

UNIT -III:

Error Correction: Types of Errors, Vertical Redundancy Check (VRC), LRC, CRC, Checksum,Error Correction using Hamming code

Data Link Control: Line Discipline, Flow Control, Error Control

Data Link Protocols: Asynchronous Protocols, Synchronous Protocols, Character OrientedProtocols, Bit-Oriented Protocol, Link Access Procedures.

UNIT -IV:

Multiplexing: Frequency Division Multiplexing (FDM), Time Division Multiplexing (TDM),Multiplexing Application, DSL.

Local Area Networks: Ethernet, Other Ether Networks, Token Bus, Token Ring, FDDI.

Metropolitan Area Networks: IEEE 802.6, SMDS

Switching: Circuit Switching, Packet Switching, Message Switching.

Networking and Interfacing Devices: Repeaters, Bridges, Routers, Gateway, Other Devices.

UNIT -V:

Multiple Access Techniques:

Frequency- Division Multiple Access (FDMA), Time - Division Multiple Access (TDMA), Code - Division Multiple Access (CDMA), OFDM and OFDMA. Random Access, Aloha- Carrier Sense Multiple Access (CSMA)- Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA), Controlled Access- Reservation- Polling- Token Passing, Channelization.

TEXT BOOKS:

1. Data Communication and Computer Networking - B. A.Forouzan, 2nd Ed., 2003, TMH.
2. Advanced Electronic Communication Systems - W. Tomasi, 5th Ed., 2008, PEI.

REFERENCE BOOKS:

1. Data Communications and Computer Networks - Prakash C. Gupta, 2006, PHI.
2. Data and Computer Communications - William Stallings, 8th Ed., 2007, PHI.
3. Data Communication and Tele Processing Systems -T. Housely, 2nd Ed, 2008, BSP.
4. Data Communications and Computer Networks- Brijendra Singh, 2nd Ed., 2005, PHI.

Code: M17 CS 1103

CODING THEORY & APPLICATIONS

Lecture	**: 3 Periods**	**Int.Marks**	**: 30**
Tutorial	**: 1 Period.**	**Ext. Marks**	**: 70**
Exam	**: 3 Hrs.**	**Credits**	**: 3**

COURSE OBJECTIVES:

1. To study the concepts of information, entropy, mutual information and study the Shannon's fundamental limits, theorems on information transmission.
2. To Introduce and classify the Error correcting codes and understand the encoding and decoding of various linear block codes, Convolutional codes.
3. To Know the mathematical description of error correcting codes
4. To Introduce the extension field called Galois field and their role in the design of BCH and RS codes
5. To Study the applications of error correcting codes

COURSE OUTCOMES:

After Completion of the course, students will be able to

1. Analyze the information theoretic problems from various disciplines like computer science, mathematics, statistics and communication engineering.
2. Apply coding techniques in various communication systems like wireless communications to achieve coding gain at low SNR values.
3. Build new structures for encoder and decoder to address the issues in evaluating performance of communication system.
4. Implement coding techniques in real time systems

SYLLABUS

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:
Burst –Error-Correcting Codes:
Decoding of Single-Burst error Correcting Cyclic codes, Single-Burst-Error-Correcting Cyclic codes, Burst-Error-Correcting Convolutional Codes, Bounds on Burst Error-Correcting Capability, Interleaved Cyclic and Convolutional Codes, Phased-Burst –Error-Correcting Cyclic and Convolutional codes.

UNIT-V: BCH- CODES
BCH code- Definition, Minimum distance and BCH Bounds, Decoding Procedure for BCH Codes- Syndrome Computation and Iterative Algorithms, Error Location Polynomials and Numbers for single and double error correction

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 Publishing.

REFERENCE BOOKS:

1. Digital Communications-Fundamental and Application - Bernard Sklar, PE.
2. Digital Communications- John G. Proakis, 5th Ed., 2008, TMH.
3. Introduction to Error Control Codes-Salvatore Gravano-oxford
4. Error Correction Coding – Mathematical Methods and Algorithms – Todd K.Moon, 2006, Wiley India.
5. Information Theory, Coding and Cryptography – Ranjan Bose, 2nd Ed, 2009, TMH.

Code: M17 CS 1104

ADVANCED DIGITAL SIGNAL PROCESSING

Lecture	**: 3 Periods**	**Int.Marks**	**: 30**
Tutorial	**: 1 Period.**	**Ext. Marks**	**: 70**
Exam	**: 3 Hrs.**	**Credits**	**: 3**

COURSE OBJECTIVES:

1. To study the in-depth treatment on methods and techniques in discrete-time signal transforms, digital filter design, optimal filtering.
2. To study the power spectrum estimation, multi-rate digital signal processing
3. To study the DSP architectures which are of importance in the areas of signal processing, control and communications.

COURSE OUTCOMES:

On Successful completion of this course the students will be able to

1. Demonstrate advanced knowledge in Filter banks and Wavelets, Efficient power Spectral Estimation Techniques, Adaptive filters.
2. To design adaptive filters for a given application
3. To design multi rate DSP systems\
4. Learn Applications of Multi rate signal processing
5. Analyze complex engineering problems critically for conducting research in Adaptive filter design
6. Solve engineering problems by designing computationally efficient DSP algorithms for feasible and optimal solutions in digital signal processing field
7. Contribute to scientific research in signal processing and inter disciplinary areas like cellular mobile communications, multi rate signal processing and spectral analysis.

SYLLABUS

UNIT –I:

Review of DFT, FFT, IIR Filters and FIR Filters:

Multi Rate Signal Processing: Introduction, Decimation by a factor D, Interpolation by afactor 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, Sub-band Coding of Speech Signals, Quadrature Mirror Filters, Trans-multiplexers, Over Sampling A/D and D/A Conversion.

UNIT -III:

Non-Parametric Methods of Power Spectral Estimation: Estimation of spectra from finiteduration 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 & ItsProperties, 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

Code: M17 CS 1105

RADAR SIGNAL PROCESSING
(ELECTIVE-I)

Lecture	**: 3 Periods**	**Int.Marks**	**: 30**
Tutorial	**: 1 Period.**	**Ext. Marks**	**: 70**
Exam	**: 3 Hrs.**	**Credits**	**: 3**

COURSE OBJECTIVES:

1. To study the Radar Signal acquisition and sampling in multiple domains
2. To provide clear instruction in radar DSP basics
3. To equip the skills needed in both design and analysis of common radar algorithms
4. To study the basics of synthetic aperture imaging and adaptive array processing
5. To study how theoretical results are derived and applied in practice

COURSE OUTCOMES:

After completion of the course, the student will be able to

1. Demonstrate knowledge in Characteristics of matched filter, Detection criteria of radar signals in noise environment, Radar waveform design requirements, Pulse compression techniques, Different coding techniques.
2. Develop skills in designing Radar systems in different noise environments.
3. Apply appropriate techniques for radar signal de-noising.

SYLLABUS

UNIT -I:

Introduction:

Radar Block Diagram, Bistatic Radar, Monostatic Radar, Radar Equation, Information Available from Radar Echo. Review of Radar Range Performance– General Radar Range Equation, Radar Detection with Noise Jamming, Beacon and Repeater Equations, MTI and Pulse Doppler Radar.

Matched Filter Receiver – Impulse Response, Frequency Response Characteristic and its Derivation, Matched Filter and Correlation Function, Correlation Detection and Cross-Correlation Receiver, Efficiency of Non-Matched Filters, Matched Filter for Non-White Noise.

UNIT -II:

Detection of Radar Signals in Noise:

Detection Criteria – Neyman-Pearson Observer, Likelihood-Ratio Receiver, Inverse Probability Receiver, Sequential Observer, Detectors–Envelope Detector, Logarithmic Detector, I/Q Detector. Automatic Detection-CFAR Receiver, Cell Averaging CFAR Receiver, CFAR Loss, CFAR Uses in Radar. Radar Signal Management–Schematics, Component Parts, Resources and Constraints

UNIT -III:

Waveform Selection :

Radar Ambiguity Function and Ambiguity Diagram – Principles and Properties; Specific Cases – Ideal Case, Single Pulse of Sine Wave, Periodic Pulse Train, Single Linear FM Pulse, Noise Like Waveforms, Waveform Design Requirements, Optimum Waveforms for Detection in Clutter, Family of Radar Waveforms.

UNIT -IV:

Pulse Compression in Radar Signals:

Introduction, Significance, Types, Linear FM Pulse Compression – Block Diagram, Characteristics, Reduction of Time Side lobes, Stretch Techniques, Generation and Decoding of FM Waveforms – Block Schematic and Characteristics of Passive System, Digital Compression, SAW Pulse Compression.

UNIT V:

Phase Coding Techniques:

Principles, Binary Phase Coding, Barker Codes, Maximal Length Sequences (MLS/LRS/PN), Block Diagram of a Phase Coded CW Radar.

Poly Phase Codes : Frank Codes, Costas Codes, Non-Linear FM Pulse Compression, Doppler Tolerant PC Waveforms – Short Pulse, Linear Period Modulation (LPM/HFM), Sidelobe Reduction for Phase Coded PC Signals.

TEXT BOOKS:

1. Radar Handbook - M.I. Skolnik, 2nd Ed., 1991, McGraw Hill.
2. Radar Design Principles : Signal Processing and The Environment - Fred E. Nathanson, 2nd Ed., 1999, PHI.
3. Introduction to Radar Systems - M.I. Skolnik, 3rd Ed., 2001, TMH.

REFERENCE BOOKS:

1. Radar Principles - Peyton Z. Peebles, Jr., 2004, John Wiley.
2. Radar Signal Processing and Adaptive Systems - R. Nitzberg, 1999, Artech House.

Code: M17 CS 1106

OPTICAL COMMUNICATION TECHNOLOGY
(ELECTIVE-I)

Lecture	**: 3 Periods**	**Int.Marks**	**: 30**
Tutorial	**: 1 Period.**	**Ext. Marks**	**: 70**
Exam	**: 3 Hrs.**	**Credits**	**: 3**

COURSE OBJECTIVES:

1. To provide students with the design and operating principles of modern optical communication systems and networks.
2. To study the commonly used components and subsystems in optical communication and network systems.
3. To design a simple optical communication link.

COURSE OUTCOMES:

At the end of the course, the students will be able to

1. Demonstrate Knowledge in Linear and Non-linear Characteristics of Optical fiber, Fiber design considerations, Minimization of Losses in Cable design, Understanding the operation of advanced fiber optic components, Modulation and demodulation techniques, Access networks.
2. Analyze complex engineering problems critically in the domain of optical communication for conducting research.
3. Formulate solutions to problems related to optical communication to meet societal and industrial needs.
4. Apply appropriate techniques to complex engineering activities in the field of communication networks.

SYLLABUS

UNIT –I:

Signal propagation in Optical Fibers:

Geometrical Optics approach and Wave Theory approach, Loss and Bandwidth, Chromatic Dispersion, Non Linear effects- Stimulated Brillouin and Stimulated Raman Scattering, Propagation in a Non-Linear Medium, Self-Phase Modulation and Cross Phase Modulation, Four Wave Mixing, Principle of Solitons.

UNIT –II:

Fiber Optic Components for Communication & Networking:

Couplers, Isolators and Circulators, Multiplexers, Bragg Gratings, Fabry-Perot Filters, Mach Zender Interferometers, Arrayed Waveguide Grating, Tunable Filters, High Channel Count Multiplexer Architectures, Optical Amplifiers, Direct and External Modulation Transmitters, Pump Sources for Amplifiers, Optical Switches and Wavelength Converters.

UNIT –III:

Modulation and Demodulation:

Signal formats for Modulation, Subcarrier Modulation and Multiplexing, Optical Modulations – Duobinary, Single Side Band and Multilevel Schemes, Ideal and Practical receivers for Demodulation, Bit Error Rates, Timing Recovery and Equalization, Reed-Solomon Codes for Error Detection and Correction.

UNIT -IV:

Transmission System Engineering:

System Model, Power Penalty in Transmitter and Receiver, Optical Amplifiers, Crosstalk and Reduction of Crosstalk, Cascaded Filters, Dispersion Limitations and Compensation Techniques.

UNIT –V:

Fiber Non-linearities and System Design Considerations:

Limitation in High Speed and WDM Systems due to Non-linearities in Fibers, Wavelength Stabilization against Temperature Variations, Overall System Design considerations – Fiber Dispersion, Modulation, Non-Linear Effects, Wavelengths, All Optical Networks.

TEXT BOOKS:

1. Optical Networks: A Practical Perspective - Rajiv Ramaswami and Kumar N. Sivarajan, 2nd Ed., 2004, Elsevier Morgan Kaufmann Publishers (An Imprint of Elsevier).
2. Optical Fiber Communications – Gerd Keiser, 3rd Ed., 2000, McGraw Hill.

REFERENCE BOOKS:

1. Optical Fiber Communications: Principles and Practice – John.M.Senior, 2nd Ed., 2000, PE.
2. Fiber Optics Communication – Harold Kolimbris, 2nd Ed., 2004, PEI
3. Optical Networks: Third Generation Transport Systems – Uyless Black, 2nd Ed., 2009, PEI
4. Optical Fiber Communications – GovindAgarwal, 2nd Ed., 2004, TMH.
5. Optical Fiber Communications and Its Applications – S.C.Gupta, 2004, PHI.

Code: M17 CS 1107

ADVANCED COMPUTER NETWORKS
(ELECTIVE-I)

Lecture	**: 3 Periods**	**Int.Marks**	**: 30**
Tutorial	**: 1 Period.**	**Ext. Marks**	**: 70**
Exam	**: 3 Hrs.**	**Credits**	**: 3**

COURSE OBJECTIVES:

1. To study the state-of-the-art in network protocols, architectures and applications.
2. To study and Analyze existing network protocols and networks.
3. To Develop new protocols in networking
4. To understand how networking research is done
5. To investigate novel ideas in the area of Networking via term-long research projects.

COURSE OUTCOMES:

On successful completion of this course the students will be able to

1. Configure PCs running Linux so that they receive IP addresses, have default routes, can resolve host names, and so on. (And similarly for Windows, if time permits.)
2. Apply knowledge of the TCP/IP layering model to intelligently debug networking problems.
3. Use Linux commands to understand how a PC is configured.
4. Differentiate between different LAN-based forwarding devices so that they can make thoughtful suggestions on how to build a network.
5. Write networking code that uses TCP and UDP in client-server applications.

SYLLABUS

UNIT -I:

Congestion and Quality of Service (QoS):

Data traffic, Congestion, Congestion Control, Two examples, Quality of Service, Techniques to improve QOS, Integrated Services and Differential services. **Queue Management:** Passive-Drop trial, Drop front, Random drop, Active- early Random drop, Random Early detection.

UNIT -II:

X.25 Standards: X.25 Layers, X.21 Protocol ,**Frame Relay:** Introduction, Frame relay operation, Frame relay layers, Congestion control, Leaky Bucket algorithms, **ATM:** Design goals, ATM architecture, Switching, Switch Fabric, ATM layers, Service classes, ATM applications

UNIT -III:

Interconnection Networks: Introduction, Banyan Networks, Properties, Crossbar switch, Threestage Class networks, Rearrangeble Networks, Folding algorithm, Benes Networks, Lopping algorithm, Bit allocation algorithm. **SONET/SDH**: Synchronous Transport signals, Physical configuration, SONET layers, SONET Frame.

UNIT -IV:

Spread Spectrum: Introduction, Basic concept, Protection against Jamming, Spreading codes(PN sequence), Generation, Properties, Types of Spread Spectrum Modulation, Application of Spread Spectrum. **Private Networks:** Virtual Private Networks, Network Address Translation **Next Generation:** IPV6 Transition from IPV4 to IPV6 ,**Mobile IP:** Addressing, Agents, Threephases, Inefficiency in Mobile IP

UNIT -V:

Wireless Networks:Wireless LAN: IEEE802.11, Architecture, MAC Sub Layer, AddressingMechanism, Physical Layer.**Bluetooth:** Architecture, Bluetooth layers, Radio layer, Base band layer, L2CAP, **Wireless WAN:** The Cellular Concept, Cell, Frequency reuse, Principle, Channel Assignment Strategies, Interference and system capacity, Types of interference, Improving capacity in cellular system, Handoff, AMPS, D-AMPS, GSM, CDMA, GPRS, 3G & 4G technologies.

TEXT BOOKS:

1. Data Communication and Networking - B, A.Forouzan, 4th Ed,TMH
2. TCP/IP Protocol Suit – B. A. Forouzen, 4th Ed, TMH

REFERENCE BOOKS:

1. Wireless Communication System- AbhishekYadav, University Sciences Press
2. Wireless Digital Communications – KamiloFeher, 1999, PHI
3. High Performance TCP-IP Networking- Mahaboob Hassan, Jain Raj, PHI
4. ATM Fundamentals- N. N. Biswas, Adventure Book Publishers, 1998
5. Wireless Communication – T. L. Singhal, McGraw Hill, 2010
6. Wireless Communication and Networking- Vijay K. Garg, Elsevier, 2009

Code: M17 CS 1108

WIRELESS LANS AND PANS
(ELECTIVE-II)

Lecture	**: 3 Periods**	**Int.Marks**	**: 30**
Tutorial	**: 1 Period.**	**Ext. Marks**	**: 70**
Exam	**: 3 Hrs.**	**Credits**	**: 3**

COURSE OBJECTIVE:

1. To study the different generations of mobile networks, WAN and PAN.
2. To understand the concepts of basic cellular system, frequency reuse, channel assignment strategies, handoff strategies, interference.
3. To understand the FDMA, TDMA, spread spectrum multiple access.
4. To study the concepts mobile environment, communication in the infrastructure , iIS-95 CDMA forward channel, IS-95 CDMA risers channel, packet and frame formats in IS-95,IMT -20000.
5. To understand the evolution of the WAN industry, wireless home networking IEEE 802.11 the PHY layer.

COURSE OUTCOMES :

After the completion of the course Students will be

1. Able to understand the second generation cellular networks, third generation wireless networks, wireless in local loop, wireless local area networks, Bluetooth and personal area networks.
2. Able to understand the concepts of spectrum allocation, basic cellular system, frequency reuse, channel assignment strategies, handoff strategies, interference, improving coverage and capacity, cell splitting.
3. Able to understand various multiple accesses techniques: FDMA, TDMA, spread spectrum multiple access, SDMA.
4. Able to understand the communication in the infrastructure , iIS-95 CDMA forward channel, IS-95 CDMA risers channel, packet and frame formats in IS-95,IMT -20000, forward channel in W-CDMA.
5. Able to understand the Historical overviews of the land industry, evolution of the wan industry, wireless home networking IEEE 802.11 the physical layer, MAC layer wireless ATM.

SYLLABUS

UNIT –I:

Wireless System & Random Access Protocols:

Introduction, First and Second Generation Cellular Systems, Cellular Communications from 1G to 3G, Wireless 4G systems, The Wireless Spectrum; Random Access Methods: Pure ALOHA, Slotted ALOHA, Carrier Sense Multiple Access (CSMA), Carrier Sense Multiple Access with Collision Detection (CSMA/CD), Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA).

UNIT –II:
Wireless LANs:

Introduction, importance of Wireless LANs, WLAN Topologies, Transmission Techniques: Wired Networks, Wireless Networks, comparison of wired and Wireless LANs; WLAN Technologies: Infrared technology, UHF narrowband technology, Spread Spectrum technology

UNIT –III:
The IEEE 802.11 Standard for Wireless LANs:

Network Architecture, Physical layer, The Medium Access Control Layer; MAC Layer issues: Hidden Terminal Problem, Reliability, Collision avoidance, Congestion avoidance, Congestion control, Security, The IEEE 802.11e MAC protocol

UNIT –IV:
Wireless PANs:

Introduction, importance of Wireless PANs, The Bluetooth technology: history and applications, technical overview, the Bluetooth specifications, piconet synchronization and Bluetooth clocks, Master-Slave Switch; Bluetooth security; Enhancements to Bluetooth: Bluetooth interference issues, Intra and Inter Piconet scheduling, Bridge selection, Traffic Engineering, QoS and Dynamics Slot Assignment, Scatternet formation.

UNIT –V:
The IEEE 802.15 working Group for WPANs:

The IEEE 802.15.3, The IEEE 802.15.4, ZigBee Technology, ZigBee components and network topologies, The IEEE 802.15.4 LR-WPAN Device architecture: Physical Layer, Data Link Layer, The Network Layer, Applications; IEEE 802.15.3a Ultra wideband.

TEXT BOOKS:

1. Ad Hoc and Sensor Networks - Carlos de MoraisCordeiro and Dharma PrakashAgrawal, World Scientific, 2011.
2. Wireless Communications and Networking - Vijay K.Garg, Morgan Kaufmann Publishers, 2009.

REFERENCE BOOKS

1. Wireless Networks - KavehPahlaram, Prashant Krishnamurthy, PHI, 2002.
2. Wireless Communication- Marks Ciampor, JeorgeOlenewa, Cengage Learning, 2007.

Code: M17 CS 1109

MOBILE COMPUTING TECHNOLOGIES
(ELECTIVE-II)

Lecture	**: 3 Periods**	**Int.Marks**	**: 30**
Tutorial	**: 1 Period.**	**Ext. Marks**	**: 70**
Exam	**: 3 Hrs.**	**Credits**	**: 3**

COURSE OBJECTIVES:

1. To acquire Knowledge of WAP, Wireless Lan
2. To study client programming and different OS architectures.
3. To learn J2ME technology and Mobile VoIP
4. To become familiar with Security issues in Mobile Computing

COURSE OUTCOMES:

On successful completion of this course the students will be able to

1. Apply advanced data communicating methods and networking protocols for wireless and mobile environments
2. Utilize and employ application frameworks for developing mobile applications including under disconnected and weakly connected environment
3. Create web sites suitable for mobile environments
4. Select components and networks for particular application
5. Creatively analyze mobile and wireless networks
6. Critically analyze security issues of mobile and wireless computing systems

SYLLABUS

UNIT –I:

Introduction to Mobile Computing Architecture:

Mobile Computing – Dialog Control – Networks – Middleware and Gateways – Application and Services – Developing Mobile Computing Applications – Security in Mobile Computing – Architecture for Mobile Computing – Three Tier Architecture – Design considerations for Mobile Computing – Mobile Computing through Internet – Making existing Applications Mobile Enabled.

UNIT –II:

Cellular Technologies: GSM, GPS, GPRS, CDMA and 3G

Bluetooth – Radio Frequency Identification – Wireless Broadband – Mobile IP – Internet Protocol Version 6 (IPv6) – Java Card – GSM Architecture – GSM Entities – Call Routing in GSM – PLMN Interfaces – GSM addresses and Identifiers – Network aspects in GSM – Authentication and Security – Mobile computing over SMS – GPRS and Packet Data Network – GPRS Network Architecture – GPRS Network Operations – Data Services in GPRS – Applications for GPRS – Limitations of GPRS – Spread Spectrum technology – Is-95 – CDMA Versus GSM – Wireless Data – Third Generation Networks – Applications on 3G

UNIT –III:

Wireless Application Protocol (WAP) and Wireless LAN:

WAP – MMS – Wireless LAN Advantages – IEEE 802.11 Standards – Wireless LAN Architecture – Mobility in wireless LAN

Intelligent Networks and Interworking:

Introduction – Fundamentals of Call processing – Intelligence in the Networks – SS#7 Signaling – IN Conceptual Model (INCM) – soft switch – Programmable Networks – Technologies and Interfaces for IN

UNIT –IV:

Client Programming, Palm OS, Symbian OS, Win CE Architecture:

Introduction – Moving beyond the Desktop – A Peek under the Hood: Hardware Overview – Mobile phones – PDA – Design Constraints in Applications for Handheld Devices – Palm OS architecture – Application Development – Multimedia – Symbian OS Architecture – Applications for Symbian, Different flavors of Windows CE -Windows CE Architecture

J2ME:JAVA in the Handset – The Three-prong approach to JAVA Everywhere – JAVA 2 Micro Edition (J2ME) technology – Programming for CLDC – GUI in MIDP – UI Design Issues – Multimedia – Record Management System – Communication in MIDP – Security considerations in MIDP – Optional Packages

UNIT –V:

Voice Over Internet Protocol and Convergence:

Voice over IP- H.323 Framework for Voice over IP – Session Initiation Protocol – Comparision between H.323 and SIP – Real Time protocols – Convergence Technologies – Call Routing – Voice over IP Applications – IP multimedia subsystem (IMS) – Mobile VoIP

Security Issues in Mobile Computing: Introduction – Information Security – Security Techniques and Algorithms – Security Protocols– Public Key Infrastructure – Trust – Security Models – Security frameworks for Mobile Environment

TEXT BOOKS:

1. Mobile Computing – Technology, Applications and Service Creation – Asoke K Talukder, Roopa R Yavagal, 2009, TATA McGraw Hill
2. Mobile Communications – Jochen Schiller – 2nd Edition – Pearson Education

REFERENCE BOOKS:

1. The CDMA 2000 System for Mobile Communications – VieriVaughi, Alexander Damn Jaonvic – Pearson
2. Adalestein - Fundamentals of Mobile &Parvasive Computing, 2008, TMH

Code: M17 CS 1110

NETWORK SECURITY & CRYPTOGRAPHY
(ELECTIVE-II)

Lecture	**: 3 Periods**	**Int.Marks**	**: 30**
Tutorial	**: 1 Period.**	**Ext. Marks**	**: 70**
Exam	**: 3 Hrs.**	**Credits**	**: 3**

COURSE OBJECTIVES:

1. To give a clear insight into cryptography, authentication and emerging security standards.
2. To impart knowledge on network security protocols.

COURSE OUTCOMES:

On successful completion of this course the students will be able to

1. Acquire thorough knowledge about Encryption Algorithms
2. Acquire thorough knowledge about cryptography
3. Acquire thorough knowledge about techniques for access control and Email security.
4. Develop security algorithms in the network.

SYLLABUS

UNIT -I:

Introduction:

Attacks, Services and Mechanisms, Security attacks, Security services, A Model for Internetwork security. Classical Techniques: Conventional Encryption model, Steganography, Classical Encryption Techniques.

Modern Techniques:

Simplified DES, Block Cipher Principles, Data Encryption standard, Strength of DES, Differential and Linear Cryptanalysis, Block Cipher Design Principles and Modes of operations.

UNIT -II:

Encryption Algorithms:

Triple DES, International Data Encryption algorithm, Blowfish, RC5, CAST-128, RC2, Characteristics of Advanced Symmetric block cifers. **Conventional Encryption :**Placement of Encryption function, Traffic confidentiality, Key distribution, Random Number Generation.

UNIT -III:

Public Key Cryptography: Principles, RSA Algorithm, Key Management, Diffie-Hellman Keyexchange, Elliptic Curve Cryptograpy. **Number Theory:**Prime and Relatively prime numbers, Modular arithmetic, Fermat's and Euler's theorems, Testing for primality, Euclid's Algorithm, the Chinese remainder theorem, Discrete logarithms.

UNIT -IV:

Message Authentication and Hash Functions: Authentication requirements and functions, Message Authentication, Hash functions, Security of Hash functions and MACs.
Hash and Mac Algorithms:MD File, Message digest Algorithm, Secure Hash Algorithm, RIPEMD-160, HMAC. Digital signatures and Authentication protocols: Digital signatures, Authentication Protocols, Digital signature standards.
Authentication Applications : Kerberos, X.509 directory Authentication service. Electronic MailSecurity: Pretty Good Privacy, S/MIME.

UNIT –V:
IP Security:

Overview, Architecture, Authentication, Encapsulating Security Payload, Combining security Associations, Key Management. Web Security: Web Security requirements, Secure sockets layer and Transport layer security, Secure Electronic Transaction.

Intruders, Viruses and Worms

Intruders, Viruses and Related threats.

Fire Walls: Fire wall Design Principles, Trusted systems.

TEXT BOOKS:

1. Cryptography and Network Security: Principles and Practice - William Stallings, Pearson Education.
2. Network Security Essentials (Applications and Standards) by William Stallings Pearson Education.

REFERENCE BOOKS:

1. Fundamentals of Network Security by Eric Maiwald (Dreamtech press)
2. Network Security - Private Communication in a Public World by Charlie Kaufman, Radia Perlman and Mike Speciner, Pearson/PHI.
3. Principles of Information Security, Whitman, Thomson.
4. Network Security: The complete reference, Robert Bragg, Mark Rhodes, TMH
5. Introduction to Cryptography, Buchmann, Springer.

Code: M17 CS 1111

OPTICAL & DATA COMMUNICATIONS LABORATORY

Lab	**: 3 Periods**	**Int.Marks**	**: 50**
Exam	**: 3 Hrs**	**Ext. Marks**	**: 50**
		Credits	**: 2**

COURSE OBJECTIVES:

1. Understand and measure the basic properties of the propagation of light in a guided-wave dielectric optical fiber, including attenuation, coupling, and handling
2. To study about various optical sources and detectors and their use in both analog & digital in the optical communication systems
3. To study the optical devices and to use in appropriate application
4. To study the analog & digital link set up using a fiber in detail
5. Understand the pc-to-pc communication using parallel port
6. To study of LAN using star topology, bus topology and tree topology and configure modem of a computer

COURSE OUTCOMES:

1. Students can identify the type of fiber optical cable and test their applications
2. Students will have the awareness to select appropriate optical source and detector for different applications
3. Students can operate and modify the setting in any kind of microwave equipments
4. Understand the fundamental concepts of data communications and networking
5. Identify different components and their respective roles in a computer communication system.
6. Apply the knowledge, concepts and terms related to data communication and networking.
7. Solve problems in networking by referring to problems solving steps through relevant information by choosing suitable techniques.
8. Acquaint them-selves with networking software simulation tools, configuring of networking devices and understand their functionality.
9. Know the strategies for securing network applications
10. Appreciate usefulness and importance of computer communication in today life and society.

SYLLABUS

OPTICAL COMMUNICATIONS EXPERIMENTS

1. D.C Characteristics of light sources /detectors (LED, Laser diode and PIN photo diode.)
2. Measurement of Numerical aperture, Propagation and Bending Loss in fiber.
4. Analog link set up using a fiber
5. Digital link set up using a fiber
6. Set up of time division multiplexing using fiber optics
7. Digital Fiber Optical Transmitter and Receiver

DATA COMMUNICATIONS EXPERIMENTS

8. Study of serial interface RS – 232
9. Study of pc to pc communication using parallel port
10. To establish pc-pc communication using LAN
11. Study of LAN using star topology, bus topology and tree topology
12. Study and configure modem of a computer
13. To configure a hub/switch
14. To study the interconnections of cables for data communication
15. Study of a wireless communication system

REFERENCE BOOKS:

1. Optical Fiber Communications – Gerd Keiser, 3rd Ed., 2000, McGraw Hill.
2. Optical Fiber Communications: Principles and Practice – John.M.Senior, 2nd Ed., 2000, PE.
3. Data Communications and Computer Networks - Prakash C. Gupta, 2006, PHI.
4. Data and Computer Communications - William Stallings, 8th Ed., 2007, PHI.

SCHEME OF INSTRUCTION & EXAMINATION
(Regulation R17)

M.TECH (COMMUNICATION SYSTEMS)
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

(With effect from **2017-2018** Admitted Batch onwards**)**
Under Choice Based Credit System

II-SEMESTER

Code No.	Name of the Subject	Credits	Lec-ture Hrs	Tutorial Hrs	Lab Hrs	Contact Hrs/ Week	Internal Marks	External Marks	Total Marks
M17 CS 1201	RF Circuit Design	3	3	1	--	4	30	70	100
M17 CS 1202	Wireless Communications and Networks	3	3	1	--	4	30	70	100
M17 CS 1203	Image and Video Processing	3	3	1	--	4	30	70	100
M17 CS 1204	Software Defined Radio	3	3	1	--	4	30	70	100
#ELE-3	Elective-III	3	3	1	--	4	30	70	100
#ELE-4	Elective-IV	3	3	1	--	4	30	70	100
M17 CS 1211	Advanced Communications Laboratory	2	--	--	3	3	50	50	100
Total		**20**	**18**	**6**	**3**	**27**	**230**	**470**	**700**

	Course Code	Course
#ELE-3	M17CS1205	Soft Computing Techniques
	M17CS1206	Smart Antennas
	M17CS1207	Secure Communications
#ELE-4	M17CS1208	Optical Networks
	M17CS1209	Digital Signal Processors and Architectures
	M17CS1210	Internet Of Things

Code: M17 CS 1201

RF CIRCUIT DESIGN

Lecture	**: 3 Periods**	**Int.Marks**	**: 30**
Tutorial	**: 1 Period.**	**Ext. Marks**	**: 70**
Exam	**: 3 Hrs.**	**Credits**	**: 3**

COURSE OBJECTIVES:

1. To design and analyze single and multiport networks and RF Filters.
2. To study the operation and device characteristics of RF Active components.
3. To design and analyze RF transistor amplifier.
4. To study the operation of Oscillators and mixers used in RF design

COURSE OUTCOMES:

On successful completion of this course the students will be able to

1. Demonstrate advanced knowledge in RF Electronics Transmission line analysis, Matching and biasing networks, RF Passive and Active component, RF Transistor amplifier design, Oscillators and RF Mixers
2. Analyze complex problems critically in the domains of RF field, RF Passive and Active components as well as a smart antenna techniques for better spectrum exploitation for conducting research
3. Solve engineering problems to arrive at optimal solutions in compliance with public health and safety, cultural, societal and environmental factors in the core areas of RF Circuit design

SYLLABUS

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 andBiasing- 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 CircuitConfigurations, 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 Oscillatorconfiguration, 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, PavelBretchko. 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 - Mathew M.Radmangh, 2001, PE Asia Publ.
2. RF Circuit Design – Christopher Bowick, Cheryl Aljuni and John Biyler, Elsevier Science, 2008.
3. Secrets of RF Design - Joseph Carr., 3rd Edition, Tab Electronics.
4. Complete Wireless Design - Cotter W. Sawyer, 2nd Edition, Mc-Graw Hill.
5. Practical RF Circuit Design for Modem Wireless Systems Vol.2 -Less Besser and Rowan Gilmore.

Code: M17 CS 1202

WIRELESS COMMUNICATIONS AND NETWORKS

Lecture	**: 3 Periods**	**Int.Marks**	**: 30**
Tutorial	**: 1 Period.**	**Ext. Marks**	**: 70**
Exam	**: 3 Hrs.**	**Credits**	**: 3**

COURSE OBJECTIVES:

1. To provide an overview of Wireless Communication networks area and its applications in communication engineering.
2. To appreciate the contribution of Wireless Communication networks to overall technological growth.
3. To understand the various terminology, principles, devices, schemes, concepts, algorithms and different methodologies used in Wireless Communication Networks.

COURSE OUTCOMES:

After completion of the course, students

1. Understand the basics of Wireless Communication Networks.
2. Learn about path losses in Mobile Radio Propagation and different path loss models.
3. Learn different types of small scale fading and simulation of different fading models.
4. Learn different Equalization and Diversity algorithms.
5. Learn advantages and disadvantages of WLAN and various IEEE standards

SYLLABUS

UNIT -I:

The Cellular Concept-System Design Fundamentals:

Introduction, Frequency Reuse, Interference and system capacity – Co channel Interference and system capacity, Channel planning for Wireless Systems, Adjacent Channel interference , Power Control for Reducing interference, Improving Coverage & Capacity in Cellular Systems- Cell Splitting, Sectoring, Channel Assignment Strategies, Handoff Strategies- Prioritizing Handoffs, Practical Handoff Considerations, Trunking and Grade of Service

UNIT –II:

Mobile Radio Propagation: Large-Scale Path Loss:

Introduction to Radio Wave Propagation, Free Space Propagation Model, Relating Power to Electric Field, Basic Propagation Mechanisms, **Reflection**: Reflection from Dielectrics, Brewster Angle, Reflection from prefect conductors, Ground Reflection (Two-Ray) Model, **Diffraction**: Fresnel Zone Geometry, Knife-edge Diffraction Model, Multiple knife-edgeDiffraction, Scattering, Outdoor Propagation Models- Longley-Ryce Model, Okumura Model, Hata Model, PCS Extension to Hata Model, Walfisch and Bertoni Model, Wideband PCS Microcell Model, Indoor Propagation Models-Partition losses (Same Floor), Partition losses between Floors, Log-distance path loss model, Ericsson Multiple Breakpoint Model, Attenuation Factor Model, Signal penetration into buildings, Ray Tracing and Site Specific Modeling.

UNIT –III:

Mobile Radio Propagation: Small –Scale Fading and Multipath

Small Scale Multipath propagation-Factors influencing small scale fading, Doppler shift, Impulse Response Model of a multipath channel- Relationship between Bandwidth and Received power, Small-Scale Multipath Measurements-Direct RF Pulse System, Spread Spectrum Sliding Correlator Channel Sounding, Frequency Domain Channels Sounding, Parameters of Mobile Multipath Channels-Time Dispersion Parameters, Coherence Bandwidth, Doppler Spread and Coherence Time, Types of Small-Scale Fading-Fading effects Due to Multipath Time Delay Spread, Flat fading, Frequency selective fading, Fading effects Due to Doppler Spread-Fast fading, slow fading, Statistical Models for multipath Fading Channels-Clarke's model for flat fading, spectral shape due to Doppler spread in Clarke's model, Simulation of Clarke and Gans Fading Model, Level crossing and fading statistics, Two-ray Rayleigh Fading Model.

UNIT -IV:

Equalization and Diversity

Introduction, Fundamentals of Equalization, Training a Generic Adaptive Equalizer, Equalizers in a communication Receiver, Linear Equalizers, Non-linear Equalization-Decision Feedback Equalization (DFE), Maximum Likelihood Sequence Estimation (MLSE) Equalizer, Algorithms for adaptive equalization-Zero Forcing Algorithm, Least Mean Square Algorithm, Recursive least squares algorithm. Diversity -Derivation of selection Diversity improvement, Derivation of Maximal Ratio Combining improvement, Practical Space Diversity Consideration-Selection Diversity, Feedback or Scanning Diversity, Maximal Ratio Combining, Equal Gain Combining, Polarization Diversity, Frequency Diversity, Time Diversity, RAKE Receiver.

UNIT -V:

WirelessNetworks

Introduction to wireless Networks, Advantages and disadvantages of Wireless Local Area Networks, WLAN Topologies, WLAN Standard IEEE 802.11, IEEE 802.11 Medium Access Control, Comparison of IEEE 802.11 a,b,g and n standards, IEEE 802.16 and its enhancements, Wireless PANs, HiperLan, WLL.

TEXT BOOKS:

1. Wireless Communications, Principles, Practice – Theodore, S. Rappaport, 2nd Ed., 2002, PHI.
2. Wireless Communications-Andrea Goldsmith, 2005 Cambridge University Press.
3. Mobile Cellular Communication – GottapuSasibhushanaRao, Pearson Education, 2012.

REFERENCE BOOKS:

1. Principles of Wireless Networks – KavehPahLaven and P. Krishna Murthy, 2002, PE
2. Wireless Digital Communications – KamiloFeher, 1999, PHI.
3. Wireless Communication and Networking – William Stallings, 2003, PHI.
4. Wireless Communication – UpenDalal, Oxford Univ.
5. Press Wireless Communications and Networking – Vijay K. Gary, Elsevier.

Code: M17 CS 1203

IMAGE AND VEDIO PROCESSING

Lecture	**: 3 Periods**	**Int.Marks**	**: 30**
Tutorial	**: 1 Period.**	**Ext. Marks**	**: 70**
Exam	**: 3 Hrs.**	**Credits**	**: 3**

COURSE OBJECTIVES:

1. To understand representation of digital images and video in the spatial (pixel) and frequency domains, and learn common digital video formats.
2. To understand spatial and temporal resolution and aliasing; basic image and video filtering operations; principles and methods of motion/optical flow estimation; fundamentals of image compression and video compression.
3. To learn recent image and video compression standards; basics of video transport over the Internet.
4. To implement image and video processing algorithms using MATLAB or another programming language;

COURSE OUTCOMES:

After undergoing this course, students will be able to:

1. Demonstrate sufficient understanding of theory of image and video processing including image/video representation, image /video filtering, image/video compression,and transport over the Internet.
2. Analyze and interpret the results of image processing methods and algorithms.
3. Demonstrate the ability to implement basic image/video processing operations using MATLAB.
4. Implement a complete image processing system to achieve a specific task, and analyze and interpret the results of this system.

SYLLABUS

UNIT –I:

Fundamentals of Image Processing and Image Transforms:

Introduction, Image sampling, Quantization, Resolution, Image file formats, Elements of image processing system, Applications of Digital image processing,Introduction, Need for transform, image transforms, Fourier transform, 2 D Discrete Fourier transform and its transforms, Importance of phase, Walsh transform, Hadamard transform, Haar transform, slant transform Discrete cosine transform, KL transform, singular value decomposition, Radon transform, comparison of different image transforms.

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.

Image Restoration:

Introduction to Image restoration, Image degradation, Types of image blur, Classification of image restoration techniques, Image restoration model, Linear and Nonlinear image restoration techniques, Blind deconvolution

UNIT –III:

Image Segmentation:

Introduction to image segmentation, Point, Line and Edge Detection, Region based segmentation., Classification of segmentation techniques, Region approach to image segmentation, clustering techniques, Image segmentation based on thresholding, Edge based segmentation, Edge detection and linking, Hough transform, Active contour

Image Compression:

Introduction, Need for image compression, Redundancy in images, Classification of redundancy in images, image compression scheme, Classification of image compression schemes, Fundamentals of information theory, Run length coding, Shannon – Fano coding, Huffman coding, Arithmetic coding, Predictive coding, Transformed based compression, Image compression standard, Wavelet-based image compression, 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, JoemOstermann and Ya–quin Zhang. 1st Ed., PH Int.
3. S.Jayaraman, S.Esakkirajan and T.VeeraKumar, "Digital Image processing, Tata McGraw Hill publishers, 2009

REFRENCE BOOKS:

1. Digital Image Processing and Analysis-Human and Computer Vision Application with CVIP Tools – ScotteUmbaugh, 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.

Code: M17 CS 1204

SOFTWARE DEFINED RADIO

Lecture	**: 3 Periods**	**Int.Marks**	**: 30**
Tutorial	**: 1 Period.**	**Ext. Marks**	**: 70**
Exam	**: 3 Hrs.**	**Credits**	**: 3**

COURSE OBJECTIVES:

1. To study the fundamental radio components and how these components are implemented in software.
2. To study the principles of software architecture to support and develop the SDR .
3. To study Policy and cooperation mechanisms that enable SDR to interoperate.
4. To study and build SDR and investigate their role in future communication systems.

COURSE OUTCOMES:

1. Understanding of analog RF components as front end block in implementation of SDR.
2. Design circuits at different multirate signalling technique for frequency conversion and Sampling issues.
3. Understanding of ADC and DAC technology.
4. Knowledge of Hardware and software development methods for embedded wireless systems
5. Make system-level decisions for software defined radio technology and products.

SYLLABUS

UNIT -I:

Introduction:

The Need for Software Radios, What is Software Radio, Characteristics and benefits of software radio- Design Principles of Software Radio, RF Implementation issues- The Purpose of RF Front – End, Dynamic Range- The Principal Challenge of Receiver Design – RF Receiver Front- End Topologies- Enhanced Flexibility of the RF Chain with Software Radios-Importance of the Components to Overall Performance- Transmitter Architectures and Their Issues- Noise and Distortion in the RF Chain, ADC and DAC Distortion.

UNIT -II:

Multi Rate Signal Processing:

Introduction- Sample Rate Conversion Principles- Polyphase Filters- Digital Filter Banks- Timing Recovery in Digital Receivers Using Multirate Digital Filters.

Digital Generation of Signals:

Introduction- Comparison of Direct Digital Synthesis with Analog Signal Synthesis-Approaches to Direct Digital Synthesis- Analysis of Spurious Signals- Spurious Components due to Periodic jitter- Band Pass Signal Generation- Performance of Direct Digital Synthesis Systems- Hybrid DDS-PLL Systems- Applications of direct Digital Synthesis- Generation of Random Sequences- ROM Compression Techniques.

UNIT -III:

Analog to Digital and Digital to Analog Conversion:

Parameters of ideal data converters- Parameters of Practical data converters- Analog to Digital and Digital to Analog Conversion- Techniques to improve data converter performance-Common ADC and DAC architectures.

UNIT -IV:

Digital Hardware Choices:

Introduction- Key Hardware Elements- DSP Processors- Field Programmable Gate Arrays- Trade-Offs in Using DSPs, FPGAs, and ASICs- Power Management Issues- Using a Combination of DSPs, FPGAs, and ASICs.

UNIT -V:

Object – Oriented Representation of Radios and Network Resources:

Networks- Object Oriented Programming- Object Brokers- Mobile Application Environments- Joint Tactical Radio System.

Case Studies in Software Radio Design: Introduction and Historical Perspective, SPEAKeasy-JTRS, Wireless Information Transfer System, SDR-3000 Digital Transceiver Subsystem, Spectrum Ware, CHARIOT.

TEXT BOOKS:

1. Software Radio: A Modern Approach to Radio Engineering - Jeffrey H. Reed, 2002, PEA Publication.
2. Software Defined Radio: Enabling Technologies- Walter Tuttle Bee, 2002, Wiley Publications.

REFERENCE BOOKS:

1. Software Defined Radio for 3G - Paul Burns, 2002, Artech House.
2. Software Defined Radio: Architectures, Systems and Functions - Markus Dillinger, KambizMadani, Nancy Alonistioti, 2003, Wiley.
3. Software Radio Architecture: Object Oriented Approaches to wireless System Enginering – Joseph Mitola, III, 2000, John Wiley & Sons.
4. R.F Microelectronics – B. Razavi, 1998, PHI.
5. DSP – A Computer Based Approach – S. K. Mithra, 1998, McGraw-Hill.

Code: M17 CS 1205

SOFT COMPUTING TECHNIQUES
(ELECTIVE-III)

Lecture	**: 3 Periods**	**Int.Marks**	**: 30**
Tutorial	**: 1 Period.**	**Ext. Marks**	**: 70**
Exam	**: 3 Hrs.**	**Credits**	**: 3**

COURSE OBJECTIVES:

1. To study the soft computing basics and branches.
2. To Understand the basic implementation details on Artificial Neural Networks
3. To understand fuzzy logic and it application in ANN.
4. To study the Genetic algorithm and its application
5. To study the applications of Soft Computing.

COURSE OUTCOME:

After undergoing the course, students will be able to

1. Differentiate between Soft Computing and hard computing.
2. Understand and apply Artificial Neural Networks, Fuzzy Logic, and Genetic algorithms for different applications.
3. Understand various applications of soft computing.

SYLLABUS

UNIT –I:

Introduction:

Approaches to intelligent control, Architecture for intelligent control, Symbolic reasoning system, Rule-based systems, the AI approach, Knowledge representation - Expert systems.

UNIT –II:

Artificial Neural Networks:

Concept of Artificial Neural Networks and its basic mathematical model, McCulloch-Pitts neuron model, simple perceptron, Adaline and Madaline, Feed-forward Multilayer Perceptron, Learning and Training the neural network, Data Processing: Scaling, Fourier transformation, principal-component analysis and wavelet transformations, Hopfield network, Self-organizing network and Recurrent network, Neural Network based controller.

UNIT –III:

Fuzzy Logic System:

Introduction to crisp sets and fuzzy sets, basic fuzzy set operation and approximate reasoning, Introduction to fuzzy logic modeling and control, Fuzzification, inferencing and defuzzification, Fuzzy knowledge and rule bases, Fuzzy modeling and control schemes for nonlinear systems, Self-organizing fuzzy logic control, Fuzzy logic control for nonlinear timedelay system.

UNIT –IV:
GeneticAlgorithm:

Basic concept of Genetic algorithm and detail algorithmic steps, Adjustment of free parameters, Solution of typical control problems using genetic algorithm, Concept on some other search techniques like Tabu search and anD-colony search techniques for solving optimization problems.

UNIT –V:
Applications:

GA application to power system optimisation problem, Case studies: Identification and control of linear and nonlinear dynamic systems using MATLAB-Neural Network toolbox, Stability analysis of Neural-Network interconnection systems, Implementation of fuzzy logic controller using MATLAB fuzzy-logic toolbox, Stability analysis of fuzzy control systems.

TEXT BOOKS:

1. Introduction to Artificial Neural Systems - Jacek.M.Zurada, Jaico Publishing House, 1999.
2. Neural Networks and Fuzzy Systems - Kosko, B., Prentice-Hall of India Pvt. Ltd., 1994.

REFERENCE BOOKS:

1. Fuzzy Sets, Uncertainty and Information - Klir G.J. &Folger T.A., Prentice-Hall of India Pvt. Ltd., 1993.
2. Fuzzy Set Theory and Its Applications - Zimmerman H.J. Kluwer Academic Publishers, 1994.
3. Introduction to Fuzzy Control - Driankov, Hellendroon, Narosa Publishers.
4. Artificial Neural Networks - Dr. B. Yagananarayana, 1999, PHI, New Delhi.
5. Elements of Artificial Neural Networks - KishanMehrotra, Chelkuri K. Mohan, Sanjay Ranka, Penram International.
6. Artificial Neural Network –Simon Haykin, 2^{nd} Ed., Pearson Education.
7. Introduction Neural Networks Using MATLAB 6.0 - S.N. Shivanandam, S. Sumati, S. N. Deepa,1/e, TMH, New Delhi.

Code: M17 CS 1206

SMART ANTENNAS
(ELECTIVE-III)

Lecture	**: 3 Periods**	**Int.Marks**	**: 30**
Tutorial	**: 1 Period.**	**Ext. Marks**	**: 70**
Exam	**: 3 Hrs.**	**Credits**	**: 3**

COURSE OBJECTIVES:

1. To understand the development of smart antennas and types of arrays possible.
2. To understand the concepts of narrowband and wide band processing.
3. To introduce to the students the various adaptive processing techniques.
4. To learn the various methods of AOA estimation.
5. To study the different diversity combining techniques

COURSE OUTCOMES:

On completion of this course, students will be able to

1. Understand the applications of smart antennas.
2. Know the various processing techniques.
3. Discuss about design and simulation of various AOA estimation techniques using software
4. Know the different diversity combining techniques and their significance.
5. Know the Adaptive Algorithm Classification
6. Know Direction of Arrival Estimation methods

SYLLABUS

UNIT I

Introduction: Basic Idea of Smart Antenna, Benefits of Smart Antenna System, The Historical Development of Smart Antennas, Emerging fields of Smart Antennas. Early Forms of Spatial Processing, Review of Fundamentals of Electromagnetic Fields and Antennas. **Array Fundamentals**: Array Weighting-Blackman weights, Hamming Weights, Gaussian Weights, Kaiser Bessel Weights. Fixed Beam Arrays, Fixed Sidelobe Cancelling, Retrodirective Arrays.

UNIT II

Principles of Random Variables and Process: Definition of Random Variables, Probability Density Functions, Expectation and Moments, Common Probability Density Functions, Stationarity and Ergodicity, Autocorrelation and Power Spectral Density, Correlation Matrix. Fixed Weight Beamforming Basics: Maximum S/I Ratio, Minimum Mean Square Error, Maximum Likelihood, and Minimum Variance. Diversity, Secrorization.

Adaptive Beamforming: Least Mean Squares (LMS), Sample Matrix Inversion (SMI), Recursive Least Squares (RLS), Constant Modulus (CM), Least Squares Constant Modulus, Conjugate Gradient (CG) Method, Spreading Sequence Array Weights, Description of the new SDMA receiver.

UNIT III

Angle of Arrival Estimation-I: Fundamentals of Matrix Algebra, Array Correlation Matrix, Non-Blind Beam forming, Blind Beam Forming, Angle of Arrival Estimation Methods: Bartlett AOA Estimate, Capon AOA Estimate, Linear Prediction AOA Estimate.

UNIT IV

Angle of Arrival Estimation-II: Maximum Entropy Angle of Arrival Estimate, Pisarenko Harmonic decomposition AOA Estimate, Min-Norm AOA Estimate, MUSIC AOA Estimate, ESPRIT AOA Estimate.

UNIT V

Smart Antenna Performance: Beam forming Array Performance, Receive Diversity Performance, Combined Diversity and Beam forming Performance, Choosing a Spatial Processing Technique, Multi User Modulation Schemes.

TEXT BOOKS:

1. Smart Antennas for Wireless Communications with MATLAB – Frank B. Gross McGraw – Hill, 2005.
2. Space Time Processing for CDMA Mobile Communications – Pieter van Rooyen, MichielLotter and Danie van Wyk – Kluwer Academic Publishers – 2000.

REFERENCE BOOKS:

1. Smart Antennas - Tapan K. Sarkar, Michel C. Wicks, M.S. Palma and Robert J. Bonnea – John Wiley & Sons – 2003.
2. Adaptive Antenna Arrays: Trends and Applications – S.Chandran- Springer – 2004.
3. Introduction to Space Time Wireless Communications - A Paulraj, Rohitnabar and Dhananjay Gore – Cambridge University Press – 2003.

Code: M17 CS 1207

SECURE COMMUNICATIONS
(ELECTIVE-III)

Lecture	**: 3 Periods**	**Int.Marks**	**: 30**
Tutorial	**: 1 Period.**	**Ext. Marks**	**: 70**
Exam	**: 3 Hrs.**	**Credits**	**: 3**

COURSE OBJECTIVES:

1. To Conceptualize the necessity of Security.
2. To understand the process involved in data modelling.
3. To analyze and handle security risks.
4. To understand latest technologies on security.

COURSE OUTCOMES:

Upon completion of this course, students will be able to:

1. Conceptualize the necessity of Security.
2. Understand the process involved in data modelling.
3. Analyze and handle security risks.
4. Understand latest technologies on security.

SYLLABUS

UNIT-I

Security concepts: Introduction to the Concept of Security, threats, security services, security mechanisms.Basic encryption techniques, Concept of cryptanalysis, Shannon's theory , Perfect secrecy, Block ciphers, Cryptographic algorithms, Features of Data Encryption Standard, Linear and Differential Cryptanalysis, Advanced Encryption Standard, Stream ciphers, Pseudo random sequence generators.

UNIT-II

Database Security: Security policies, Policy enforcement & related issues, Design principles, Multilevel relational data models, Security impact on database function, inference problem Public Key Infrastructure (PKI), Internet Security Protocols, Network Security.

UNIT-III

Software Security: Defining a discipline, A Risk Management Framework, Code review with a tools, Architectural risk analysis, Software penetrating testing, Risk Based security Testing, An Enterprise S/W security program, Security knowledge.

UNIT-IV

Intrusion detection: Defining Intrusion Detection, Security concepts intrusion Detection concept, determining strategies for Intrusion Detection, Responses, Technical issues.

UNIT-V

Biometric Security: Biometric Fundamentals, Types of Biometrics, Fingerprints and Hand Geometry, Facial and Voice Recognition, Iris and Retina scanning, Signature Recognition and Keystroke Dynamics, Behavioural and Esoteric Biometric Technologies, Issues Involving Biometrics, Privacy.

TEXT BOOKS:

1.William Stallings, " Cryptography and Network Security", 4 th edition, Pearson Education, 2006

REFERENCES:

1. Douglas A. Stinson, "Cryptography, Theory and Practice", 2nd edition, Chapman & Hall, CRC Press Company, Washington.
2. Wade Trappe, Lawrence C. Washington, " Introduction to Cryptography with Coding Theory" Second edition – Pearson Education, 2006
3." Biometric Security and Privacy: Opportunities & Challenges in The Big Data Era ",
by Richard Jiang, Somaya Al-Madeed, Ahmed Bouridane, Danny Crookes, AzeddineBeghdadi, Springer 2017.

Code: M17 CS 1208

OPTICAL NETWORKS
(ELECTIVE-IV)

Lecture	**: 3 Periods**	**Int.Marks**	**: 30**
Tutorial	**: 1 Period.**	**Ext. Marks**	**: 70**
Exam	**: 3 Hrs.**	**Credits**	**: 3**

COURSE OBJECTIVES:

To learn about

1. Various components of optical networks
2. Multiplexing techniques and fiber characteristics
3. First generation and broadcast optical network
4. Network management and access networks
5. Various photonic switches

COURSE OUTCOMES:

After the course the students should be able to:

1. Solve a simple WDM network design and optimization problem.
2. Define the main limitations and possibilities of the optical network technologies.
3. Define the main differences between optical networking and traditional networking.
4. Explain the benefits of optical layer survivability.
5. Describe the main issues in management and control of optical networks.

SYLLABUS

UNIT –I:

Client Layers of Optical Networks:

SONET / SDH – Multiplexing, Frame Structure, Physical Layer, Infrastructure, ATM – Functions, Adaptation layers, QoS, Flow Control Signaling and Routing, IP – Routing, QoS, MPLS, Storage Area Networks – ESCON, Fiber Channel, HIPPI, Gigabit Ethernet.

UNIT -II:

WDM network Elements and Design:

Optical Line Terminals and Amplifiers, Add/Drop Multiplexers, Optical Cross Connects, Cost trade-offs in Network Design, LTD and RWA Problems, Dimensioning – Wavelength Routing Networks, Statistical and Maximum Load Dimensioning Models.

UNIT –III:

Network Control and Management:

Network Management Functions, Optical Layer Services and Interfacing, Layers within Optical Layer, Multivendor Interoperability, Performance and Fault Management, Configuration Management, Optical Safety.

UNIT –IV:

Network Survivability:

Basic Concepts of Survivability, Protection in SONET/SDH Links and Rings, Protection in IP Networks, Optical Layer Protection – Service Classes, Protection Schemes, Interworking between Layers.

UNIT –V:

Access Networks and Photonic Packet Switching:

Network Architecture, Enhanced HFC, FTTC, Photonic Packet Switching – OTDM, Synchronization, Header Processing, Buffering, Burst Switching, Test Beds.

TEXT BOOKS:

1. Optical Networks: A Practical Perspective - Rajiv Ramaswami and Kumar N. Sivarajan, 2nd Ed., 2004, Elsevier Morgan Kaufmann Publishers (An Imprint of Elsevier).
2. WDM Optical Networks: Concepts, Design and Algorithms – C. Siva Rama Murthy and Mohan Guruswamy 2nd Ed., 2003, PEI.
3. Optical Networks: Third Generation Transport Systems – Uyless Black, 2nd Ed., 2009, PEI.

REFERENCE BOOKS:

1. Optical Fiber Communications: Principles and Practice – John.M.Senior, 2nd Ed., 2000, PE.
2. Fiber Optics Communication – Harold Kolimbris, 2nd Ed., 2004, PEI.
3. Networks – Timothy S. Ramteke, 2 ed., 2004, PEI.
4. Optical Fiber Communications – GovindAgarwal, 2nd Ed., 2004, TMH.
5. Optical Fiber Communications and Its Applications – S.C.Gupta, 2004, PHI.
6. Telecommunication System Engineering –Roger L.Freeman, 4th Ed., John Wiley, 2004.

Code: M17 CS 1209

DIGITAL SIGNAL PROCESSORS AND ARCHITECTURES (ELECTIVE-IV)

Lecture	**: 3 Periods**	**Int.Marks**	**: 30**
Tutorial	**: 1 Period.**	**Ext. Marks**	**: 70**
Exam	**: 3 Hrs.**	**Credits**	**: 3**

COURSE OBJECTIVES:

1. To study the basic DFT,FFT and rate conversion algorithms.
2. To study the number format, dynamic range and sources of errors in DSP systems
3. To learn about TMS programmable DSPs and their programming capabilities.
4. To understand basic DSP algorithms on TMS processors
5. To study the FFT algorithms on TMS320C54XX DSP device.

COURSE OUTCOMES:

After undergoing the course, students will be able to

1. Apply DFT and FFT algorithms for DSP application
2. Apply the number format, dynamic range and various sources of errors in DSP system
3. Implement application programs on a DSP processor
4. Implement various DSP algorithms on TMS processors
5. Implement FFT algorithms on TMS320C54XXDSP algorithm.

SYLLABUS

UNIT –I:

Introduction to Digital Signal Processing:

Introduction, A Digital signal-processing system, The sampling process, Discrete time sequences. Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT), Linear time-invariant systems, Digital filters, Decimation and interpolation.

Computational Accuracy in DSP Implementations:

Number formats for signals and coefficients in DSP systems, Dynamic Range and Precision, Sources of error in DSP implementations, A/D Conversion errors, DSP Computational errors, D/A Conversion Errors, Compensating filter.

UNIT –II:

Architectures for Programmable DSP Devices:

Basic Architectural features, DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Address Generation UNIT, Programmability and Program Execution, Speed Issues, Features for External interfacing.

UNIT -III:

Programmable Digital Signal Processors:

Commercial Digital signal-processing Devices, Data Addressing modes of TMS320C54XX DSPs, Data Addressing modes of TMS320C54XX Processors, Memory space of TMS320C54XX Processors, Program Control, TMS320C54XX instructions and Programming, On-Chip Peripherals, Interrupts of TMS320C54XX processors, Pipeline operation of TMS320C54XX Processors.

UNIT –IV:

Analog Devices Family of DSP Devices:

Analog Devices Family of DSP Devices – ALU and MAC block diagram, Shifter Instruction, Base Architecture of ADSP 2100, ADSP-2181 high performance Processor.

Introduction to Blackfin Processor - The Blackfin Processor, Introduction to Micro Signal Architecture, Overview of Hardware Processing Units and Register files, Address Arithmetic Unit, Control Unit, Bus Architecture and Memory, Basic Peripherals.

UNIT –V:

Interfacing Memory and I/O Peripherals to Programmable DSP Devices:

Memory space organization, External bus interfacing signals, Memory interface, Parallel I/O interface, Programmed I/O, Interrupts and I/O, Direct memory access (DMA).

TEXT BOOKS:

1. Digital Signal Processing – Avtar Singh and S. Srinivasan, Thomson Publications, 2004.
2. A Practical Approach to Digital Signal Processing - K Padmanabhan, R. Vijayarajeswaran, Ananthi. S, New Age International, 2006/2009
3. EmbeddedSignalProcessingwiththeMicroSignalArchitecturePublisher: Woon-SengGan, Sen M. Kuo, Wiley-IEEE Press, 2007

REFERENCE BOOKS:

1. Digital Signal Processors, Architecture, Programming and Applications – B. Venkataramani and M. Bhaskar, 2002, TMH.
2. Digital Signal Processing –Jonatham Stein, 2005, John Wiley.
3. DSP Processor Fundamentals, Architectures & Features – Lapsley et al. 2000, S. Chand & Co.
4. Digital Signal Processing Applications Using the ADSP-2100 Family by The Applications Engineering Staff of Analog Devices, DSP Division, Edited by Amy Mar, PHI
5. *The Scientist and Engineer's Guide to Digital Signal Processing* by Steven W. Smith, Ph.D.,California Technical Publishing, ISBN 0-9660176-3-3, 1997
6. *Embedded Media Processing* by David J. Katz and Rick Gentile of Analog Devices,Newnes , ISBN 0750679123, 2005

Code: M17 CS 1210

INTERNET OF THINGS
(ELECTIVE-IV)

Lecture	**: 3 Periods**	**Int.Marks**	**: 30**
Tutorial	**: 1 Period.**	**Ext. Marks**	**: 70**
Exam	**: 3 Hrs.**	**Credits**	**: 3**

COURSE OBJECTIVES:

1. To know about the new paradigm of objects interacting with people, with information systems, and with other objects.
2. To focus on hands-on project development to find innovative applications of combinations of IoT technologies in real-life scenarios.

COURSE OUTCOMES:

After the completion of the course, Students will be able to

1. Identify and describe different kinds of Internet-connected product concepts.
2. Analyze, designe and develop prototypes models of Internet-connected products using various tools.
3. Understand the challenges and apply right techniques for user-interaction with connected-objects.

SYLLABUS

UNIT – I

Introduction: IoT overview, The IoT paradigm, Smart objects, IoT Platforms (like Aurdino, ARM Cortex, Raspberry Pi / Intel Galileo), Bits and atoms, Convergence of Technologies. Introduction to Internet and web networking basics: HTTP, Rest, JSON, XML, Interfacing to Cloud Harnessing mobile computing for IoT.

UNIT – II

Introduction to Technologies behind IoT: RFID, NFC, Mobil Data Technologies (GPRS, 3G, 4G), Wifi. Powering the IoT using low power wireless technologies like Bluetooth smart technology, Zigbee. WSN. RTLS + GPS Agents andMultiagent systems.

UNIT – III

IoT Architecture: Machine to Machine, Web of Things, IoT protocols (The Layering concepts ,IoT Communication Pattern, IoT protocol Architecture, The 6LoWPAN - IPv6 over Low power Wireless Personal Area Networks).

UNIT – IV

IoT Applications and issues: Combination scenarios. Breaking assumptions.IoT in retail, IoT in healthcare, IoT in manufacturing. Prototyping Connected Objects: Open source prototype platforms, Arduino based internet communication. Integrating and accessing Internet services, Rasberry PI / Beagle board based Gateways, Data Analysis Techniques.

UNIT – V

Case Studies and Guest lectures from Industry (for different verticals like Retail, Healthcare, Home Automation etc).

TEXT BOOKS

1. 6LoWPAN: The Wireless Embedded Internet, Zach Shelby, Carsten Bormann, Wiley.
2. Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems, Dr. OvidiuVermesan, Dr. Peter Friess, River Publishers.

REFERENCE BOOKS:

1. Building the Internet of Things. Sara Cordoba, WimerHazenberg, Menno Huisman. BIS Publishers. 2011.

Code: M17 CS 1211

ADVANCED COMMUNICATIONS LABORATORY

Lab	**: 3 Periods**	**Int.Marks**	**: 50**
Exam	**: 3 Hrs**	**Ext. Marks**	**: 50**
		Credits	**: 2**

COURSE OBJECTIVES:

The objectives of this course are:

1. To simulate various advanced communication techniques using MATLAB.
2. To get better understanding of convolutional encoder and fiber losses
3. Understand the implementations of FIR & IIR filters using DSP trainer kit.
4. To study the spread spectrum modulations and demodulations using kit

COURSE OUTCOMES:

After completion of the course, the student is able to

1. Calculate BER using binary data
2. Understand the importance of various filter implementations using DSP trainer kit
3. Understanding the Waveforms at various test points of a mobile phone using Mobile Phone Trainer
4. Studying the Performance of spread spectrum communication system.

SYLLABUS

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. Measurement of Bit Error Rate using Binary Data
2. Verification of minimum distance in Hamming code
3. Determination of output of Convolutional Encoder for a given sequence
4. Determination of output of Convolutional Decoder for a given sequence
5. Efficiency of DS Spread- Spectrum Technique
6. Simulation of Frequency Hopping (FH) system
7. Effect of Sampling and Quantization of Digital Image
8. Verification of Various Transforms (FT / DCT/ Walsh / Hadamard) on a given Image (Finding Transform and Inverse Transform)
9. Point, Line and Edge detection techniques using derivative operators.
10. Implementation of FIR filter using DSP Trainer Kit (C-Code/ Assembly code)
11. Implementation of IIR filter using DSP Trainer Kit (C-Code/ Assembly code)
12. Determination of Losses in Optical Fiber
13. Observing the Waveforms at various test points of a mobile phone using Mobile Phone Trainer
14. Study of Direct Sequence Spread Spectrum Modulation & Demodulation using CDMA-DSS-BER Trainer
15. Study of ISDN Training System with Protocol Analyzer
16. Characteristics of LASER Diode

REFERENCE 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. Digital Image Processing – Gonzaleze and Woods, 3rd Ed., Pearson.
4. Optical Fiber Communications – Gerd Keiser, 3rd Ed., 2000, McGraw Hill.
5. Digital Communications-Fundamental and Application - Bernard Sklar, PE.

SCHEME OF INSTRUCTION & EXAMINATION
(Regulation R17)

M.TECH (COMMUNICATION SYSTEMS)
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

(With effect from **2017-2018** Admitted Batch onwards**)**
Under Choice Based Credit System

III-SEMESTER

Course Code	Course	Scheme of Examination	C	Int	Ext	Total
M17 CS 2101	Comprehensive Viva-Voce	Viva-Voce	2	50	-	50
M17 CS 2102	Seminar-I	Oral Presentation	2	50	-	50
M17 CS 2103	Project Work Part-I	Review	16	50	-	50
		Total	**20**	**150**	**-**	**150**

1. The Viva-Voce for the Comprehensive Viva-Voce and Seminar-I shall be held with the Project Guide, PG coordinator, and Head of the Department. The marks shall be awarded in the ratio of 20, 10 and 20 Marks by the members respectively
2. Candidates can do their Project Work Part-I&II work within the department or in any industry/research organization for two semesters (i.e. 3rd and 4th semesters). In case of thesis done in an industry/research organization, one advisor (Guide) should be from the department and one advisor (Co-Guide) should be from the industry/research organization.
3. The Project Work Part-I should be submitted at the end of 3rd Semester and it will be evaluated through Review by a committee consisting of Head of the Department, PG coordinator and Project guide. The marks shall be awarded in the ratio of 20, 10 and 20 Marks by the members respectively.

SCHEME OF INSTRUCTION & EXAMINATION
(Regulation R17)

M.TECH (COMMUNICATION SYSTEMS)
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

(With effect from **2017-2018** Admitted Batch onwards**)**
Under Choice Based Credit System

IV-SEMESTER

Course Code	Course	Scheme of Examination	C	Int	Ext	Total
M17 CS 2201	Seminar-II	Oral presentation	2	50	-	50
M17 CS 2202	Project Work Part-II	Viva-voce	18		100	100
		Total	**20**	**50**	**100**	**150**

1. The viva-voce for Seminar-II shall be held with the Project Guide, PG coordinator, and Head of the Department. The marks shall be awarded in the ratio of 20, 10 and 20 Marks by the members respectively.
2. A publication of a paper on the thesis work in a National/International Journal at the end of 4^{th} semester is mandatory for the submission of thesis work.
3. The Project Work Part-II should be submitted at the end of 4th semester and it will be evaluated through Viva–Voce examination by a committee consisting of External Examiner, Head of the Department, Project guide and PG coordinator. The marks shall be awarded in the ratio of 40, 20, 20 and 20 Marks by the members respectively.