### SEMESTER I

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### LIST OF ELECTIVES

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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

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

UNIT III ORDINARY DIFFERENTIAL EQUATIONS
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
Joint distributions – Marginal and Conditional distributions – Functions of two dimensional random variables – Regression Curve – Correlation.

UNIT V QUEUEING MODELS

TOTAL: 45+15:60 PERIODS

REFERENCES:
UNIT I  ANTENNA FUNDAMENTALS  9
Antenna fundamental parameters, Radiation integrals, Radiation from surface and line current distributions – dipole, monopole, loop antenna; Mobile phone antenna - base station, hand set antenna; Image; Induction, reciprocity theorem, Broadband antennas and matching techniques, Balance to unbalance transformer, Introduction to numerical techniques.

UNIT II  RADIATION FROM APERTURES  9
Field equivalence principle, Radiation from Rectangular and Circular apertures, Uniform aperture distribution on an infinite ground plane; Slot antenna; Horn antenna; Reflector antenna, aperture blockage, and design consideration.

UNIT III  ARRAYS  9
Introduction-General structure of phased array, linear array theory, variation of gain as a function of pointing direction, effects of phase quantization, frequency scanned arrays, analog beam forming matrices-Active modules, digital beam forming, MEMS technology in phased arrays-Retro directive and self phased arrays.

UNIT IV  MICRO STRIP ANTENNA  9
Radiation Mechanism from patch; Excitation techniques; Microstrip dipole; Rectangular patch, Circular patch, and Ring antenna – radiation analysis from transmission line model, cavity model; input impedance of rectangular and circular patch antenna; Microstrip array and feed network; Application of microstrip array antenna.

UNIT V  EMC ANTENNA AND ANTENNA MEASUREMENTS  9
Concept of EMC measuring antenna; Receiver and Transmitter antenna factors; Log periodic dipole, Biconical, Ridge guide, Multi turn loop; Antenna measurement and instrumentation – Gain, Impedance and antenna factor measurement; Antenna test range Design.

REFERENCES:

TOTAL : 45 PERIODS
CU7102 ADVANCED DIGITAL COMMUNICATION TECHNIQUES L T P C
3 0 0 3

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


UNIT II EQUALIZATION TECHNIQUES


UNIT III BLOCK CODED DIGITAL COMMUNICATION

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; Hammnnig; Golay; Cyclic; BCH ; Reed – Solomon codes - Space time block codes

UNIT IV CONVOLUTIONAL CODED DIGITAL COMMUNICATION


UNIT V OFDM

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 noncoherent 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:
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

UNIT II  SPECTRUM ESTIMATION  9

UNIT III  LINEAR ESTIMATION AND PREDICTION  9

UNIT IV  ADAPTIVE FILTERS  9

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, TOTAL: 60 PERIODS

REFERENCES:
UNIT I  OPTICAL SYSTEM COMPONENTS  
Light propagation in optical fibers – Loss & bandwidth, System limitations, Non-Linear effects; Solitons; Optical Network Components – Couplers, Isolators & Circulators, Multiplexers & Filters, Optical Amplifiers, Switches, Wavelength Converters.

UNIT II  OPTICAL NETWORK ARCHITECTURES  
Introduction to Optical Networks; SONET / SDH standards, Metropolitan Area Networks, Layered Architecture; Broadcast and Select Networks – Topologies for Broadcast Networks, Media Access Control Protocols, Testbeds for Broadcast & Select WDM; Wavelength Routing Architecture.

UNIT III  WAVELENGTH ROUTING NETWORKS  
The optical layer, Node Designs, Optical layer cost tradeoff, Routing and wavelength Assignment [RWA], Virtual topology design, Wavelength Routing Testbeds, Architectural variations.

UNIT IV  PACKET SWITCHING AND ACCESS NETWORKS  

UNIT V  NETWORK DESIGN AND MANAGEMENT  
Transmission System Engineering – System model, Power penalty - transmitter, receiver, Optical amplifiers, crosstalk, dispersion; Wavelength stabilization; Overall design considerations; Control and Management – Network management functions, Configuration management, Performance management, Fault management, Optical safety, Service interface.

REFERENCES:

CU7111  COMMUNICATION SYSTEM LABORATORY  
List of Experiments
Use Network Analysers for the following experiments:
1. Measurement of transmission line parameters.
3. Design and testing of a Microstrip coupler.
4. Characteristics of λ/4 and λ/2 transmission lines.

Use appropriate simulation tools for the following experiments:
1. Channel equalizer design ( LMS, RLS )
2. Antenna Radiation Pattern measurement.
3. Performance Evaluation of digital modulation schemes
4. OFDM transceiver design
5. Simulation of Microstrip Antennas

TOTAL : 45 PERIODS
OBJECTIVES:

- To introduce the concepts of wireless communication.
- To make the students to know about the various propagation methods, Channel models, capacity calculations multiple antennas and multiple user techniques used in the mobile communication.
- To enhance the understanding of Wi-fi, 3G systems and 4G networks.

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, Threshold 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, Spatial 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.

CU7202  MIC AND RF SYSTEM DESIGN  L T P C  3 0 0 3

OBJECTIVES:
1. To understand the fundamentals of RF radio system design.
2. To understand the various components that constitute an RF radio system for wireless Communications.
3. To know the basic analysis techniques needed for evaluating the performance of an RF radio system for Wireless applications.

UNIT I  CMOS PHYSICS, TRANSCEIVER ECIFICATIONSAND ARCHITECTURES  9
CMOS: Introduction to MOSFET Physics – Noise: Thermal, shot, flicker, popcorn noise transceiver Specifications: Two port Noise theory, Noise Figure, THD, IP2, IP3,Sensitivity, SFDR, Phase noise - Specification distribution over a communication link Transceiver Architectures: Receiver: Homodyne, Heterodyne, Image reject, Low IF Architectures – Transmitter: Direct up conversion, Two step up conversion

UNIT II  IMPEDANCE MATCHING AND AMPLIFIERS  9

UNIT III  FEEDBACK SYSTEMS AND POWER AMPLIFIERS  9

UNIT IV  RF FILTER DESIGN, OSILLATOR, MIXER  9
Overview-basic resonator and filter configuration-special filter realizations-filter implementation. Basic oscillator model-high frequency oscillator configuration-basic characteristics of mixers-phase locked loops-RF directional couplers hybrid couplers-detector and demodulator circuits.

UNIT V  MIC COMPONENTS, ANTENNAS AND MEASUREMENT TECHNIQUES  9

TOTAL: 45 PERIODS

OUTCOMES:
• To be able to design RF circuits
• To be able to analyse the performance of RF circuits
REFERENCES:

AP7301 ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY

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.

TOTAL: 45 PERIODS
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:

CU7211 INNOVATIVE SYSTEM DESIGN LABORATORY

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:
  o Social relevance of their work
  o Utility of the system developed
  o Level of proof of concept
  o Industry support if obtained, etc.

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.

TOTAL: 60 PERIODS
UNIT I  NAVIGATION, TRACKING AND SAFETY SYSTEMS

UNIT II  INERTIAL NAVIGATION AND DIFFERENTIAL GPS SYSTEMS

UNIT III  REMOTE SENSING SYSTEMS AND TECHNIQUES

UNIT IV  BROADCAST SYSTEMS

UNIT V  SATELLITE NETWORKING SYSTEM WITH IPv6

TOTAL: 45 PERIODS

REFERENCES:
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
3 0 0 3

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

TOTAL: 45 PERIODS

REFERENCES:
REFERENCES:

CU7002 MEMS AND NEMS

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
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

UNIT III MICRO SENSORS
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
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
Atomic Structures and Quantum Mechanics, Molecular and Nanostructure Dynamics: Shrodingter Equation and Wavefunction Theory, Density Functional Theory, Nanostructures and Molecular Dynamics, Electromagnetic Fields and their quantization, Molecular Wires and Molecular Circuits.

TOTAL: 45 PERIODS
REFERENCES:

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
9
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
9
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
9
Design systems - Logic Synthesis - Half gate ASIC -Schematic entry - Low level design language -
PLA tools -EDIF- CFI design representation. Verilog and logic synthesis -VHDL and logic
synthesis - types of simulation -boundary scan test - fault simulation - automatic test pattern
generation.

UNIT IV
FPGA
9
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
9
Design Methodologies – Processes and Flows - Embedded software development for SOC –
Techniques for SOC Testing – Configurable SOC – Hardware / Software cosdesign Case studies:
Digital camera, Bluetooth radio / modem, SDRAM and USB

TOTAL: 45 PERIODS
REFERENCES:

NC7102 COMMUNICATION NETWORK MODELING AND SIMULATION

UNIT I INTRODUCTION TO MODELING AND SIMULATION

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

UNIT III LOWER LAYER & LINK LAYER WIRELESS MODELING

UNIT IV CHANNEL MODELING & MOBILITY MODELING
UNIT V  HIGHER LAYER MODELING & MODELING THE NETWORK TOPOLOGY


REFERENCES:

TOTAL: 45 PERIODS

CU7003  DIGITAL COMMUNICATION RECEIVERS  L T P C
3 0 0 3

UNIT I  REVIEW OF DIGITAL COMMUNICATION TECHNIQUES
Base band communication; signal space representation, linear and nonlinear modulation techniques, Error tracking and Spectral characteristics of digital modulation.

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:

CU7004 DETECTION AND ESTIMATION THEORY

OBJECTIVES:
- To enable the student to understand the basic principles of random signal processing, spectral estimation methods and their applications.
- 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 FAADING 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:
- The student would be able to demonstrate an understanding of the basic principles of random signal processing, spectral estimation methods and their applications.
- 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.
- The student would be in a position to apply his knowledge for designing a baseband system addressing the channel impairments.

VL7013 VLSI FOR WIRELESS COMMUNICATION L T P C 3 0 0 3

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 9

UNIT II MIXERS 9

UNIT III FREQUENCY SYNTHESIZERS 9

UNIT IV SUB SYSTEMS 9
Data converters in communications, adaptive Filters, equalizers and transceivers

UNIT V IMPLEMENTATIONS 9

TOTAL : 45 PERIODS
REFERENCES:

CU7005 COGNITIVE RADIO L T P C

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 congntion 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.

DS7071 SPEECH AND AUDIO SIGNAL PROCESSING L T P C
3 0 0 3

OBJECTIVES:
- To study the basic concepts of speech and audio.
- To study the analysis of various M-band filter banks for audio coding
- To learn various transform coders for audio coding.
- To study the speech processing methods in time and frequency domain

UNIT I MECHANICS OF SPEECH AND AUDIO

Absolute Threshold of Hearing - Critical Bands- Simultaneous Masking, Masking-Asymmetry, and the Spread of Masking- Nonsimultaneous Masking - Perceptual Entropy - Basic measuring philosophy -Subjective versus objective perceptual testing - The perceptual audio quality measure (PAQM) - Cognitive effects in judging audio quality.

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 ZCR and 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


TOTAL: 45 PERIODS

REFERENCES
2. Applications of Digital Signal Processing to Audio And Acoustics
   Mark Kahrs, Karlheinz Brandenburg, KLUWER ACADEMIC PUBLISHERS NEW YORK, BOSTON, DORDRECHT, LONDON, MOSCOW

DS7201 ADVANCED DIGITAL IMAGE PROCESSING

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

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

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

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, Multiresolution 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  L T P C
3 0 0 3

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  9
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  L T P C
3 0 0 3

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

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

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  9
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  9
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  9

UNIT V  APPLICATIONS  9

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:

DS7101  DSP PROCESSOR ARCHITECTURE AND PROGRAMMING  L T P C
3 0 0 3
OBJECTIVES:
The objective of this course is to provide in-depth knowledge on
• Digital Signal Processor basics
• Third generation DSP Architecture and programming skills
• Advanced DSP architectures and some applications.
OUTCOMES:
Students should be able to:
- Become Digital Signal Processor specialized engineer
- DSP based System Developer

UNIT I  FUNDAMENTALS OF PROGRAMMABLE DSPs  9
Multiplier and Multiplier accumulator – Modified Bus Structures and Memory access in PDSPs – Multiple access memory – Multi-port memory – VLIW architecture- Pipelining – Special Addressing modes in P-DSPs – On chip Peripherals.

UNIT II  TMS320C5X PROCESSOR  9
Architecture – Assembly language syntax - Addressing modes – Assembly language Instructions - Pipeline structure, Operation – Block Diagram of DSP starter kit – Application Programs for processing real time signals.

UNIT III  TMS320C6X PROCESSOR  9

UNIT IV  ADSP PROCESSORS  9
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  9

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

NC7101  HIGH PERFORMANCE NETWORKS  L T P C  3 0 0 3

COURSE 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
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

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

UNIT V NETWORK SECURITY AND MANAGEMENT

TOTAL: 45 PERIODS

REFERENCES:

CP7023 RECONFIGURABLE COMPUTING

OBJECTIVES
- To understand the need for reconfigurable computing
- To expose the students to various device architectures
- To examine the various reconfigurable computing systems
- To understand the different types of compute models for programming reconfigurable architectures
- To expose the students to HDL programming and familiarize with the development environment
- To expose the students to the various placement and routing protocols
- To develop applications with FPGAs

UNIT I DEVICE ARCHITECTURE
UNIT II	RECONFIGURABLE COMPUTING ARCHITECTURES
AND SYSTEMS	9

UNIT III	PROGRAMMING RECONFIGURABLE SYSTEMS	9

UNIT IV	MAPPING DESIGNS TO RECONFIGURABLE PLATFORMS	9

UNIT V	APPLICATION DEVELOPMENT WITH FPGAS	9
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
1. Identify the need for reconfigurable architectures
2. Discuss the architecture of FPGAs
3. Point out the salient features of different reconfigurable architectures
4. Build basic modules using any HDL
5. Develop applications using any HDL and appropriate tools
6. Design and build an SoPC for a particular application

REFERENCES:

NC7001	NETWORK ROUTING ALGORITHMS
L T P C
3 0 0 3

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:
- 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.
- 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 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

UNIT V  SENSOR NETWORKS – ROUTING PROTOCOLS AND OPERATING SYSTEMS  9

TOTAL: 45 PERIODS
REFERENCES
UNIT V  MULTIMEDIA COMMUNICATION ACROSS NETWORKS


TOTAL: 45 PERIODS

REFERENCES:

NC7002 MULTIMEDIA COMPRESSION TECHNIQUES

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

UNIT II  TEXT COMPRESSION

UNIT III  AUDIO COMPRESSION

UNIT IV  IMAGE COMPRESSION

35
UNIT V VIDEO COMPRESSION

TOTAL: 45 PERIODS

REFERENCES:

CU7008 ULTRAWIDE BAND COMMUNICATION

UNIT I INTRODUCTION TO UWB
History, Definition, FCC Mask, UWB features, UWB Interference: IEEE 802.11.a Interference, Signal to Interference ratio calculation, Interference with other wireless services.

UNIT II UWB TECHNOLOGIES AND CHANNEL MODELS

UNIT III UWB SIGNAL PROCESSING
Data Modulation schemes, UWB Multiple Access Modulation, BER, Rake Receiver, Transmit-Reference (T-R) Technique, UWB Range- Data Rate Performance, UWB Channel Capacity UWB Wireless Locationing: Position Locationing Methods, Time of Arrival Estimation, NLOS Location Error , Locationing with OFDM

UNIT IV UWB ANTENNAS
Antenna Requirements, Radiation Mechanism of the UWB Antennas, Types of Broad band antennas, Parameters, Analysis of UWB Antennas, Link Budget for UWB System. Design examples of broad band UWB antennas.

UNIT V UWB APPLICATIONS AND REGULATIONS
Wireless Ad hoc Networking, UWB Wireless Sensor, RFID , Consumer Electronics and Personal Asset Location, Medical applications UWB Regulation and standards in various countries , UWB Regulation in ITU, IEEE Standardization
REFERENCES:

IF7301 SOFT COMPUTING

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
Evolution of Computing - Soft Computing Constituents – From Conventional AI to Computational Intelligence - Machine Learning Basics

UNIT II GENETIC ALGORITHMS
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

UNIT IV FUZZY LOGIC

UNIT V NEURO-FUZZY MODELING

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
- Use Support Vector Machine for enabling the machine learning
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

TOTAL: 45PERIODES
REFERENCES:

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 9

UNIT II OSI NETWORK MANAGEMENT 9
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) 9
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 9

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UNIT V  NETWORK MANAGEMENT APPLICATIONS

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:

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:  

CU7009  NEURAL NETWORK 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 ATTRACTOR 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 Resonance Structural Details of Resonance Model – Adaptive Resonance Theory – Applications

UNIT V SELF ORGANISING MAPS:

PULSED NEURON MODELS:

REFERENCES: