### SEMESTER I

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**TOTAL NO. OF CREDITS: 69**

## LIST OF ELECTIVES

### ELECTIVE- I

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OBJECTIVES:
- To develop the ability to use the concepts of Linear algebra and Special functions for solving problems related to Networks.
- To formulate and construct a mathematical model for a linear programming problem in real life situation;
- To expose the students to solve ordinary differential equations by various techniques.

OUTCOMES:
- To achieve an understanding of the basic concepts of algebraic equations and method of solving them.
- To familiarize the students with special functions and solve problems associated with Engineering applications.

UNIT I  LINEAR ALGEBRA  12

UNIT II  LINEAR PROGRAMMING  12
Formulation – Graphical solution – Simplex method – Two phase method - Transportation and Assignment Models

UNIT III  ORDINARY DIFFERENTIAL EQUATIONS  12
Runge Kutta Methods for system of IVPs, numerical stability, Adams-Bashforth multistep method, solution of stiff ODEs, shooting method, BVP: Finite difference method, orthogonal collocation method, orthogonal collocation with finite element method, Galerkin finite element method.

UNIT IV  TWO DIMENSIONAL RANDOM VARIABLES  12
Joint distributions – Marginal and Conditional distributions – Functions of two dimensional random variables – Regression Curve – Correlation.

UNIT V  QUEUEING MODELS  12

TOTAL: 45+15=60 PERIODS

REFERENCES:
OBJECTIVES:
The purpose of this course is to provide in-depth treatment on methods and techniques in
- discrete-time signal transforms, digital filter design, optimal filtering
- power spectrum estimation, multi-rate digital signal processing
- DSP architectures which are of importance in the areas of signal processing, control
  and communications.

OUTCOMES:
Students should be able to:
- To design adaptive filters for a given application
- To design multirate DSP systems.

UNIT I  DISCRETE RANDOM SIGNAL PROCESSING  9
Weiner Khitchine relation - Power spectral density – filtering random process, Spectral
Factorization Theorem, special types of random process – Signal modeling-Least Squares method,
Pade approximation, Prony’s method, iterative Prefiltering, Finite Data records, Stochastic Models.

UNIT II  SPECTRUM ESTIMATION  9
Non-Parametric methods - Correlation method - Co-variance estimator - Performance analysis of
estimators – Unbiased consistent estimators - Periodogram estimator - Barlett spectrum estimation
- Welch estimation - Model based approach - AR, MA, ARMA Signal modeling - Parameter
estimation using Yule-Walker method.

UNIT III  LINEAR ESTIMATION AND PREDICTION  9
Maximum likelihood criterion - Efficiency of estimator - Least mean squared error criterion - Wiener
filter - Discrete Wiener Hoff equations - Recursive estimators - Kalman filter - Linear prediction,
Prediction error - Whitening filter, Inverse filter - Levinson recursion, Lattice realization, Levinson
recursion algorithm for solving Toeplitz system of equations.

UNIT IV  ADAPTIVE FILTERS  9
FIR Adaptive filters - Newton’s steepest descent method - Adaptive filters based on steepest
descent method - Widrow Hoff LMS Adaptive algorithm - Adaptive channel equalization - Adaptive
echo canceller - Adaptive noise cancellation - RLS Adaptive filters - Exponentially weighted RLS -
Sliding window RLS - Simplified IIR LMS Adaptive filter.

UNIT V  MULTIRATE DIGITAL SIGNAL PROCESSING  9
Mathematical description of change of sampling rate - Interpolation and Decimation - Continuous
time model - Direct digital domain approach - Decimation by integer factor - Interpolation by an
integer factor - Single and multistage realization - Poly phase realization - Applications to sub band
coding - Wavelet transform and filter bank implementation of wavelet expansion of signals.

L +T= 45+15=60, TOTAL: 60 PERIODS

REFERENCES:
Delhi, 2005.
5. S. Kay,” Modern spectrum Estimation theory and application”, Prentice Hall, Englewood Cliffs,
CU7102 ADVANCED DIGITAL COMMUNICATION TECHNIQUES

L T P C 3 0 0 3

COURSE OBJECTIVES:

- To understand the basics of signal-space analysis and digital transmission.
- To understand the coherent and noncoherent receivers and its impact on different channel characteristics.
- To understand Orthogonal Frequency Division Multiplexing.
- To understand the different block coded and convolutional coded digital communication systems.
- To understand the different Equalizers.

UNIT I  COHERENT AND NON-COHERENT COMMUNICATION 9

UNIT II  EQUALIZATION TECHNIQUES 9

UNIT III  BLOCK CODED DIGITAL COMMUNICATION 9
Architecture and performance – Binary block codes; Orthogonal; Biorthogonal; Transorthogonal – Shannon’s channel coding theorem; Channel capacity; Matched filter; Concepts of Spread spectrum communication – Coded BPSK and DPSK demodulators– Linear block codes; Hamming; Golay; Cyclic; BCH ; Reed – Solomon codes. Space time block codes

UNIT IV  CONVOLUTIONAL CODED DIGITAL COMMUNICATION 9

UNIT V  OFDM 9
Generation of sub-carriers using the IFFT; Guard Time and Cyclic Extension; Windowing; OFDM signal processing; Peak Power Problem: PAP reduction schemes- Clipping, Filtering, Coding and Scrambling.

TOTAL: 45 PERIODS

OUTCOMES:
Upon Completion of the course, the students will be able to

- Develop the ability to understand the concepts of signal space analysis coherent and non-coherent receivers.
- Comprehend the generation of OFDM signals and the processing of the signals.
- Possess knowledge on different block codes and convolutional codes.
- Conceptually appreciate different Equalization techniques.

REFERENCES:
OBJECTIVES:
- To develop a comprehensive understanding of multimedia networking.
- To study the types of VPN and tunneling protocols for security.
- To learn about network security in many layers and network management.

UNIT I  INTRODUCTION  9
Review of OSI, TCP/IP; Multiplexing, Modes of Communication, Switching, Routing. SONET – DWDM – DSL – ISDN – BISDN, ATM.

UNIT II  MULTIMEDIA NETWORKING APPLICATIONS  9
Streaming stored Audio and Video – Best effort service – protocols for real time interactive applications – Beyond best effort – scheduling and policing mechanism – integrated services – RSVP- differentiated services.

UNIT III  ADVANCED NETWORKS CONCEPTS  9

UNIT IV  TRAFFIC MODELLING  8
Little’s theorem, Need for modeling, Poisson modeling and its failure, Non - poisson models, Network performance evaluation.

UNIT V  NETWORK SECURITY AND MANAGEMENT  10

TOTAL: 45 PERIODS

REFERENCES:
UNIT II  MONTE CARLO SIMULATION  9
Fundamental concepts, Application to communication systems, Monte Carlo integration, Semi-analytic techniques, Case study: Performance estimation of a wireless system.

UNIT III  LOWER LAYER & LINK LAYER WIRELESS MODELING  9

UNIT IV  CHANNEL MODELING & MOBILITY MODELING  9

UNIT V  HIGHER LAYER MODELING & MODELING THE NETWORK TOPOLOGY  9

REFERENCES:

NC7111  COMMUNICATION AND NETWORKS LABORATORY  L T P C
0 0 3 2

OBJECTIVES:
- To impart state-of-the-art knowledge on advanced topics in networks in an interactive manner through the simulation experiments.
- To involve students in analytical studies of networks through network simulation

Use appropriate simulation tools for the following experiments:
3. Simulation study of WiMAX channel coding DSP
4. AODV / DSR routing algorithm
5. Security algorithms in wired networks
6. MAC protocol in wired and wireless networks
7. Simulation study of a Wireless Sensor Network

TOTAL: 45 PERIODS
UNIT I  DATA ENCRYPTION STANDARD


UNIT II  ADVANCED ENCRYPTION STANDARD


UNIT III  PUBLIC KEY ENCRYPTION AND HASH FUNCTIONS


UNIT IV  NETWORK SECURITY PRACTICE


UNIT V  WIRELESS NETWORK SECURITY


TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES:
UNIT I  WIRELESS CHANNEL PROPAGATION AND MODEL

UNIT II  DIVERSITY
Capacity of flat and frequency selective fading channels-Realization of independent fading paths, Receiver Diversity: selection combining, Maximum-ratio Combining, Equal gain Combining. Transmitter Diversity: Channel known at transmitter, channel unknown at the transmitter.

UNIT III  MIMO COMMUNICATIONS
Narrowband MIMO model, Parallel decomposition of the MIMO channel, MIMO channel capacity, MIMO Diversity Gain:Beamforming, Diversity-Multiplexing trade-offs, Space time Modulation and coding : STBC,STTC, Spacial Multiplexing and BLAST Architectures.

UNIT IV  MULTI USER SYSTEMS
Multiple Access : FDMA,TDMA, CDMA,SDMA, Hybrid techniques, Random Access: ALOHA,SALOHA,CSMA, Scheduling, power control, uplink downlink channel capacity, multiuser diversity, MIMO-MU systems.

UNIT V  WIRELESS NETWORKS
3G Overview, Migration path to UMTS, UMTS Basics, Air Interface, 3GPP Network Architecture, 4G features and challenges, Technology path, IMS Architecture - Introduction to wireless LANs - IEEE 802.11 WLANs - Physical Layer- MAC sublayer.

TOTAL: 45 PERIODS

REFERENCES:

OUTCOMES:
1. The students understand the state of art techniques in wireless communication.
2. Students are enriched with the knowledge of present day technologies to enable them to face the world and contribute back as researchers.
UNIT I  ADHOC NETWORKS AND ROUTING PROTOCOLS  9

UNIT II  MULTICAST ROUTING AND SECURITY  9

UNIT III  QoS AND ENERGY MANAGEMENT  9

UNIT IV  SENSOR NETWORKS – ARCHITECTURE AND MAC PROTOCOLS  9
Single node architecture – Hardware components, energy consumption of sensor nodes, Network architecture – Sensor network scenarios, types of sources and sinks, single hop versus multi-hop networks, multiple sinks and sources, design principles, Development of wireless sensor networks. , physical layer and transceiver design consideration in wireless sensor networks, Energy usage profile, choice of modulation, Power Management - MAC protocols – fundamentals of wireless MAC protocols, low duty cycle protocols and wakeup concepts, contention-based protocols, Schedule-based protocols - SMAC, BMAC, Traffic-adaptive medium access protocol (TRAMA), Link Layer protocols – fundamentals task and requirements, error control, framing, link management.

UNIT V  SENSOR NETWORKS – ROUTING PROTOCOLS AND OPERATING SYSTEMS  9

TOTAL: 45 PERIODS
REFERENCES

NC7211 INNOVATIVE SYSTEM DESIGN LABORATORY  L T P C  0 0 3 2

OBJECTIVES:
1. To encourage the students to identify socially relevant problems,
2. To enable him to think of creative solutions for the same,
3. To design and conduct suitable experiments, as well as to analyze and interpret data to produce meaningful conclusions and match with theoretical concepts,
4. To enable the student to appreciate the practical aspects of system design and understand the associated challenges.
5. To help him develop low cost proof of concept system prototype.

METHODOLOGY:
• Students could form teams not exceeding 2 members,
• Students should submit / present their ideas to the Lab-in-Charge and get it approved,
• Student should submit proposal with system/ technical details and cost implications,
• Students should periodically demonstrate the progress they have made.

EVALUATION:
• Students should be evaluated on the basis of the following:
  Social relevance of their work
  Utility of the system developed
    o Level of proof of concept
    o Industry support if obtained, etc.

TOTAL: 45 PERIODS

OUTCOMES:
1. The student would be able to identify socially relevant issues and apply his knowledge to evolve feasible solutions.
2. The student would be able to comprehensively record and report the measured data, write reports, communicate research ideas and do oral presentations effectively.
UNIT I NAVIGATION, TRACKING AND SAFETY SYSTEMS 9

UNIT II INERTIAL NAVIGATION AND DIFFERENTIAL GPS SYSTEMS 9

UNIT III REMOTE SENSING SYSTEMS AND TECHNIQUES 9

UNIT IV BROADCAST SYSTEMS 9

UNIT V SATELLITE NETWORKING SYSTEM WITH IPV6 9

TOTAL: 45 PERIODS

REFERENCES:

AP7103 ADVANCED MICROPROCESSOR AND MICROCONTROLLER 3 0 0 3

OBJECTIVES:
- To familiarize the fundamental concepts of microprocessor architecture.
- To gain knowledge about high performance CISC and RISC architectures.
- To study about 8 bit Microcontrollers viz. 68HC11 and PIC.
UNIT I  OVERVIEW  

UNIT II  HIGH PERFORMANCE CISC ARCHITECTURE – PENTIUM  

UNIT III  HIGH PERFORMANCE RISC ARCHITECTURE – ARM  
Organization of CPU – Bus architecture –Memory management unit - ARM instruction set - Thumb Instruction set- addressing modes – Programming the ARM processor.

UNIT IV  MOTOROLA 68HC11 MICROCONTROLLERS  
Instruction set addressing modes – operating modes- Interrupt system- RTC-Serial Communication Interface – A/D Converter PWM and UART.

UNIT V  PIC MICROCONTROLLER  

TOTAL: 45 PERIODS
REFERENCES:

VL7001  ANALOG AND MIXED MODE VLSI DESIGN  
OBJECTIVES:
- To study the concepts of MOS large signal model and small signal model
- To understand the concepts of D/A conversion methods and their architectures.
- To design filters for ADC.
- To study about the switched capacitor circuits.

UNIT I  INTRODUCTION AND BASIC MOS DEVICES  
Challenges in analog design-Mixed signal layout issues- MOS FET structures and characteristics-large signal model – small signal model- single stage Amplifier-Source follower- Common gate stage – Cascode Stage

UNIT II  SIBMICRON CIRCUIT DESIGN  
Submicron CMOS process flow, Capacitors and resistors, Current mirrors, Digital Circuit Design, Delay Elements – Adders- OP Amp parameters and Design
UNIT III  DATA CONVERTERS
Characteristics of Sample and Hold- Digital to Analog Converters- architecture-Differential Non linearity-Integral Non linearity- Voltage Scaling-Cyclic DAC-Pipeline DAC-Analog to Digital Converters- architecture – Flash ADC-Pipeline ADC-Differential Non linearity-Integral Non linearity

UNIT IV  SNR IN DATA CONVERTERS
Overview of SNR of Data Converters- Clock Jitters- Improving Using Averaging – Decimating Filters for ADC- Band pass and High Pass Sinc Filters- Interpolating Filters for DAC

UNIT V  SWITCHED CAPACITOR CIRCUITS
Resistors, First order low pass Circuit, Switched capacitor Amplifier, Switched Capacitor Integrator

REFERENCES:

CU7001  REAL TIME EMBEDDED SYSTEMS  L  T  P  C
UNIT I  INTRODUCTION TO EMBEDDED COMPUTING  3 0 0 3
Complex systems and microprocessors – Design example: Model train controller – Embedded system design process – Formalism for system design – Instruction sets Preliminaries – ARM Processor – CPU: Programming input and output – Supervisor mode, exception and traps – Coprocessor – Memory system mechanism – CPU performance – CPU power consumption.

UNIT II  COMPUTING PLATFORM AND DESIGN ANALYSIS  9
CPU buses – Memory devices – I/O devices – Component interfacing – Design with microprocessors – Development and Debugging – Program design – Model of programs – Assembly and Linking – Basic compilation techniques – Analysis and optimization of execution time, power, energy, program size – Program validation and testing.

UNIT III  PROCESS AND OPERATING SYSTEMS  9

UNIT IV  HARDWARE ACCELERATES & NETWORKS  9
Accelerators – Accelerated system design – Distributed Embedded Architecture – Networks for Embedded Systems – Network based design – Internet enabled systems.

UNIT V  CASE STUDY  9
Hardware and software co-design - Data Compressor - Software Modem – Personal Digital Assistants – Set–Top–Box. – System-on-Silicon – FOSS Tools for embedded system development.

REFERENCES:
OBJECTIVES:

- To introducing the concepts of microelectromechanical devices.
- To know the fabrication process of Microsystems.
- To know the design concepts of micro sensors and micro actuators.
- To introducing concepts of quantum mechanics and nano systems.

UNIT I  OVERVIEW AND INTRODUCTION  9
New trends in Engineering and Science: Micro and Nanoscale systems Introduction to Design of MEMS and NEMS, Overview of Nano and Microelectromechanical Systems, Applications of Micro and Nanoelectromechanical systems, Microelectromechanical systems, devices and structures Definitions, Materials for MEMS: Silicon, silicon compounds, polymers, metals

UNIT II  MEMS FABRICATION TECHNOLOGIES  9

UNIT III  MICRO SENSORS  9
MEMS Sensors: Design of Acoustic wave sensors, resonant sensor, Vibratory gyroscope, Capacitive and Piezo Resistive Pressure sensors- engineering mechanics behind these Microsensors. Case study: Piezo-resistive pressure sensor

UNIT IV  MICRO ACTUATORS  9
Design of Actuators: Actuation using thermal forces, Actuation using shape memory Alloys, Actuation using piezoelectric crystals, Actuation using Electrostatic forces (Parallel plate, Torsion bar, Comb drive actuators), Micromechanical Motors and pumps. Case study: Comb drive actuators

UNIT V  NANOSYSTEMS AND QUANTUM MECHANICS  9
Atomic Structures and Quantum Mechanics, Molecular and Nanostructure Dynamics: Shrodinger Equation and Wave function Theory, Density Functional Theory, Nanostructures and Molecular Dynamics, Electromagnetic Fields and their quantization, Molecular Wires and Molecular Circuits.

REFERENCES:
4. Chang Liu, “Foundations of MEMS”, Pearson education India limited, 2006,

AP7202  ASIC AND FPGA DESIGN  L T P C  3 0 0 3

OBJECTIVES:

- To study the design flow of different types of ASIC.
- To familiarize the different types of programming technologies and logic devices.
- To learn the architecture of different types of FPGA.
- To gain knowledge about partitioning, floor planning, placement and routing including circuit extraction of ASIC
- To analyse the synthesis, Simulation and testing of systems.
- To understand the design issues of SOC.
- To know about different high performance algorithms and its applications in ASICs.
UNIT I  OVERVIEW OF ASIC AND PLD
Types of ASICs - Design flow – CAD tools used in ASIC Design – Programming Technologies: Antifuse – static RAM – EPROM and EEPROM technology, Programmable Logic Devices : ROMs and EPROMs – PLA –PAL. Gate Arrays – CPLDs and FPGAs

UNIT II  ASIC PHYSICAL DESIGN
System partition -partitioning - partitioning methods – interconnect delay models and measurement of delay - floor planning - placement – Routing : global routing - detailed routing - special routing - circuit extraction - DRC

UNIT III  LOGIC SYNTHESIS, SIMULATION AND TESTING

UNIT IV  FPGA
Field Programmable gate arrays- Logic blocks, routing architecture, Design flow technology - mapping for FPGAs, Xilinx XC4000 - ALTERA’s FLEX 8000/10000, ACTEL’s ACT 1,2,3 and their speed performance
Case studies:  Altera MAX 5000 and 7000 - Altera MAX 9000 – Spartan II and Virtex II FPGAs - Apex and Cyclone FPGAs

UNIT V  SoC DESIGN

TOTAL: 45 PERIODS

REFERENCES:
OBJECTIVES:

- To study the design concepts of low noise amplifiers.
- To study the various types of mixers designed for wireless communication.
- To study and design PLL and VCO.
- To understand the concepts of CDMA in wireless communication.

UNIT I  COMPONENTS AND DEVICES

UNIT II  MIXERS

UNIT III  FREQUENCY SYNTHESIZERS

UNIT IV  SUB SYSTEMS
Data converters in communications, adaptive Filters, equalizers and transceivers

UNIT V  IMPLEMENTATIONS

TOTAL: 45 PERIODS

REFERENCES:
UNIT II  OPTIMUM RECEIVERS FOR AWGN CHANNEL  
Correlation demodulator, matched filter, maximum likelihood sequence detector, optimum receiver for CPM signals, M-ary orthogonal signals, envelope detectors for Maryand correlated binary signals.

UNIT III  RECEIVERS FOR FADING CHANNELS  
Characterization of fading multiple channels, statistical models, flat and frequency selective fading, diversity technique, Optimal receivers for data detection and synchronization parameter estimation, coded waveform for fading channel.

UNIT IV  SYNCHRONIZATION TECHNIQUES  
Carrier and signal synchronization, carrier phase estimation-PLL, Decision directed loops, symbol timing estimation, maximum likelihood and non-decision directed timing estimation, joint estimation.

UNIT V  ADAPTIVE EQUALIZATION  

TOTAL: 45 PERIODS

REFERENCES:

AP7301  ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY  
L T P C
3 0 0 3

OBJECTIVES:
- To understand the basics of EMI
- To study EMI Sources
- To understand EMI problems
- To understand Solution methods in PCB
- To understand Measurement technique for emission
- To understand Measurement technique for immunity

UNIT I  EMI/EMC CONCEPTS  
EMI-EMC definitions and Units of parameters; Sources and victim of EMI; Conducted and Radiated EMI Emission and Susceptibility; Transient EMI, ESD; Radiation Hazards.

UNIT II  EMI COUPLING PRINCIPLES  
Conducted, radiated and transient coupling; Common ground impedance coupling; Common mode and ground loop coupling; Differential mode coupling; Near field cable to cable coupling, cross talk; Field to cable coupling; Power mains and Power supply coupling.
UNIT III EMI CONTROL TECHNIQUES
Shielding- Shielding Material-Shielding integrity at discontinuities, Filtering- Characteristics of Filters-Impedance and Lumped element filters-Telephone line filter, Power line filter design, Filter installation and Evaluation, Grounding- Measurement of Ground resistance-system grounding for EMI/EMC-Cable shielded grounding, Bonding, Isolation transformer, Transient suppressors, Cable routing, Signal control. EMI gaskets

UNIT IV EMC DESIGN OF PCBS
EMI Suppression Cables-Absorptive, ribbon cables-Devices-Transient protection hybrid circuits, Component selection and mounting; PCB trace impedance; Routing; Cross talk control- Electromagnetic Pulse-Noise from relays and switches, Power distribution decoupling; Zoning; Grounding; VIAs connection; Terminations.

UNIT V EMI MEASUREMENTS AND STANDARDS
Open area test site; TEM cell; EMI test shielded chamber and shielded ferrite lined anechoic chamber; Tx /Rx Antennas, Sensors, Injectors / Couplers, and coupling factors; EMI Rx and spectrum analyzer; Civilian standards-CISPR, FCC, IEC, EN; Military standards-MIL461E/462. Frequency assignment - spectrum conversation. British VDE standards, Euro norms standards in Japan - comparisons. EN Emission and Susceptibility standards and Specifications.

OUTCOMES:
Upon Completion of the course, the students will be able to
• To design a EMI free system
• To reduce system level crosstalk
• To design high speed Printed Circuit board with minimum interference
• To make our world free from unwanted electromagnetic environment

REFERENCES:
3. Henry W.Ott,”Noise Reduction Techniques in Electronic Systems”, A Wiley Inter Science

CU7004 DETECTION AND ESTIMATION THEORY

OBJECTIVES:
1. To enable the student to understand the basic principles of random signal processing, spectral estimation methods and their applications.
2. To enable the student to understand the different signal detection and estimation methods used in communication system design and the implications of proper synchronization methods for proper functioning of the system.

UNIT I DISCRETE RANDOM SIGNAL PROCESSING
UNIT II  SPECTRAL ESTIMATION
Estimation of spectra from finite duration signals, Nonparametric methods – Periodogram, Modified periodogram, Bartlett, Welch and Blackman-Tukey methods, Parametric methods – ARMA, AR and MA model based spectral estimation, Solution using Levinson-Durbin algorithm.

UNIT III  DETECTION AND ESTIMATION CRITERIA
Detection criteria : Bayes detection techniques, MAP, ML, detection of M-ary signals, Neyman Peason, minimax decision criteria. Estimation: linear estimators, non-linear estimators, Bayes, MAP, ML, properties of estimators, phase and amplitude estimation.

UNIT IV  SYNCHRONIZATION
Signal parameter estimation, carrier phase estimation, symbol timing estimator, joint estimation of carrier phase and symbol timing.

UNIT V  RECEIVERS FOR AWGN AND FADING CHANNELS
Optimum receivers for AWGN channel - Correlation demodulator, matched filter, maximum likelihood sequence detector, envelope detectors for M-ary signals; Characterization of fading multipath channels, RAKE demodulator, Multiuser detection techniques.

TOTAL: 45 PERIODS

REFERENCES:

OUTCOMES:
1. The student would be able to demonstrate an understanding of the basic principles of random signal processing, spectral estimation methods and their applications.
2. The student would be able to demonstrate an understanding of the different signal detection and estimation methods used in communication system design and the implications of proper synchronization methods for proper functioning of the system.
3. The student would be in a position to apply his knowledge for designing a baseband system addressing the channel impairments.

CU7005  COGNITIVE RADIO

OBJECTIVES:
1. To enable the student to understand the evolving paradigm of cognitive radio communication and the enabling technologies for its implementation.
2. To enable the student to understand the essential functionalities and requirements in designing software defined radios and their usage for cognitive communication.
3. To expose the student to the evolving next generation wireless networks and their associated challenges.
UNIT I INTRODUCTION TO SDR
Definitions and potential benefits, software radio architecture evolution – foundations, technology tradeoffs and architecture implications, Antenna for Cognitive Radio.

UNIT II SDR ARCHITECTURE
Essential functions of the software radio, architecture goals, quantifying degrees of programmability, top level component topology, computational properties of functional components, interface topologies among plug and play modules, architecture partitions.

UNIT III INTRODUCTION TO COGNITIVE RADIOS
Marking radio self-aware, the cognition cycle, organization of cognition tasks, structuring knowledge for cognition tasks, Enabling location and environment awareness in cognitive radios – concepts, architecture, design considerations.

UNIT IV COGNITIVE RADIO ARCHITECTURE
Primary Cognitive Radio functions, Behaviors, Components, A-Priori Knowledge taxonomy, observe – phase data structures, Radio procedure knowledge encapsulation, components of orient, plan, decide phases, act phase knowledge representation, design rules.

UNIT V NEXT GENERATION WIRELESS NETWORKS
The XG Network architecture, spectrum sensing, spectrum management, spectrum mobility, spectrum sharing, upper layer issues, cross – layer design.

TOTAL: 45 PERIODS

REFERENCES:

OUTCOMES:
1. The student would be able to appreciate the motivation and the necessity for cognitive radio communication strategies.
2. The student would be able to evolve new techniques and demonstrate their feasibility using mathematical validations and simulation tools.
3. The student would be able to demonstrate the impact of the evolved solutions in future wireless network design.
OBJECTIVES:
1. To study the basic concepts of speech and audio.
2. To study the analysis of various M-band filter banks for audio coding.
3. To learn various transform coders for audio coding.
4. To study the speech processing methods in time and frequency domain.

UNIT I MECHANICS OF SPEECH AND AUDIO

UNIT II TIME-FREQUENCY ANALYSIS: FILTER BANKS AND TRANSFORMS

UNIT III AUDIO CODING AND TRANSFORM CODERS

UNIT IV TIME AND FREQUENCY DOMAIN METHODS FOR SPEECH PROCESSING
Time domain parameters of Speech signal – Methods for extracting the parameters :Energy, Average Magnitude – Zero crossing Rate – Silence Discrimination using ZCRand energy Short Time Fourier analysis – Formant extraction – Pitch Extraction using time and frequency domain methods HOMOMORPHIC SPEECH ANALYSIS:

UNIT V LINEAR PREDICTIVE ANALYSIS OF SPEECH

REFERENCES:
2. Applications of Digital Signal Processing to Audio And Acoustics Mark Kahrs, Karlheinz Brandenburg, KLUWER ACADEMIC PUBLISHERS NEW YORK, BOSTON, DORDRECHT, LONDON, MOSCOW
OBJECTIVES:
- To understand the image fundamentals and mathematical transforms necessary for image processing and to study the image enhancement techniques.
- To understand the image segmentation and representation techniques.
- To understand how image are analyzed to extract features of interest.
- To introduce the concepts of image registration and image fusion.
- To analyze the constraints in image processing when dealing with 3D data sets.

UNIT I  FUNDAMENTALS OF DIGITAL IMAGE PROCESSING  9
Elements of visual perception, brightness, contrast, hue, saturation, mach band effect, 2D image transforms-DFT, DCT, KLT, and SVD. Image enhancement in spatial and frequency domain, Review of morphological image processing

UNIT II  SEGMENTATION  9
Edge detection, Thresholding, Region growing, Fuzzy clustering, Watershed algorithm, Active contour methods, Texture feature based segmentation, Model based segmentation, Atlas based segmentation, Wavelet based Segmentation methods

UNIT III  FEATURE EXTRACTION  9
First and second order edge detection operators, Phase congruency, Localized feature extraction-detecting image curvature, shape features Hough transform, shape skeletonization, Boundary descriptors, Moments, Texture descriptors- Autocorrelation, Co-occurrence features, Runlength features, Fractal model based features, Gabor filter, wavelet features.

UNIT IV  REGISTRATION AND IMAGE FUSION  9
Registration- Preprocessing, Feature selection-points, lines, regions and templates Feature correspondence-Point pattern matching, Line matching, region matching Template matching Transformation functions-Similarity transformation and Affine Transformation. Resampling- Nearest Neighbour and Cubic Splines
Image Fusion-Overview of image fusion, pixel fusion, Multire solution based fusion discrete wavelet transform, Curvelet transform. Region based fusion.

UNIT V  3D IMAGE VISUALIZATION  9
Sources of 3D Data sets, Slicing the Data set, Arbitrary section planes, The use of color, Volumetric display, Stereo Viewing, Ray tracing, Reflection, Surfaces, Multiply connected surfaces, Image processing in 3D, Measurements on 3D images.

TOTAL: 45 PERIODS

OUTCOMES:
Upon Completion of the course, the students will be able to
- To understand image formation and the role human visual system plays in perception of gray and color image data.
- To apply image processing techniques in both the spatial and frequency (Fourier) domains.
- To design image analysis techniques in the form of image segmentation and to evaluate the methodologies for segmentation.
- To conduct independent study and analysis of feature extraction techniques.
- To understand the concepts of image registration and image fusion.
- To analyze the constraints in image processing when dealing with 3D data sets and to apply image processing algorithms in practical applications.
TEXT BOOKS:

REFERENCES:

DS7202 RADAR SIGNAL PROCESSING

OBJECTIVES:
• To understand the Radar Signal acquisition and sampling in multiple domains
• To provide clear instruction in radar DSP basics
• To equip the skills needed in both design and analysis of common radar algorithms
• To understand the basics of synthetic aperture imaging and adaptive array processing
• To illustrate how theoretical results are derived and applied in practice

UNIT I INTRODUCTION TO RADAR SYSTEMS
History and application of radar, basic radar function, elements of pulsed radar, review of signal processing concepts and operations, A preview of basic radar signal processing, radar system components, advanced radar signal processing

UNIT II SIGNAL MODELS
Components of a radar signal, amplitude models, types of clutters, noise model and signal-to-noise ratio, jamming, frequency models: the doppler shift, spatial models, spectral model

UNIT III SAMPLING AND QUANTIZATION OF PULSED RADAR SIGNALS
Domains and criteria for sampling radar signals, Sampling in the fast time dimension, Sampling in slow time: selecting the pulse repetition interval, sampling the doppler spectrum, Sampling in the spatial and angle dimension, Quantization, I/Q Imbalance and Digital I/Q

UNIT IV RADAR WAVEFORMS
Introduction, The waveform matched filter, Matched filtering of moving targets, The ambiguity function, The pulse burst waveform, frequency-modulated pulse compression waveforms, Range sidelobe control for FM waveforms, the stepped frequency waveform, Phase-modulated pulse compression waveforms, COSTAS Frequency Codes.

UNIT V DOPPLER PROCESSING
Alternate forms of the Doppler spectrum, Moving target indication (MTI), Pulse Doppler processing, dwell-to-dwell stagger, Pulse pair processing, additional Doppler processing issues, clutter mapping and the moving target detector, MTI for moving platforms: adaptive displaced phase center antenna processing

TOTAL: 45 PERIODS
REFERENCES:
2. Principles of Radar and Sonar Signal Processing, Francois Le Chevalier, Artech House
5. Radar Principles, Peyton Z. Peebles, 2009 Wiley India

CP7008 SPEECH PROCESSING AND SYNTHESIS

OBJECTIVES
- To understand the mathematical foundations needed for speech processing
- To understand the basic concepts and algorithms of speech processing and synthesis
- To familiarize the students with the various speech signal representation, coding and recognition techniques
- To appreciate the use of speech processing in current technologies and to expose the students to real-world applications of speech processing

UNIT I FUNDAMENTALS OF SPEECH PROCESSING

UNIT II SPEECH SIGNAL REPRESENTATIONS AND CODING

UNIT III SPEECH RECOGNITION

UNIT IV TEXT ANALYSIS

UNIT V SPEECH SYNTHESIS

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of the course, the students will be able to
- Identify the various temporal, spectral and cepstral features required for identifying speech units – phoneme, syllable and word
- Determine and apply Mel-frequency cepstral coefficients for processing all types of signals
- Justify the use of formant and concatenative approaches to speech synthesis
- Identify the apt approach of speech synthesis depending on the language to be processed
- Determine the various encoding techniques for representing speech.
REFERENCES:

CU7006 WAVELET TRANSFORMS AND APPLICATIONS L T P C
3 0 0 3

OBJECTIVES:
- To study the basics of signal representation and Fourier theory
- To understand Multi Resolution Analysis and Wavelet concepts
- To study the wavelet transform in both continuous and discrete domain
- To understand the design of wavelets using Lifting scheme
- To understand the applications of Wavelet transform

UNIT I FUNDAMENTALS

UNIT II MULTI RESOLUTION ANALYSIS
Definition of Multi Resolution Analysis (MRA) – Haar Basis – Construction of General Orthonormal MRA – Wavelet Basis for MRA – Continuous Time MRA Interpretation for the DTWT – Discrete Time MRA – Basis Functions for the DTWT – PRQMF Filter Banks.

UNIT III CONTINUOUS WAVELET TRANSFORMS
Wavelet Transform – Definition and Properties – Concept of Scale and its Relation with Frequency – Continuous Wavelet Transform (CWT) – Scaling Function and Wavelet Functions (Daubechies Coiflet, Mexican Hat, Sinc, Gaussian, Bi Orthogonal) – Tiling of Time – Scale Plane for CWT.

UNIT IV DISCRETE WAVELET TRANSFORM

UNIT V APPLICATIONS

TOTAL: 45 PERIODS
OUTCOMES
Upon Completion of the course, the students will be able to
• Use Fourier tools to analyse signals
• Gain knowledge about MRA and representation using wavelet bases
• Acquire knowledge about various wavelet transforms and design wavelet transform
• Apply wavelet transform for various signal & image processing applications

TEXT BOOKS

REFERENCES
UNIT IV  ADSP PROCESSORS  
Architecture of ADSP-21XX and ADSP-210XX series of DSP processors- Addressing modes and assembly language instructions – Application programs – Filter design, FFT calculation.

UNIT V  ADVANCED PROCESSORS  

TOTAL: 45 PERIODS

REFERENCES:
4. Rulph Chassaing, Digital Signal Processing and Applications with the C6713 and C6416 DSK, A JOHN WILEY & SONS, INC., PUBLICATION, 2005

AP7102  ADVANCED DIGITAL LOGIC SYSTEM DESIGN  
L T P C  
3 0 0 3

OBJECTIVES:
- To analyze synchronous and asynchronous sequential circuits
- To realize and design hazard free circuits
- To familiarize the practical issues of sequential circuit design
- To gain knowledge about different fault diagnosis and testing methods
- To estimate the performance of digital systems
- To know about timing analysis of memory and PLD

UNIT I  SEQUENTIAL CIRCUIT DESIGN  

UNIT II  ASYNCHRONOUS SEQUENTIAL CIRCUIT DESIGN  
Analysis of Asynchronous Sequential Circuit (ASC) – Flow Table Reduction – Races in ASC – State Assignment Problem and the Transition Table – Design of ASC – Static and Dynamic Hazards – Essential Hazards – Design of Hazard free circuits - Data Synchronizers – Designing Vending Machine Controller – Mixed Operating Mode Asynchronous Circuits. Practical issues such as clock skew, synchronous and asynchronous inputs and switch bouncing.

UNIT III  FAULT DIAGNOSIS & TESTING  
UNIT IV PERFORMANCE ESTIMATION
Estimating digital system reliability, transmission lines, reflections and terminations, system integrity, network issues for digital systems, formal verifications of digital system: model-checking, binary decision diagram, theorem proving, circuit equivalence.

UNIT V TIMINGS ANALYSIS
ROM timings, Static RAM timing, Synchronous Static RAM and its timing, Dynamic RAM timing, Complex Programmable Logic Devices, Logic Analyzer Basic Architecture, Internal structure, Data display, Setup and Control, Clocking and Sampling.

REFERENCES:
UNIT V  APPLICATION DEVELOPMENT WITH FPGAS

Case Studies of FPGA Applications – System on a Programmable Chip (SoPC) Designs.

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of the course, the students will be able to
- Identify the need for reconfigurable architectures
- Discuss the architecture of FPGAs
- Point out the salient features of different reconfigurable architectures
- Build basic modules using any HDL
- Develop applications using any HDL and appropriate tools
- Design and build an SoPC for a particular application

REFERENCES:

NC7001  NETWORK ROUTING ALGORITHMS

OBJECTIVES:
- To expose the students to the layered architecture for communication networks and the specific functionality of the network layer.
- To enable the student to understand the basic principles of routing and the manner this is implemented in conventional networks and the evolving routing algorithms based on Internetworking requirements, optical backbone and the wireless access part of the network.
- To enable the student to understand the different routing algorithms existing and their performance characteristics.

UNIT I  INTRODUCTION

UNIT II  INTERNET ROUTING
Interior protocol : Routing Information Protocol (RIP), Open Shortest Path First (OSPF), Bellman Ford Distance Vector Routing. Exterior Routing Protocols: Exterior Gateway Protocol (EGP) and Border Gateway Protocol (BGP). Multicast Routing: Pros and cons of Multicast and Multiple Unicast Routing, Distance Vector Multicast Routing Protocol (DVMRP), Multicast Open Shortest Path First (MOSPF), MBONE, Core Based Tree Routing.

UNIT III  ROUTING IN OPTICAL WDM NETWORKS
Classification of RWA algorithms, RWA algorithms, Fairness and Admission Control, Distributed Control Protocols, Permanent Routing and Wavelength Requirements, Wavelength Rerouting-Benefits and Issues, Lightpath Migration, Rerouting Schemes, Algorithms- AG, MWPG.
UNIT IV MOBILE - IP NETWORKS

UNIT V MOBILE AD – HOC NETWORKS
Internet-based mobile ad-hoc networking communication strategies, Routing algorithms – Proactive routing: destination sequenced Distance Vector Routing (DSDV), Reactive routing: Dynamic Source Routing (DSR), Ad hoc On-Demand Distance Vector Routing (AODV), Hybrid Routing: Zone Based Routing (ZRP).

TOTAL: 45 PERIODS

REFERENCES:

OUTCOMES:
1. Given the network and user requirements and the type of channel over which the network has to operate, the student would be in a position to apply his knowledge for identifying a suitable routing algorithm, implementing it and analyzing its performance.
2. The student would also be able to design a new algorithm or modify an existing algorithm to satisfy the evolving demands in the network and by the user applications.
UNIT IV MULTIMEDIA COMMUNICATION STANDARDS 9

UNIT V MULTIMEDIA COMMUNICATION ACROSS NETWORKS 9

REFERENCES:

NC7002 MULTIMEDIA COMPRESSION TECHNIQUES L T P C
3 0 0 3

OBJECTIVES:
To provide in-depth knowledge about
• Data Compression
• Text Compression and Audio Compression
• Image and Video Compression

OUTCOMES:
Students will be able to
• Explain Scalar quantization theory and Rate distribution Theory
• Understand different coding techniques
• Describe Contour based compression and Motion estimation techniques

UNIT I INTRODUCTION 9

UNIT II TEXT COMPRESSION 9

UNIT III AUDIO COMPRESSION 9
UNIT IV IMAGE COMPRESSION 9

UNIT V VIDEO COMPRESSION 9

TOTAL: 45 PERIODS

REFERENCES:

TOTAL: 45 PERIODS
REFERENCES:

IF7301 SOFT COMPUTING L T P C
3 0 0 3

OBJECTIVES
- To learn the key aspects of Soft computing and Neural networks.
- To know about the components and building block hypothesis of Genetic algorithm.
- To understand the features of neural network and its applications
- To study the fuzzy logic components
- To gain insight onto Neuro Fuzzy modeling and control.
- To gain knowledge in machine learning through Support vector machines.

UNIT I INTRODUCTION TO SOFT COMPUTING 9
Evolution of Computing - Soft Computing Constituents – From Conventional AI to Computational Intelligence - Machine Learning Basics

UNIT II GENETIC ALGORITHMS 9
Introduction, Building block hypothesis, working principle, Basic operators and Terminologies like individual, gene, encoding, fitness function and reproduction, Genetic modeling: Significance of Genetic operators, Inheritance operator, cross over, inversion & deletion, mutation operator, Bitwise operator, GA optimization problems, JSPP (Job Shop Scheduling Problem), TSP (Travelling Salesman Problem), Differences & similarities between GA & other traditional methods, Applications of GA.

UNIT III NEURAL NETWORKS 9

UNIT IV FUZZY LOGIC 9

UNIT V NEURO-FUZZY MODELING 9

TOTAL : 45 PERIODS

OUTCOMES
- Implement machine learning through Neural networks.
- Develop a Fuzzy expert system.
- Model Neuro Fuzzy system for clustering and classification.
- Write Genetic Algorithm to solve the optimization problem
REFERENCES:
9. Eiben and Smith “Introduction to Evolutionary Computing” Springer

NC7003 NETWORK PROCESSOR

UNIT I INTRODUCTION

UNIT II NETWORK PROCESSOR TECHNOLOGY

UNIT III COMMERCIAL NETWORK PROCESSORS

UNIT IV NETWORK PROCESSOR: ARCHITECTURE AND PROGRAMMING

UNIT V IOS TECHNOLOGIES
REFERENCES:
www.cisco.com

NE7007  NETWORK MANAGEMENT  L T P C
3 0 0 3

OBJECTIVES
The objective of this course is to
- To understand the need for interoperable network management
- To learn to the concepts and architecture behind standards based network management
- To understand the concepts and terminology associated with SNMP and TMN
- To understand network management as a typical distributed application
- To study the current trends in network management technologies

UNIT I  FUNDAMENTALS OF COMPUTER NETWORK TECHNOLOGY

UNIT II  OSI NETWORK MANAGEMENT
OSI Network management model-Organizational model-Information model, communication model. Abstract Syntax Notation - Encoding structure, Macros Functional model CMIP/CMIS

UNIT III  INTERNET MANAGEMENT(SNMP)
SNMP(V1 and V2)-Organizational model-System Overview, The information model, communication model-Functional model, SNMP proxy server, Management information, protocol remote monitoring - , RMON SMI and MIB, RMON1,RMON2 - A Case Study of Internet Traffic Using RMON.

UNIT IV  BROADBAND NETWORK MANAGEMENT

UNIT V  NETWORK MANAGEMENT APPLICATIONS

TOTAL : 45 PERIODS
OUTCOMES:
Upon completion of this course, the students will be able to
- Analyze the issues and challenges pertaining to management of emerging network technologies such as wired/wireless networks and high-speed internets.
- Apply network management standards to manage practical networks. Formulate possible approaches for managing OSI network model.
- Use on SNMP for managing the network.
- Use RMON for monitoring the behavior of the network.
- Explore the possibilities of improving the speed of the network and managing them.
- Identify the various components of network and formulate the scheme for the managing them.

REFERENCES:
REFERENCES:

CU7009 NEURAL NETWORKS AND APPLICATIONS

UNIT I BASIC LEARNING ALGORITHMS

UNIT II RADIAL-BASIS FUNCTION NETWORKS AND SUPPORT VECTOR MACHINES RADIAL BASIS FUNCTION NETWORKS

SUPPORT VECTOR MACHINES

UNIT III COMMITTEE MACHINES

NEURODYNAMICS SYSTEMS
UNIT IV  
ATTRACTION NEURAL NETWORKS:  

ADAPTIVE RESONANCE THEORY:  
Noise-Saturation Dilemma - Solving Noise-Saturation Dilemma – Recurrent On-center –Off surround Networks – Building Blocks of Adaptive Resonance – Substrate of ResonanceStructural Details of Resonance Model – Adaptive Resonance Theory – Applications

UNIT V  
SELF ORGANISING MAPS:  

PULSED NEURON MODELS:  

TOTAL: 45 PERIODS

REFERENCES: