Expt -9	To analyze the performance of baseband system using Eye diagram.	
Expt -10	Implementation of cyclic Encoding and Decoding of BCD bit Sequence.	
Expt -11		
Expt -12	To analyze the performance of Amplitude Shift keying (ASK).	
Expt -13	To analyze and compare performance of 1) Phase Shift Keying (PSK). 2) Differential Phase Shift Keying (DPSK). 3) Quadrature Phase Shift Keying (QPSK)	
Expt -14	Generation of PN sequence and to determine auto and cross correlation..	
Expt -15	To implement Shanon-Fano / Huffman coding using MATLAB.	
	* Minimum 10 experiments based on/relevant to the above list.	

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NOTIFICATION

No. 80 /2019 Date : 26 /07/2019

Subject :- Implementation of revised Syllabi prescribed for Sem. VII & VIII B.E. (Electronics & Telecommunication Engg.) (CGS) for the session 2019-2020 & onwards.

It is notified for general information of all concerned that the authorities of the University has accepted the revised syllabi of Semester **VII & VIII B.E. (Electronics & Telecommunication Engg.) (CGS)** from the session 2019-2020 and onwards as per **Appendix – A** given below :-

Sd/-
(Dr.H.R.Deshmukh)
I/c. Registrar
Sant Gadge Baba Amravati University

Appendix – A

SEMESTER – VII

Subject (Th): 7ET1- VLSI DESIGN

Course Pre-requisites: 1. (3ET3) Electronic Devices & Circuits.
2. (4ET4) Digital Electronics

Course Objectives:
1. To study CMOS transistor theory and performance parameters.
2. To learn design of digital VLSI circuits, computer aided simulation and synthesis tools on programmable chips (FPGA/CPLD) using Verilog HDL.
3. To be aware of manufacturing process in VLSI technology.
4. To study layout design rules for size & power optimization.

Course Outcomes: After successfully completing the course, the students will be able to:
1.Gain knowledge about the trends in VLSI semiconductor technology and it's impacts on scaling and performance.
2. Draw Layout, Stick diagrams of simple CMOS Circuits.
3. Understand Front & Back end design aspects of simple VLSI Digital circuits.
4. Model digital circuits with Verilog HDL, simulate, synthesize and prototype in PLDs.

Unit-1 : CMOS Circuit Design-I: Moore's Law, MOS structure capacitance, Channel capacitance, Junction capacitance, MOS Transistor Switches, CMOS Logic gates, CMOS Inverter - DC Characteristics, CMOS combinational logic design, Intoroduction to Delays in CMOS, Power consumption / Dissipation Issues. [T1, T2, R1] (09)

Unit-2 CMOS Circuit Design-II: Clocked Latch and Flip-Flop Circuits, CMOS Transmission Gates (Pass Gates), Static Read - Write Memory (SRAM) Circuits, Dynamic Read-Write Memory (DRAM) Circuits.. [T1, T2, R1] (08)

Unit-3 CMOS Technology & Design Rules: CMOS fabrication processing steps, p-well CMOS Process, n-well CMOS Process, Twin well process, Silicon-on-Insulator Process, CMOS Process enhancements –Interconnect, Circuit Elements, CMOS Lambda-based Design Rules, Stick Diagrams, Physical layout of simple CMOS Logic Gates. [T1, T2, R2, R3, R6] (08)

Unit-4 VLSI Cloc□ing & Digital System Design using Verilog □DL: VLSI Design flow, Module, ports, Data tpes, Compiler, Directives, Operators, Propogation Delay (Inertial & Transport), Clocks Skew, Clock distribution techniques, Clock Jitter. CMOS Clocking Styles, Introduction to basic faults in VLSI: stuck at 0 and stuck at 1 fault. [T1, T4, R1]

(06)

Unit-5 Digital System Design using Verilog □DL: Gate-Level Modeling, Data Flow Modelling, Structural Modeling using combinational and sequential circuits examples, behavioural Modeling, Initial & always statements, procedural assignments. [T3, R4, R5] (07)

Unit-6 Digital system design using Verilog □DL : Timing controls, Conditional Statements, Loops, Sequential and Parallel Blocks, Generate blocks, Task and Functions, Procedural continuous assignments, Overriding Parameters, Introduction to state machines examples. [T3, R4, R5] (08)

[Total 4□□

Text Boo□s:

1. S. M. Kang and Y. Leblebici, "CMOS Digital Integrated Circuits : Analysis and Design", 3rd Edn., MH, 2002.
2. Neil H. Weste, D. Harris, "Principles of CMOS VLSI design A Circuit & System Perspective" 4th Edition, Pearson(Addison-Wesley), 2011.
3. Samir Palnitkar, "Verilog HDL: A guide to Design and Synthesis", 2nd edition, Prentice Hall PTR, 2003.
4. Wayne Wolfe, "Modern VLSI Design: IP based Approach", 4th Edition, PHI.

Reference Boo□s:

1. Jan M.Rabaey, A.Chandrakasan, B. Nikolic,"Digital Integrated Circuits:A Design Perspective", 2nd Edn.Pearson.
2. S.K. Ghandhi, "VLSI Fabrication Principles", John Wiley Inc., New York, 1994 (2nd Edition).
3. Plummer, Deal, Griffin, "Silicon VLSI Technology: Fundamentals, Practice & Modeling" PH, 2001.
4. Michael Ciletti, "Advance digital design with the Verilog HDL", Pearson publication.
5. Navabi Z., "Verilog Digital System Design", McGraw-Hill Publishing, New York, 1999.
6. S.M. Sze (Ed), "VLSI Technology", McGraw Hill.

7ET2 DIGITAL IMAGE PROCESSING

Course Requisite: 1. (4ET1) Signals and Systems.
2. (6ET4) Digital Signal Processing.

Course Objectives: To understand and gain complete knowledge about :

1. The fundamentals of digital image processing
2. Image transform used in digital image processing
3. Image enhancement techniques used in digital image processing
4. Image restoration techniques and methods used in digital image processing
5. Image compression and Segmentation used in digital image processing.

Course Outcomes: On completion of this module the student will be able to :

1. Analyze general terminology of digital image processing.
2. Examine various types of images, intensity transformations and spatial filtering.
3. Develop Fourier transform for image processing in frequency domain.
4. Evaluate the methodologies for image segmentation, Compression and restoration etc.
5. Implement image process and analysis algorithms.
6. Apply image processing algorithms in practical applications.

Unit-1 : Introduction to digital image processing: Digital Image Fundamental, Elements of Visual Perception, Simple Image Model, Sampling and Quantization, Basic Relationships between Pixel Imaging Geometry, Gray scale image representation. (09)

Unit-2 : Image Transforms: Introduction to the Fourier Transform, DFT, Properties of Two Dimensional Fourier Transform, FFT, Hadamard, Harr, DCT, Slant Transform. (09)

Unit-3: Image Enhancement: Basic Techniques, Enhancement by point processing, Spatial Filtering, Enhancement in Frequency domain, histogram based processing, homomorphic filtering. (09)

Unit-4 Image Restoration: Degradation model, Diagonalisation concept, Algebraic approach to Restoration. Inverse filtering, Weiner (CNS) filtering Restoration in Spatial domain, Basic morphological concept, morphological principles, binary morphology, Basic concepts of erosion and dilation.

(08)

Unit-5 Image Compression: Fundamentals, Image compression models, Elements of Information theory, Lossy and predictive methods, vector quantization, runlength coding, Huffman coding, and lossless compression, compression standards.

(09)

Unit-6 Image Segmentation: Detection of discontinuities, Edge Linking and boundary detection, Thresholding, Regional oriented Segmentation. (08) [**Total 52**

Text Boo s:
1. Gonzalez and Woods, "Digital Image Processing", Addison / Wesley.
2. A. K. Jain, "Digital Image Processing", PHI.

References:
1. Sanjay Sharma, "Digital Image Processing", S. K. Katariya & Sons, New Delhi.
2. William K. Pratt, "Digital Image Processing", 3rd ed., John Wiley and Sons Publications.

7ET3 SATELLITE AND OPTICAL FIBER COMMUNICATION

Course Requisite: 1. (4ET5) Communication Engineering- I.
2. (5ET4) Communication Engineering- II.
3. (6ET3) Digital Communication.

Course Objectives:
1. To understand basics of orbital mechanism, the types of satellite orbits and orbital aspects of satellite communication.
2. To understand the various services of satellite.
3. To introduce and understand optical fiber communication system.
4. To understand and elaborate different components of fibre optic communication system.

Course Outcomes: Upon successful completion of this course, the student will be able to:
1. Understand orbital aspects of satellite communication.
2. Know orbital effects in communication system performance.
3. Elaborate the satellite link model.
4. Describe satellite services; VSAT, GPS.
5. Understand functioning of optical sources and detectors.
6. Describe optical fiber communication system and its performance measures.

Unit-1: Introduction: Satellite frequency bands, Satellite types-LEO, MEO, GEO, HEO, Kepler's laws, Satellite orbits, Geo-stationary Satellite. Orbital Aspects of Satellite Communication: Orbital period and velocity, Effect of orbital inclination, Azimuth and Elevation, Converge angle and Slant range, Orbit determination, Orbital effect in communication system performance. [T1,R3] (08)

Unit-2: Satellite Channels: Electromagnetic field propagation, Atmospheric losses, Receiver noise, Carrier to Noise ratio, Satellite system link model: Uplink, Downlink, Cross link, Transponder, Satellite system parameters, Satellite link analysis, Frequency reuse and depolarization. [R3] (08)

Unit-3: Satellite Services: Very Small Aperture Satellite (VSAT): Overview of VSAT system, Network architecture, Access control protocols, Signal format, Modulation coding and interference issues, VSAT antennas, Transmitter and Receiver, Link analysis for VSAT network. Satellite Navigation and Global Positioning System (GPS): Radio and Satellite navigation, Position, Location in GPS, GPS receivers and codes, GPS navigation message and signal levels, Timing accuracy, GPS receiver operation, Differential GPS. [T1] (08)

Unit-4: Optical Fiber Communication System: Basic optical laws and definitions, Optical fiber modes and configurations, N.A. Attenuation: Units, absorption, scattering losses radioactive losses, core and cladding losses. Material dispersion, wave guide dispersion, intermodal dispersion. [T2,R1] (08)

Unit-5: Optical Sources: Light Emitting Diodes: Structure, Light source materials. Laser Diodes: Structure, threshold conditions, Modulations of laser diodes. Light source linearity, reliability considerations. [T2,R1] (08)

Unit-6: Optical Detectors: Physical principles of photodiodes, Photo detector noise, Detectors response time, Avalanche multiplication noise, Temperature effect on avalanche gain. [T2,R1] (08) [**Total 4**

Text Boo s:
1. Pratt Timothy and Bostian W.Charles, "Satellite Communication", Willey Int. Pub., New York.
2. G. Keiser, "Optical Fibre Communication", McGraw Hill International.

References:
1. Seniors J. M., "Optical Fibre Communication and Applications", Prentice Hall of India Pvt. Ltd., New Delhi.
2. Dennis Roddy, "Satellite Communication", McGraw Hill Int, New York.
3. Robert M Gagliardi, "Satellite Communication", CBS Pub. 4. Anil K, Maini and Varsha Agrawal, "Satellite Communication", Wiley pub.

7ET4 INDUSTIRIAL MANAGEMENT AND UALITY CONTROL

Course requisites: 1. **(**6ET6**)** Communication Skills.

Course Objectives:
1. To understand management, administration and organization in terms of principles and functions.
2. To interpret marketing, materials, production, finance and personnel management.
3. To understand project report, concept of budget and their components.
4. To study concept of quality, business ethics and analyze various quality control techniques.

Course Outcomes: After completing the course, the students will be able to:
1. Practice the fundamental principles and functions of business management.
2. Recognize and apply knowledge of marketing and materials management.
3. Interpret and evaluate personnel management and evaluation methods of job rating.
4. Evaluate balance sheet, costing and budgetary aspects, project report, profit and loss statement and ratio analysis.
5. Identify factors controlling quality of design and conformance.
6. Apply professional ethics, Kaizen, Quality Circles, ISO-9000 series and TQM in organization.

Unit-1 Principles and Techniques of Management : Meaning of and differences among business management, administration and organization, functions of management, planning, organization structure, motivation, delegation and decentralization, communication, leadership and decision making. (08)

Unit-2 Mar et and Materials Management : A) Marketing strategy, market research, consumer behavior, advertising and sales promotion, channels of distribution, pricing of products. B) Classes of material, scope of material control, purchasing procedures, order procedures, inventory control, types of production. (10)

Unit-3 Personnel Management : Meaning and functions of personnel management, recruitment, selection, promotion, wages and salary administration, training and development, functions and scope of trade unions in Indian industries. Welfare of labour, Problems of labour turn over & retention.
Merit Rating**:** Job evaluation, different methods of merit ratings. (08)

Unit-4 Project and Financial Management: A) Case studies of project report, preparation of profit and loss statement and balance sheet..
B) Principles of costing, cost sheet preparation, types of budgets and their importance. (08)

Unit-5 uality Control : Concept of quality and quality control, elements of quality, factors controlling quality of design and conformance, process control, inspection planning and scheduling, 7QC (Seven Quality Control) techniques, vendor inspection, sampling plans, Quality audit system. (10)

Unit-6 uality Management and Professional Ethics : Concepts and applications of Kaizen, quality circle, ISO 9000 series, just-in-time, quality planning and total quality management, elements of TQM. Professional business ethics: concept, ethical business codes and values. (08) [**Total 52**

Text Boo s:

1. O.P.Khanna, “Industrial Engineering and Management”, Dhanpat Rai Publications.
2. Telsang Martand.T., “Industrial and Business Management”, S.Chand Publications.
3. Anil Bhat, Arya Kumar, “Management: Principles, Processes and Practices”, Oxford University Press.
4. Bharat Wakhlu, “Total Quality”, S. Chand Publications.
5. Armand V. Feigenbaum, “Total Quality Control”, Tata Mc-Hill Education.

References :
1. M. Mahajan, “Industrial Engineering and Production Management”, Dhanpat Rai & Sons, New Delhi.
2. Bose D. Chandra, “Fundamentals of Financial Management”, PHI Learning Publications.
3. Abdul Matheen, “Project Management”, Laxmi Publications.

7ET5 Prof. Elect. – I (i) COMPUTER ORGANIZATION

Course Requisite: 1. (4ET4) Digital Electronics
2. (5ET3) Microprocessor & Microcontroller

Course Objectives: To understand and gain complete knowledge about:

1. Understand the computer components, bus interconnections and different types of memories.
2. Learn the different types of data transfer techniques.
3. Understand the different types of instruction formats and addressing modes.
4. Aware of the difference between the RISC and CISC architecture.
5. Learn the concepts of microinstruction its sequencing and execution.
6. Understand the multiple processor organizations.

Course Outcomes: On completion of this module the student should be able to:
1. Design different types of memory systems.
2. Perform different types of floating point arithmetic operations.
3. Design ALU as per the requirement.
4. Understand difference between the Pentium and power PC.
5. Design Micro-programmed control unit as per the requirement.
6. Design multiprocessor based systems.

Unit-1 Computer components & functions. Interconnection structures, Bus Interconnection, PCI, Computer memory system overview, semiconductor main memory, chip logic, error correction, cache memory, elements of cache design, Associative mapping, Advanced DRAM organization, magnetic disk, RAID, CD-ROM. (09)

Unit-2 External devices, I/O modules, Programmed I/O, DMA, Interrupt I/O, I/O channels & IOPs, SCSI & firewire interfaces. Operating system overview, Integer representation and arithmetic, Booths's algorithm, Floating point representation and arithmetic, Precision considerations, guard bits, rounding, quiet and signaling NaNs, denormalised numbers, Little, Big and Bi-Endian. (09)

Unit-3 ALU: Machine instruction characteristics, operand types, operation types, Addressing modes, Instruction formats, CPU structure, processor organization, register organization, instruction cycle, instruction pipelining, Branch prediction. (09)

Unit-4 RISC machine, Instruction Execution characteristics, Register file concept, Compiler based register optimization, RICS architecture, RISC pipelining, RISC v/s CISC, Case study SPARC, superscalar overview, Design issues in instruction level parallelism and machine parallelism, Case study of PowerPC. (08)

Unit-5 Control unit operation: Micro-operations, control of the processor, Hardwired implementation. Micro-programmed control: Concepts, microinstruction sequencing and execution, Applications of microprogramming. 09
Unit-6 Multiple processor organizations, Symmetric processors, Mainframe SMP, Cache coherence and MESI protocol, clusters, Non-uniform Memory access, vector computation. (08) [**Total 52**

Text Boo s:
1. William Stallings, "Computer Organization & Architecture", 5/e (Pearson Education).
2. A. S. Tanenbaum, "Structured Computer Organization", 4/e, McGrawHill (ISE).

References: 1. C. Hamacher, R Zaky, "Computer Organization", 5/e, McGraw Hill (ISE).
2. J.P.Hayes, "Computer Architecture & Organization", 4/e, McGraw Hil (ISE).
3. M.Mano & C. Kime, "Logic & Computer design fundamentals", (2 e), Pearson Education.

Subject (Th): 7ET5 Prof. Elect. – I (ii) PLC AND AUTOMATION

Course Requisite: 1. (3ET4) Instrumentation and Sensors.
2. (5ET2) Power Electronics & Drives.

Course Objectives:
1. To understand Basic Architecture of PLC.
2. To study Different input/output peripherals and communication standards used with PLC.
3. To study Basic Instructions used for Ladder programming.
4. To develop skills to write basic PLC programs.
5. To know SCADA and its application in industrial automation.

Course Outcome: By the end of this course, the students shall be able to:
1. Describe working of various blocks of basic industrial automation system.
2. Interface the peripherals with PLC.
3. Develop PLC programs for various Applications.
4. Application of SCADA in industrial automation.

Unit-1 : PLC Basic: Introduction to PLC, Need of PLC, Types of PLC, Block diagram, processor section, solid state memory, Input modules & output module (Analog, Digital, Discrete). Advantages and limitations of Automation. (09)

Unit-2 : Input Output Devices: Mechanical switches, proximity switches, encoders, Transducer and Sensor- RTD, Thermistors, Thermocouple, Displacement, position, motion sensor, pressure, liquid level detector, fluid flow measurement, optical sensors. Relays, directional control valve, motors, stepper motors. (09)

Unit-3 : PLC Functions: Symbols of ladder diagram, Symbols of I/O Devices, PLC Timer functions, PLC Counter functions, Comparison functions, data handling functions, Bit functions, data move functions, skip & bypass IO functions. (08)

Unit-4 : PLC Programming for Electronic Application: Types of programming language, Development of ladder diagrams: Various types for ladder programming, flowchart, ladder programming for logic gets, flip- flop (JK, RS, D, T), Up down counters, ladders programming for various industrial process. (08)

Unit-5 : PLC Programming for Industrial Automation: Design and development of ladder logic diagram of DOL starter, star delta converter, forward reverse of motor, temperature control of motor, switching appliance using sensor, on delay timer, ladders programming for various industrial process. (08)

Unit-6 : SCADA: Introduction to supervisory control: Introduction, Block diagram, what is real time, scan interval, Communications in SCADA- types & methods used, Remote Terminal Unit (RTU), and Industrial Application of SCADA system. (08) [**Total 50**

Text Boos :

1. "Programmable logic controllers principle and application", John W. Webb, PHI publication.
2. "Process Control Instrumentation Technology", Curtis Johnson PHI publication.
3. "SCADA supervisory control and data acquisition", Stuart A. Boyer, ISA Publication.

Reference Boos :

1. "PLCs & SCADA: Theory and Practice", Rajesh Mehra and Vikrant Vijay, Laxmi Publications.
2. "Programmable Logic Controllers", John R Hackworth, Pearson education.
3. "Introduction to programmable logic controllers", Gary A Dunning.
4. "Mitsubishi FX programmable logic controllers Application and programming" by John Ridley.

7ET5 Prof. Elect. – I (iii) SMART SENSORS

Course Requisite: 1. (3ET4) Instrumentation and Sensors
2. (5ET3) Micro Processor & Micro Controller

Course Objectives:
1. To acquire fundamental knowledge of Smart Sensors.
2. Understand the nature of sensors, their operation & some aspects related to noise and interference.
3. Study the interfacing of different sensors with microcontroller unit (MCU).
4. Understand use of MCUs/DSPs to Increase Sensor Intelligence.
5. To identify applications of smart sensors in various fields.

Course Outcomes: After successful completion the course, the students will be able to:
1. Recognize different types of sensors.
2. Describe the characteristics and operation of smart sensors.
3. Interface the sensors with MCU.
4. Analyze MCUs/DSPs to improve the sensor IQ.
5. Discriminate various control techniques for smart sensors.

Unit-1 : Smart Sensor and the Nature of Semiconductor Sensor Output: Mechanical-Electronic Transitions in Sensing, Nature of Sensors, Integration of Micromachining and Microelectronics, Sensor Output Characteristics, Wheatstone bridge, Piezoresistivity in Silicon, Semiconductor Sensor Definitions, Static versus Dynamic Operation, Noise/Interference Aspects. (08)

Unit-2 Sensing Technologies: Capacitive Sensing, Piezoelectric Sensing, Hall Effect, Chemical sensors, Improving Sensor Characteristics, Digital Output Sensors, Incremental Optical Encoders, Digital Techniques, Low-Power, Low-Voltage Sensors, combined Solution: Micromachining and Microelectronics. (09)

Unit-3 : Getting Sensor Information into the MCU: Amplification and Signal Conditioning, Instrumentation Amplifiers, Switched-Capacitor Amplifier, Barometer Application Circuit, 4-20 mA Signal Transmitter, Inherent Power Supply Rejection, Separate Versus Integrated Signal Conditioning, Digital Conversion, A/D Converters, Performance of A/D Converters, Implications of A/D Accuracy and Errors. (09)

Unit-4 : MCUs DSPs to Increase Sensor I : MCU Control, MCUs for Sensor Interface Peripherals, Memory, Input/output, Onboard A/D Conversion, Power-Saving Capability, Local Voltage or Current Regulation, Modular MCU Design, DSP Control, Algorithms Versus Lookup Tables, Linearization, PWM Control, Auto zero and Auto range, Diagnostics, Indirect (Computed, Not Sensed) Versus Direct Sensing, Sensor Integration. (09)

Unit-5 : Control Techniques: Programmable Logic Controllers, Open Versus Closed-Loop Systems, PID Control, State Machines, Fuzzy Logic, Neural Networks, Combined Fuzzy Logic and Neural Networks, Adaptive Control, Observers for Sensing, Other Control Areas, RISC Versus CISC, Combined CISC, RISC and DSP, The Impact of Artificial Intelligence. (09)

Unit-6 Transceivers, Transponders, and Telemetry: The RF Spectrum, Spread Spectrum, Wireless Data and Communications, Wireless Local Area Networks, FAX/ Modems, Wireless Zone Sensing, Optical Signal Transmission, RF Sensing Surface Acoustical Wave Devices, Radar, Remote Emissions Sensing, Remote Keyless Entry, Intelligent Transportation System, RF-ID, Telemetry, RF MEMS. (08) [**Total 52**

Text Boo: "Understanding Smart Sensors", Randy Frank, 2nd Edition, House Boston, London.

7ET5 Prof. Elect. – I (iv) FUZZY LOGIC AND NEURAL NETWOR□S

Course Requisite : 1. (6ET2) Control Systems Engineering

Course Objectives::
1. ?? ????? fundamental concepts of Artificial Neural Network (ANN).
2. To understand various learning rules for ANN and different supervised and unsupervised learning networks.
3. To study fundamental concepts of Fuzzy Logic(FL), fuzzification and defuzzification.
4. To understand different supervised and unsupervised learning networks.
5. To learn applications of FL for pattern recognition and control.

Course Outcomes: After successful completion the course the student will be able to:

1. Develop algorithms for supervised and unsupervised ANN.
2. Implement the ANN concepts to solve real life problems.
3. Analyze the ANN network.
4. Develop algorithms in fuzzy logic for applications such as pattern recognition.
5. Implement the fuzzy logic concepts to solve real life problems.

Unit-1 Introduction: Biological Neurons and their artificial models, introduction to neural computing, Components of neuron, input and output weight, threshold, weight factors, transfer functions, concepts of supervised and unsupervised learning. (07)

Unit-2 Supervised Learning: Linear separability, Single layer network. **Perceptron:** Training algorithm and limitations. **Multilayer Networ□:** Architecture of feed forward network, Learning rule, generalized delta rule, learning function. Error Back propagation algorithm (EBPA), Learning factors. (09)

Unit-3 Unsupervised Learning: Introduction, Clustering and similarity measures, Winner Take all learning, recall mode, outstar learning rule , Self organizing map, Counter propagation networks. **Recurrent associative memories**: basic concepts, discrete time Hopfield network, storage and retrieval algorithm. (09)

Unit-4 Introduction: Uncertainty in information, basic concepts of Fuzzy sets, operations on fuzzy sets, properties. **Fu□y relations :** operations, properties, fuzzy Cartesian product and composition, tolerance and equivalence relations . (08)

Unit-5 Membership functions: Features, fuzzification, membership value assignments methods: intuition, inference, rank ordering, Fuzzy Rule based systems: linguistic hedges , rulebased systems, graphical technique of inference. **Defu□ification:** Lambda-cuts for Fuzzy sets and Fuzzy relations, Defuzzification methods. (10)

Unit-6 Fu□y pattern Recognition: feature analysis, partitioning of feature space, single sample identification, multifeature pattern recognition. **Simple Fu□y logic controller (FLC):** Assumptions in a Fuzzy control system design, simple FLC, general FLCs, simple examples. (08) [**Total 51□**

Text Boo□s: 1. J.M. Zurada, “Introduction to Artificial Neural Systems”, Jaico Publishing House.
2. Timothy Ross, “Fuzzy Logic with Engineering Applications”, McGraw Hill International Edition.

References:
1. Meherotra Kishan, Mohan C.K., Ranka Sanjay, “Elements of artificial neural networks”, Penram Int. Pub., Mumbai.
2. G. J. Klir and Bo Yoan, "Fuzzy Sets and Fuzzy Logic: Theory and Applications", PHI publications.

7ET5 Prof. Elect. – I (v) SPEEC□ PROCESSING

Course Requisite :
1. (4ET1) Signals & Systems.
2. (6ET4) Digital Signal Processing.

Course Objectives: 1. To be able to relate human physiology and anatomy with signal processing paradigms.
2. To acquire the knowledge of speech generation and speech recognition models.
3. To understand methods/techniques used in speech signal estimation & detection.

Course Outcomes: After successfully completing the course students will be able to:

1. Illustrate how the speech production is modeled.
2. Summarize the techniques involved in collecting the features from the speech signal in time and frequency domain.
3. Compare the techniques involved in speech and speaker detection.
4. Summarize the various speech coding techniques.
5. Apply techniques/methods used for speech enhancement and speech recognition.

Unit-1 Speech Production and Acoustic Phonetics: The process of speech production, Acoustic theory of speech production, Digital models of speech signals of speech signal, Articulator phonetics, Acoustic Phonetics, Co-articulation, Prosody. (08)

Unit-2 Speech Analysis: Time and frequency domain analysis of speech, Linear predictive coding (LPC) analysis, Cepstral analysis, Speech parameter (pitch) estimation. (09)

Unit-3 Speech Synthesis: Principles of speech synthesis, Articulatory synthesis, Formant synthesis and LPC synthesis. (09)

Unit-4 Coding of Speech Signals: Introduction, Quantization, Speech redundancies, Time domain waveform coding, Linear predictive coding, Linear delta modulation, Adaptive delta modulation, Adaptive differential pulse code modulation, Filter bank analysis, Phase vocoders and Channel vocoders. (10)

Unit-5 Speech Enhancement: Introduction, Nature of interfering sounds, speech enhancement techniques, spectral subtraction and filtering, harmonic filtering, Spectral subtraction, Adaptive noise cancellation (09)

Unit-6 Speech Recognition: Introduction, Baye's rule, Segmental feature extraction, MFCC, DTW, HMM approaches for speech recognition. (07) [**Total 52**

Text Books:
1. "Speech Communications: Human & Machine", Douglas O'Shaughnessy, Universities Press.
2. "Digital Processing of Speech Signals", Rabiner and Schafer, Prentice Hall, 1978.

References:
1. "Discrete-Time Speech Signal Processing: Principles and Practice", Thomas F. Quatieri, Publisher: Prentice Hall.
2. "Speech and Audio Signal Processing: Processing and Perception of Speech and Music", Nelson Morgan and Ben Gold, John Wiley & Sons.
3. "Speech Analysis Synthesis and Perception", J. L. Flanagan, Second edition, Springer-Verlag (1972).
4. "Speech and Audio Signal Processing", Gold & Morgan, 1999, Wiley and Sons.

7ET5 Prof. Elect. – I (vi) RF MODELING & ANTENNA

Course Requisite : 1. (3ET5) Electromagnetic fields.
2. (8ET1) UHF & Microwave.

Course Objectives:
1. To impart the knowledge in modeling of RF system design.
2. To acquire knowledge of fundamental principles and techniques of antenna theory.
3. To study characteristics of different antenna types.

Course Outcomes: After successful completion of the course the student will be able to:
1. Acquire the concepts of active and passive components in RF domain.
2. Understand design of RF Filters.
3. Analyze the radiation mechanisms of commonly used antennas.
4. Demonstrate knowledge of antennas commonly used in Communication Engineering.
5. Discriminate antennas on the basis of their electrical characteristics.

Unit-1 Behavior of Active and Passive Components in RF range: Frequency Spectrum, hazards of Electromagnetic Radiations, and fundamentals of radio frequency design, High Frequency behavior, equivalent circuit and frequency response of resistor, capacitor, inductor, diode, BJT, and FET, Characteristics, structure and applications of coaxial line, stripline, microstrip line, and coplanar lines. (09)

Unit-2 Filter Design: Analysis of infinite periodic structures terminated Periodic structures, k-β diagrams and wave velocities, Image Parameter Method: Image impedances and transfer functions for two port networks, constant-k filter sections, m-derived filter sections, and composite filters, Insertion Loss Method: Characterization by power loss ratio, maximally flat, equal ripple, and linear phase low pass filter prototype, Filter transformations: impedances, frequency scaling, and band pass and band stop, Richard's transformation, Kuroda's identity, impedance, and admittance inverters. (09)

Unit-3 Fundamentals of Antenna: Conceptual understanding and radiation mechanism, Fundamental Parameters of Antennas: Radiation pattern, radiation power density, radiation intensity , beam width, directivity, antenna efficiency, gain, beam efficiency, bandwidth, input impedance, antenna radiation efficiency, antenna vector effective length and equivalent areas, maximum directivity and maximum effective areas, Friss transmission equation, antenna temperature, Vector potential A for an electric current source J, vector potential F for an magnetic current source M, electric and magnetic fields for electric J and Magnetic M current sources and concept of near and far field radiation. (10)

Unit-4 Wire Antennas: Infinitesimal dipole and small dipole: Radiation field, near field, far field directivity, region separation, Finite Length dipole: Basic parameters of half wavelength dipole, folded dipole, Monopole antenna, Ground Effects, Linear elements near or on infinite perfect conductors, Loop antennas: Basic parameters. (08)

Unit-5 Antenna Arrays: Linear arrays, planner arrays, and circular arrays, Array of two isotropic point sources, non-isotropic sources, Principle of pattern multiplication, Linear arrays of n elements, broadside, radiation pattern, directivity, beam width and null directions, array factor, Antenna analysis using Binomial, Dolph-Tschebyscheff, Yagi Uda antenna. (08)

Unit-6 Special types of antennas: Frequency Independent Antennas: Log periodic and helical antennas Microstrip Antennas: Characteristics, applications and limitations, Reflector Antennas and Horn Antennas: Characteristics, applications and limitations. (08) [**Total 52**

Text Boos:

1. Costantine A. Balanis, "Antenna Theory Analysis And Design", John Wiley Publication.
2. John D. Kraus, " Antennas", Tata McGraw Hill publication.
3. David M Pozar, "Microwave Engineering", John Wieley and Sons, Inc. Hobokenh, New Jersey, 4th Edn, 2012.

References:
1. Annapurna Das and Sisir K Das, "Microwave Engineering", Tata McGraw Hill,New Delhi, 2nd Edition, 2009.
2. Reinhold Ludwig and Pavel Bretchko, "RF Circuit Design", Pearson Education Asia.

Subject (Pr) : 7ETp6 VLSI DESIGN - LAB

Course Requisite : 1. (7ET1) VLSI Design.

Course Objectives:

1. To design digital VLSI circuits using computer aided simulation and synthesis tools.
2. To verify various design parameters of digital VLSI circuits using appropriate ASIC design tool.
3. To develop Verilog code for various combinational and sequential digital circuits and implement on programmable chips (FPGA/CPLD) using Verilog HDL.

Course Outcomes: At the end of the course the student will be able to:

1. Understand Front & Back end design aspects of simple VLSI Digital circuits.
2. Model digital circuits with Verilog HDL, simulate, synthesize and prototype in PLDs.

Section A - VLSI Bac End Design programs :

The experiments in this section are to be designed and implemented using Cadence / Mentor Graphics / Synopsys / Microwind CAD tools.

LIST OF E PERIMENTS :

Expt-1 : Layout, physical verification, placement & route for design, static timing analysis, Parametric analysis of CMOS Inverter on silicon using appropriate ASIC design tool.
Expt -2 : Layout, physical verification, placement & route for design, static timing analysis, Parametric analysis of two input NAND and NOR logic gates on silicon using appropriate ASIC design tool.
Expt -3 : Layout, physical verification, placement & route for design, static timing analysis, Parametric analysis of D-flip-flop with reset on silicon using appropriate ASIC design tool.
Expt -4 : Layout, physical verification, placement & route for design, static timing analysis, Parametric analysis of 4-bit shift register with enable on silicon using appropriate ASIC design tool.

Section B - VLSI Front End Design programs :
The experiments in this section are to be designed and implemented using Cadence / Mentor Graphics / Synopsys / CAD tools with Verilog HDL code entry.
Expt-5 : To write Verilog code for 2-to-4 decoder and simulate with test bench, synthesis, implement on PLD.
Expt -6 : To write Verilog code for 8-to-1 Multiplexer and simulate with test bench, synthesis, implement on PLD.
Expt -7 : To write Verilog code for D flip-flop with reset and simulate with test bench, synthesis, implement on PLD.
Expt - : To write Verilog code for BCD counter along with seven segment decoder to display count on seven segment display and simulate with test bench, synthesis, implement on PLD. The clock input to counter should be connected to suitable push button key on CPLD/FPGA kit.
Expt -9 : To write Verilog code for any suitable sequence detector and simulate with test bench, synthesis, implement on PLD.

[* Minimum 08 experiments based on/relevant to the above list.]

Subject (Pr): 7ETp7- S□ILL DEVELOPMENT LAB -V (Signal and Image Processing)

Course Requisite:
1. (4ET1) Signals and Systems
2. (5ETp9) Skill Development Lab-III (Simulation)
3. (6ET3) Digital Communication
4. (6ET4) Digital Signal Processing
5. (7ET2) Digital Image Processing

Course Objectives: To understand and gain complete knowledge about:

1. Design and implementation of signal processing in communication systems.
2. Simulation and performance evaluation of digital communication systems.
3. Design and implementation of algorithms to perform basic image processing operations.
4. Performance evaluation of image processing algorithms and systems.

Course Outcomes:
After successful completion of the course, students will be able to :

1. Apply signal processing algorithm in various communication systems.
2. Identify the sustainability of communication system.
3. Evaluate the methodologies for image pre-processing and post processing.
4. Apply image processing algorithms in practical applications.

Subject: S□ILL DEVELOPMENT LAB-V (Signal and Image Processing) L

Unit-1 Signal Processing in Communication Systems using MATLAB/SCILAB: Monte Carlo simulation of a binary communication system. Multiamplitude signal transmission. Communication system design for band limited channel: Signal design for zero and controlled ISI. Linear equalizers, adaptive linear equalizers. Probability of error for Quadrature Amplitude Modulation in an AWGN Channel. Channel Coding: linear block codes. (8)

Unit-2 Image Preprocessing using MATLAB/SCILAB: Working with images, Image types, Image importing and exporting, displaying images, finding image characteristics, converting image formats, Applying image enhancement techniques, Adjusting image intensity, Enhancing images using arithmetic operations, Rotating images, Cropping and resizing images, Block processing, Image convolution and correlation, Spatial domain filtering, Frequency domain filtering. (8)

Unit-3 Feature Extraction and Segmentation using MATLAB/SCILAB: Transforms, Reducing noise, Deblurring images, Correcting background illumination, Image thresholding, Edge detection, Watershed segmentation, Morphological operations, Performance evaluation and ROC analysis. (8) [**Total 24□**

Text Boo□s:
1. John G.Proakis and Masoud Salehi, “Contemporary Communication System using MATLAB” Northeastern Univ., Vikas publication house.
2. Gonzalez and Woods, “Digital Image Processing Using MATLAB, McGraw Hill , II Edition.
3. William Pratt, “Digital Image Processing”, III Edition, John Wiley & Sons Publication.

E□PERIMENT LIST:
Expt-1 Use Monte Carlo simulation to estimate and plot probability of error versus signal to noise ratio for a binary communication system that employs correlators or match filters.

Expt-2 Simulate the theoretical expression for probability of error for the optimum detector in M-level PAM system and plot the probability of error versus signal to noise ratio for M=2, 4,8,16.

Expt-3 Design a digital implementation of the transmitter and receiver filter GT(*f*) and GR(*f*) such that their product is equal to the spectrum of duobinary pulse and GR(*f*) is the matched filter to GT(*f*).

Expt-4 : Simulate an adaptive equalizer based on the LMS algorithm.

Expt-5 : Perform Monte Carlo simulation of 16-QAM communication system using a rectangular signal constellation.

Expt-6 : Simulate the program segment for generator matrix for a (10,4) linear block code and determine all code words and minimum weight of the code.

Expt-7 : To develop a code for resizing and rotating an image.

Expt-□: To develop a code for enhancing the input image using different enhancement techniques.

Expt-9 : To develop a code for Histogram equalization.

Expt-10 : Implement low pass, high pass filtering over input image in spatial domain.

Expt-11 : Implement low pass, high pass filtering over input image in frequency domain.

Expt-12 : Implement salt and pepper noise removal using a simple median filter

Expt-13 : To develop a code for calculating DFT and DCT images.

Expt-14 : To implement global and local thresholding for segmentation of image

Expt-15 : To develop a code for edge detection using derivative filter mask with Prewitt, Sobel and Laplacian operators.

Expt-16 : To demonstrate image morphology using boundary extraction and interior filling.

Expt-17 To develop a code for detection of brain tumor using Watershed segmentation. * Minimum 12 experiments based on/relevant to the above list.

SEMESTER VIII

Subject (Th): □ET1- U□F & MICROWAVES

Course Requisite: 1. (3ET5) Electromagnetic fields.

Course Objectives: To learn :

1. Basic concepts of Microwave active and passive devices.
2. Transmission characteristic of microwave through waveguide and microstrip line.
3. Measurement of microwave parameters.

Course Outcomes: At the end of the course students will be able to:

1. Understand operations of microwave active and passive devices.
2. Describe characteristics of microwave propagation through transmission line.
3. Use S-parameters for characterization of microwave devices.
4. Measure various parameters of microwave system.

Unit-1 Microwave Tubes: Introduction to microwave Engg. and applications, advantages, frequency bands, Limitation of Conventional devices at high frequency, Microwave Tubes: Two cavity, Multicavity klystron, and reflex klystron, Cylindrical Cavity Magnetron, TWT. (08)

Unit-2 Semiconductor Microwave Devices: Gunn diode: RWH theory, Gunn domain, modes of Gunn oscillation, Negative resistance amplifier (principle), Parametric amplifiers: operation & types, Principle of operation of IMPATT, TRAPATT diodes, & MASER. (08)

Unit-3 Waveguide system and Microstrip lines: Concept of Transmission line, reflection and transmission coefficient, VSWR. **Waveguides:** Rectangular Wave guide, Circular Waveguide, Power losses and power handling capacity of rectangular waveguide , Attenuation in wave guides, Introduction to microstrip lines and its types, characteristic impedance, losses in microstrip lines. (10)

Unit-4 Microwave Resonator: Series and parallel resonant circuits (RLC), transmission line resonators (λ/2, (λ/4) open-short circuited line, Cavity resonators: rectangular and circular cavities, resonant frequency, and quality factor of resonators, Fabry-Perot resonator. (08)

Unit-5 Microwave passive components & Scattering matrix: Microwave passive components, terminator, Attenuator, phase shifter, Scattering matrix formulation, Two hole directional coupler, E-plane tee, H-plane tee, Magic tee and its scattering matrix,. Microwave propagation in ferrites, devices employing Faraday rotation: Isolator, Gyrator & Circulator. (08)

Unit-6 Microwave Measurements: Frequency Measurements, Power Measurements, Attenuation Measurements, VSWR Measurements, Impedance Measurements, insertion Loss Measurements, Dielectric constant Measurements. (08) [**Total 50**□

Text Boo□s:

1. Liao, Samuel Y., “Microwave Devices & Circuits”, Tata Mc-Graw Hill Co. Ltd., New Delhi.
2. David M Pozar, “Microwave Engineering” Wiely 3 rd Edition.
3. Collin, Robert E., “Foundations for Microwave Engineering”, Mc- Graw Hill, New York.

References:

1. Kennedy G., “Electronics Communication Systems”, Tata Mc-Graw Hill Book Co.,New Delhi..
2. K.C. Gupta, “Microwave Engineering”, New Age.
3. Reich, Scolnik, Ordung, Krangs, “Microwave Principles”, PHI.
4. M.L. Sisodiya and G.S. Raghuwanshi, “Microwave Circuits and Passive devices”, John Wiley & Sons Ltd.
5. Mathew M. Radmanesh, “RF and Microwave Electronics – Illustrated”, Prentice Hall.

Subject (Th): ET2 WIRELESS COMMUNICATION

Course Requisite:
1. (4ET5) Communication Engineering-I.
2. (6ET3) Digital Communication.
3. (7ET2) Data Communication Network.

Course Objectives:
1. To understand basics of Cellular System.
2. To study the design fundamentals of cellular radio system, capacity & Coverage improvement techniques.
3. To understand mobile radio propagation mechanism and fading.
4. To understand operation of various 2nd and 3rd generation cellular systems; GSM, IS95, CDMA2000, WCDMA and LTE.
5. To study various wireless data communication networks; WiMAX, WLAN and Bluetooth.

Course Outcomes: Upon successful completion of this course, the student will be able to:

1. Illustrate the evolution of cellular mobile system and understand cellular concepts.
2. Use design fundamentals of cellular radio system.
3. Understand propagation mechanism and fading in mobile radio system.
4. Demonstrate concepts of various 2nd and 3rd generation cellular systems and wireless data communication networks.

Unit-1 Cellular Fundamentals: Evolution of Mobile Systems (1G, 2G, 3G, 4G), Cellular Concept, Cell Fundamentals, Cellular Telephone System, Timing Diagram of Call Processing in Cellular System, Channel Allocation Techniques, Hand off Strategies, Types of Hand off. [T1,T2,R1] (08)

Unit-2 Cellular Radio System Design Fundamentals: Frequency Reuse, Co-channel Reuse Ratio, Co-channel Interference and System Capacity, Adjacent Channel Interference, Improving Coverage and Capacity in Cellular System: Cell Splitting, Sectoring, Repeater for Range Extension, Microcell Zone. [T1,T2, R1] (08)

Unit-3 Mobile Radio Propagation Mechanism: Basic Propagation Mechanism: Reflection, Diffraction and Scattering. Small Scale Fading and Multipath: Factors Influencing Small Scale Fading. Parameters of Mobile Multipath Channel. Types of Small Scale Fading: Fading Effect Due to Multipath Time Delay Spread, Fading Effect Due to Doppler Spread. [T1] (08)

Unit-4 GSM System: GSM Network Architecture, GSM Signaling Protocol Architecture, GSM Channels, Frame Structure, Speech Coding, Authentication and Security, GSM Call Procedures, GSM Hand Off Procedures. [T3,T1] (08)

Unit-5 CDMA Digital Cellular Standard (IS-95): Architecture of CDMA System, CDMA Air Interface, IS-95 Forward Channel, IS-95 Reverse Channel, CDMA Call Processing, Power control in CDMA System, Hand Of in CDMA. Comparison of CDMA and GSM. **WCDMA UMTS:** WCDMA Air Interface, Attributes of WCDMA System, Forward WCDMA Channel, Reverse WCDMA Channel. **CDMA2000:** Forward and Reverse Channel, Hand Off and Power Control. [T3,T1] (08)

Unit-6 3GPP Long-Term Evolution: Frequency Bands and Spectrum Flexibility, Network Structure, Protocol Structure, PHY and MAC Layer Overview. [T4]
Wireless Local Area Networ: Wi-Fi, Advantages and Disadvantages, WLAN Topology, IEEE 802.11 standard. [R1,R2]
Bluetooth: Overall Architecture, Protocol Stack, Physical Connection, MAC Mechanism, Frame Formats. [T2,R1] (08) **Total 4**

Text Boos:
1. Theodore S. Rappaport, “Wireless Communications: Principles &Practice”, Second edn., Pearson Edn. (2002).
2. K. Pahlavan and P. Krishnamurthy, “Principles of Wireless Networks”, Pearson Educn. Asia Publication (2002).
3. T. L. Singal, “Wireless Communication”. McGraw Hill Education.
4. A. F. Molisch, “Wireless Communications”, Second Edition, Wiley Publication.

References:
1. G. S. Rao, “Mobile Cellular Communication”, Pearson Education.
2. Upena Dalal, “Wireless communication”, Oxford University Press.
3. William CY Lee, “Mobile Cellular Telecommunications”, (second edition) McGraw Hill Inc.

ET3 DATA COMMUNICATION NETWOR

Course Requisite:
1. (5ET4) Communication Engg.-II.
2. (6ET3) Digital Communication.

Course Objectives:
1. To understand the general principles of network design and compare the different network topologies.
2. To understand the general principles of switching and various routing algorithms.
3. To acquire the knowledge of functions and protocols of OSI and TCP/IP models.
4. To understand security issues in data network.

Course Outcomes: After successfully completion of this course, students should be able to:

1. Identify different types of network devices and their functions within a network.
2. Describe different types of network topologies and protocols.
3. Differentiate the layers of the OSI and TCP/IP model.
4. Understand various types of routing algorithms and concepts of IP addresses.
5. Deal with security issues in data network.

Unit-1 Data Communication Networ: A brief history of Internet, Protocols and Standards, Standard Organizations, Need for Protocol Architecture, OSI Reference Model, Overview of TCP/IP architecture, Addresses in TCP/IP.
Types of Networ: LAN, MAN, WAN. **Networ connecting Devices:** Hubs, Repeater, Bridges, Switches, Routers, Gateways. **Networ Topology:** Mesh, Bus, Tree, Ring, Star. [T1, T3] (08)

Unit-2 Data Lin Control Protocols: Need for Flow control, Stop and Wait Flow Control, Sliding Window Flow Control, Stop and wait ARQ, Go-Back-N ARQ, Selective Repeat ARQ, Transmission efficiency of ARQ protocols. **Multiple Access Control Protocols:** Random Access Techniques: ALOHA, Slotted ALOHA. Contention Techniques: CSMA, CSMA/ CD (IEEE 802.3), CSMA/CA. Controlled Access Techniques: Polling, Token Passing. **Medium Access Control Protocols:** Token Bus (IEEE 802.4), Token Ring (IEEE802.5). [T1,T2] (08)

Unit-3 Networ Layer Logical Addressing: Network layer Issues, IPV4 addresses, Class full addressing, Classless addressing (Problems expected), IPv4: Datagram, Fragmentation, Checksum, Address Resolution Protocol(ARP), IPv6 addresses, IPv6 Packet format, Comparison between IPv4 and IPv6**.**
Networ Layer Routing: Alternate routing in circuit switched network, Fixed Routing, Flooding, and Random Routing in Packet Switched networks T1] (08)

Unit-4. **Routing Algorithms and Transport layer:** Dijkstra's Algorithm (Problems expected), Bellman Ford Algorithm (Problems expected). **Traffic Control:** Leaky bucket algorithm, Token bucket algorithm. **Transport Layer:** User datagram protocol (UDP), Transmission control protocol (TCP). [T1,T3] (08)

Unit-5 Application Layer: Name Space, Domain Name System (DNS), Distribution of Name Space, DNS in the Internet, Resolution. Remote Login**:** TELNET, Electronic Mail: SMTP, POP, FTP, World Wide Web, HTTP. T1] (08)

Unit-6 Networ Security: Security services, Message confidentiality, Message integrity, Message authentication, Digital Signature, Entity Authentication, Key Management. T1] (08) [**Total 4**

Text Boos:
1. B. Forouzan, "Data Communications and Networking", 4th Edition, McGraw-Hill.
2. Andrew S. Tanenbaum and David J. Wetherall, "Computer Networks", 5th Edition, Pearson Educn., Inc.
3. William Stallings, "Data and Computer Communication", 8th Edition, Pearson Education, Inc.

Reference Boos:
1. James F. Kuross, Keith W. Ross, "Computer Networking A Top-Down Approach Featuring the Internet", Third Edition, Addison Wesley, 2004.
2. Nader F. Mir, "Computer and Communication Networks", Pearson Education,2007.
3. Comer, "Computer Networks and Internets with Internet Applications", Fourth Edition, Pearson Education, 2003.

Subject (Th): ET4 Prof. Elect. II (i) EMBEDDED SYSTEM AND RTOS

Course Requisite :
1. (4ET4) Digital Electronics.
2. 2. (5ET3) Microprocessor and Microcontroller.

Course Objectives:
1. To acquaint students with knowledge of embedded processor, its hardware and software.
2. To provide skills in embedded C programming.
3. To understand real time operating systems, inter-task communication and embedded software development tools.
4. To learn concurrent system on a real-time operating system.

Course Outcomes: After completion of the course the students will be able to:

1. Distinguish real-time embedded systems from other systems.
2. Describe fundamentals of embedded based firmware design.
3. Evaluate the need for real-time operating system.
4. Develop real-time algorithm for task scheduling.
5. Summarize technique used for product enclosure design and development.
6. Specify, design and implement a small embedded system.

Unit-1 Introduction to Embedded Systems: Definition of Embedded System, Comparison between Embedded Systems and General Computing Systems, History of Embedded Systems, Classification of Embedded Systems, Purpose of Embedded System. **Building Blocks of Embedded System:** Core of the Embedded System, Memory, Sensors and Actuators, Communication Interface, Embedded firmware, PCB and Passive Components. Characteristic and Quality Attributes of Embedded Systems. (09)

Unit-2 Hardware Software Co-Design and Program Modules: Fundamental issues in hardware software Co-Design, Computational models in Embedded Design, Introduction to UML, Hardware Software trade-Off. **Embedded Hardware Design and Development**: Analog and Digital Electronic components, VLSI and Integrated Circuit Design EDA tools. (08)

Unit-3 Embedded Firmware Design and Development: Embedded firmware design approaches, Embedded Firmware Development languages, Programming in Embedded C. (09)

Unit-4 RTOS based Embedded System Design: Operating System basic, Types of Operating Systems, Task, Process and Threads, Multiprocessing and Multitasking, Task Scheduling, Threads, Processes and Scheduling, Task communication and Synchronization, Device Driver, How to Choose an RTOS. (10)

Unit-5 Integration and Testing of Embedded Hardware and Firmware: Integration of Hardware and Firmware. **Product Enclosure Design and Development:** Product Enclosure Design tools, Product Enclosure Development techniques. (09)

Unit-6 Embedded Product Development Life Cycle: Objectives, Phases of EDLC, Modeling of EDLC, **Design Case Studies:** Digital Camera, Battery Operated Smart Card Reader. (07) [**Total 52**

Text Books:
1. Shibu. K. V, "Introduction to Embedded Systems", Tata Mcgraw Hill, 2009.
2. Frank Vahid, "Embedded System Design Unified Hardware and Software".

References:
1. Steve Heath, "Embedded System Design", Elsevier, 2005.
2. David E. Simon, "An Embedded Software Primer", Pearson Education, 2003.

ET4 Prof. Elect. II (ii) AUTOMOTIVE ELECTRONICS

Course Requisite:
1. (3ET4) Instrumentation and Sensors.
2. (5ET3) Microprocessor & Microcontroller.
3. (7ET2) Data Communication Network.

Course Objectives:
1. To gain the fundamental knowledge of electrical and electronics components used for vehicle operations.
2. To study applications of sensors and actuators used in vehicle systems.
3. To understand use of microprocessors/microcontrollers in vehicle control systems.
4. To study various communication protocols used in automotive electronics.
5. To study fundamentals of diagnostics procedures of electronic systems in automobiles.
6. To gain information on modern safety system for vehicles.

Course Outcomes: After completion of the course students will be able to:

1. Demonstrate the knowledge of automotive systems for vehicles.
2. Illustrate the use of sensors and actuators in vehicles.
3. Identify the use of microcontrollers/microprocessor for automotive applications.
4. Summarize communication protocols used in automotive electronics.
5. Use diagnostic procedures and sequence for fault finding to give corrective measures.
6. Demonstrate the knowledge of system safety in automobiles.

Unit-1 Automotive Systems: Introduction to modern automotive systems and need for electronics in automobiles and application areas of electronic systems in modern automobiles, Ignition systems, Fuel delivery systems, Engine control functions, Fuel control, Automotive Transmission fundamentals, Vehicle braking fundamentals, Steering Control and Steering system basics, Fundamentals of electronically controlled power steering & its types. (09)

Unit-2 Automotive Sensors and Actuators: Sensors: characteristics, response, error, Redundancy of sensors in ECUs, Examples of sensors for: Accelerometers, wheel speed, brake pressure, Vehicle speed, Throttle position, Temperature, Mass air flow (MAF), Airbag system, and lambda sensor. Actuators: Solenoids, motors, and piezoelectric force generators, Relays, Automatic transmission control system. (08)

Unit-3 Microcontrollers Microprocessors in Automotive domain & ECU Design Cycle: Introduction to Microcontrollers/Microprocessors in Automotive Domain, Criteria to choose the right microcontroller/processor for various automotive applications, ECU Design Cycle: V-Model development cycle, Components of ECU, Examples of ECU on Chassis, Infotainment, Body Electronics. (09)

Unit-4 Automotive Communication protocols, Infotainment systems: Overview of Automotive communication protocols: CAN, LIN, Flex Ray, MOST Ethernet, Communication interface with ECUs and with infotainment gadgets, Infotainment Systems: Application of Telematics in Automotive domain, GPS, GPRS. (09)

Unit-5 Diagnostics Fundamentals, Basic wiring system and multiplex wiring system, Preliminary checks and adjustments, Self-diagnostic system. Fault finding and corrective measures, Diagnostic procedures and sequence, On board and off board diagnostics in Automobiles, OBDII. (08)

Unit-6 Safety Systems in Automobiles: Active Safety Systems: ABS, TCS, ESP, Brake assist etc. Passive Safety Systems: Airbag, Advanced Driver Assistance (ADAS), Examples of assistance applications: Lane Departure Warning, Collision Warning, Automatic, Cruise Control, Pedestrian Protection, headlight Control. (09) [**Total 52**

Text Boo s:

1. Tom Denton, "Automobile Electrical and Electronics Systems", 3rd Edition, Elsevier, 2004.
2.Allan Bonnick, "Automotive Computer Controlled Systems Diagnostic Tools and Techniques", Elsevier Science, 2001.
3. Tom Denton, "Advanced Automotive Fault Diagnosis", 2nd Edition, Elsevier, 2006.

References:

1. A K Babu, "Automotive Electrical and Electronics", Khanna publication, 2001.
2. Iqbal Husain, "Electric and Hybrid Vehicles: Design fundamentals", CRC Press, 2003.
3. Ronald K Jurgen, "Automotive Electronics Handbook", 2nd Edition, McGraw-Hill, 1999.
4. Terence Rybak, Mark Stefika, "Automotive Electromagnetic Compatibility (EMC)", Springer 2004.

ET4 Prof. Elect. II (iii) WIRELESS SENSOR NETWOR

Course Requisite: 1. (8ET2) Wireless Communication
2. (7ET2) Data Communication Network

Course Objectives:

1. To study architecture and environment for wireless sensor network.
2. To understand the mutual relationships and dependencies between different protocols and architectural decisions by offering an in-depth investigation of relevant protocol mechanisms.
3. To study principle and architecture of existing Middleware for sensor networks.
4. To understand the design issues and requirements of network management.
5. To review various sensor network platforms, operating systems for wireless sensor network.

Course Outcome: By the end of this course, the students shall be able to:

1. Understand wireless sensor technology and its architecture.
2. Identify and review various sensor network protocols.
3. To understand various types of Middleware used in WSN.
4. Understand the network management design issues and differentiate various operating systems used in wireless sensor network.

Unit-1 Introduction and overview of Wireless Sensor Networks, Commercial and Scientific applications of Wireless Sensor Networks, Basic Wireless Sensor Technology, Sensor Taxonomy, Wireless Network environment, Wireless Network trends (08)

Unit-2 Radio technology primer, Available wireless technologies, Wireless Sensors Networks Protocols, Physical Layer, Fundamentals of Medium Access Control Protocols for Wireless Sensor Networks, MAC protocols for WSN, Case Study, IEEE 802.15 4LR WPAN, Standard case study. (08)

Unit-3 Sensors Network Protocols, Data dissemination and gathering, Routing challenges and design issues in wireless sensor, Routing strategies in WSN. (08)

Unit-4 Protocols: Transport control protocols for wireless sensors Networks, Traditional transport control protocol, transport protocol design issues, examples of existing transport control protocol, performance of TCP. (08)

Unit-5 Middleware for Sensors Networks, WSN middleware principles, Middleware architecture, existing middleware. Network Management for wireless sensor Networks, Requirements, Design issues, Examples of management Architecture (08)

Unit-6 Operating Systems for WSN: Operating System Design Issues, Examples of Operating Systems, TinyOS, Mate, MagnetOS, MANTIS, OSPM, EYES OS, SenOS, EMERALDS, PicOS. Performance and Traffic Management: Design issues, Performance Metrics and Modeling. (08) [**Total 4**

Text Boo□:
"Wireless sensor Networks: Technology, Protocols, and Application", Kazem Sohraby, Daniel Minoli, Taieb Znati, Wiley Interscience Publication.

Reference Boo□s :
1. "Wireless Sensor Networks" C.S. Raghavendra, Krishna M. Sivalingam, Taieb F. Znati, Springer Edition.
2. "Computer Network", Andrew Tanenbaum, 4th ed, Pearson Education.

Subject (Th): □ET4 Prof. Elect. II (iv) BIOMEDICAL ENGINEERING

Course Objectives:
1. Understanding role of engineers in medical field
2. Studying various electrical signals generated in human body.
3. To study various electrodes, recorders and problems for recording biomedical signals.
4. Study different medical imaging systems.
5. Introduction to patient care & safety
6. Introduction of various life saving instruments.

Course Outcome:
By the end of this course, the students shall be able to:
1. Understand the importance and association of engineering with medical field.
2. Understand the significance of various human signals and recording techniques.
3. Familiarize with various medical imaging systems, various life saving equipments.
4. Conceptualize patient care & safety requirements and its importance.

Unit-1 Introduction to Biomedical Engineering: Physiological system of heart, Man instrument system, Sources of bioelectric potentials, Different bioelectric signals like ECG, EMG and EEG, Bio potential Electrode theory, Basic electrode, Electrodes for EEG, ECG, EMG, Biochemical electrodes. Skin contact Theory: skin contact impedance measurement of skin contact impedance, motion artifacts, Nernst Equation. (09)

Unit-2 Biomedical Recorders and Measurement: Biomedical recorders for EEG, ECG, EMG, Measurement of Blood Pressure: Direct method, Indirect methods- The Rheographic method, Ultrasonic Doppler shift method, Square wave electromagnetic Blood flow meter, Measurement of Heart rate, Measurement of pulse rate. (09)

Unit-3 Medical Imaging System: Instrumentation for diagnostics X-rays, X- rays basics properties, X-ray machine, Special imaging techniques, Computerized Axial Tomography (CAT), Ultrasonic imaging system: Physics of Ultrasound, Biological effect of ultrasound. Ultrasonics: A-scan, M-scan, B-scan, Real-time ultrasonic imaging systems. (08)

Unit-4 Therapeutic Equipments: Need of Physiological and electrotherapy equipments. Cardiac pacemakers, Cardiac Defibrillators, Nerve and Muscle stimulators. Diathermy Machines: Short wave, Microwave, Ultrasonic. (08)

Unit-5 Patient Care and Monitoring and Safety : System concepts, Bedside patient monitors, central monitors, Intensive care monitoring. Biotelemetry: Single channel and Multichannel bio-telemetry, telephonic data transmission PATIENT SAFETY: Electric shock hazards, leakage current. Types of Leakage current, measurement of leakage current, methods of reducing leakage current, precautions to minimize electric shock hazards. (08)

Unit-6 □Anaesthesia Machines & Ventilators□: Anaesthesia Machines: Need for anaesthesia, Delivery of anaesthesia, anaesthesia machine & patient breathing circuit Ventilators: Mechanics of respiration, Artificial ventilation, Ventilators, Ventilator Terms, Microprocessor controlled Ventilators. (08) [**Total 50□**

Text Boo□s :
1. Khandpur R.S. "Handbook of Biomedical Instrumentation", Tata Mc-Graw Hill, New Delhi.
2. Cromwell L. & Wiebell. F. J., "Biomedical Instrumentation", PHI Publications.

Reference Boo□s :
1. Webstar J.G., "Medical Instrumentation", Third ed. John Wiely & Sons.
2. Carr & Brown, "Introduction to Biomedical Equipment Technology", Prentice Hall.

Subject (Th) : □ET4 Prof. Elect. II (v) DATA COMPRESSION & ENCRYPTION

Course Requisite: 1. (6ET3) Digital Communication.

Course Objectives:
1. To familiarize students with different data compression techniques for text, audio, image and video compression.
2. To equip students with fundamental knowledge of various data encryption and authentication techniques.

Course Outcomes: Upon successful completion of the course, the student will be able to:

1. Demonstrate the knowledge of lossy and lossless data compression techniques commonly used.
2. Develop the statistical basis and analyze performance metrics for lossy and lossless data compression.
3. Demonstrate use of various private and public key encryption techniques used in cryptosystems.
4. Identify need of digital signatures and authentication protocols.
5. Categorize various intruders and intrusion detection techniques.
6. Classify various viruses, related threats and countermeasures.

Unit-1 Text Compression: Shannon Fano Coding, Huffmann coding, Arithmetic coding and dictionary techniques-LZW, family algorithms, Entropy measures of performance and Quality measures. (08)

Unit-2 Audio Compression: Digital Audio, Lossy sound compression, μ-law and A-law companding, DPCM and ADPCM audio compression, MPEG audio standard, frequency domain coding, format of compressed data. (09)

Unit-3 Image And Video Compression: Lossless techniques of image compression, gray codes, Two dimensional image transforms, JPEG, JPEG 2000, Predictive Techniques PCM and DPCM. Video compression and MPEG industry standard. (09)

Unit-4 Conventional Encryption: Introduction, Types of attacks, Steganography, Data Encryption Standards, Block Cipher Principle, S-box design, triple DES with two three keys. (09)

Unit-5 Public ey Encryption and Number Theory: Euler's theorem, Chinese remainder theorem, Principle of public key cryptography, RSA algorithm, Diffie-Hellman Key Exchange. Elliptic curve cryptology, message authentication and Hash functions, Hash and Mac algorithms, Digital signatures. (09)

Unit-6 System Security & Case Studies: Intruders, Viruses, Worms, firewall design, antivirus techniques, digital Immune systems, Certificate based & Biometric authentication, Secure Electronic Payment System. (08) [**Total 52**

Text Boos:

1. "Data Compression", David Salomon, Springer Publication, 4th Edition.
2. "Introduction to Data Compression", Khalid Sayood, Morgan Kaufmann Series, 3rd Edition
3. "Cryptography and Network Security", William Stallings, Pearson Education Asia Publication.
4. "Cryptography and Network Security", Behrouz Forouzan, McGraw-Hill, 1st Edition.

References:

1. "The Data Compression Book", Mark Nelson, BPB publication, 2nd Edition.
2. "Applied Cryptography", Bruce Schnerer, John Willey & Sons Inc. Publication, 2nd Edition.
3. "Cryptography & Network Security", Atul Kahate, Tata McGraw Hill, 2nd Edition.
4. "Cryptography and Network Security", Behrouz A. Forouzan , Special Indian Addition, SIE.
5. "Network Security & Cryptography", Bernard Menezes, Cenage Learning.

Subject (Th): ET4 Prof. Elect. II (vi) ULTRA WIDE BAND COMMUNICATION

Course Requisite:

1. (6ET3) Digital Communication
2. (8ET2) Wireless Communication

Course Objectives:

1. To equip students with fundamental knowledge of UWB Technology.
2. To acquire knowledge of UWB signal propagation in wireless channel.
3. To focuses on the basic techniques that concerns the UWB communication systems and its existence with other communication system.

Course Outcomes:

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

1. Understand the advantages of wireless communication systems in ultra high frequency band.
2. Understand UWB signal propagation characteristics and the required signal processing at transmitter and receiver.
3. Understand the UWB channel modeling and analysis.
4. Identify UWB Communication Standards and its application.

Unit-1 UWB Definition, FCC Mask, Gaussian pulse and its higher derivatives, Hermite Pulses, Legandre Pulses. Modulation Schemes: Impulse Radio Scheme, Multi-Carrier Schemes. Data Modulation: Pulse Amplitude Modulation, On–Off Keying, Pulse Position Modulation. (08)

Unit-2 Rake Receive, Rake Receiver Types, Detection Techniques, Synchronization in UWB Systems. UWB Antennas, UWB Antenna Characteristics, Antenna Types. (08)

Unit-3 UWB wireless Channel: Impulse Response Modeling of UWB Wireless Channels, The IEEE UWB Channel Model, Frequency Modeling of UWB Channels, Comparison of Time and Frequency Models. (08)

Unit-4 UWB Communication Standards and Systems, UWB standardization in wireless personal area networks, DS-UWB proposal, MB-OFDM UWB proposal. (08)

Unit-5 Beam forming for UWB signals: radar UWB array systems, Wireless positioning and location: GPS techniques, Positioning techniques time resolution issues, UWB positioning and communications. (08)

Unit-6 UWB Interference, IEEE802-11.a Interference, Method of Signal to Interference Ratio Calculation, Interference of UWB to Existing OFDM System, Interference of UWB to Narrowband Systems, Interference to WiMAX, Interference Reduction. (08) [**Total 4□□**

Text Boo□s:

1. Ian Oppermann, Matti Hamalainen and Jari Iinatti, "UWB Theory & Applications", John Wiley & Sons Ltd, 2004.
2. Homayoun Nikookar and Ramjee Prasad, "Introduction to Ultra Wideband for Wireless Communications", Springer Book e-ISBN: 978-1-4020-6633-7.

References :

1. M. Ghavami, L. B. Michael and R. Kohno, "Ultra Wideband Signals and Systems in Communication Engineering", 2nd Edition, John Wiley & Sons, NY, USA, 2007.
2. Jeffrey H. Reed, "An Introduction to Ultra Wideband Communication Systems", Prentice Hall Inc., NJ, USA, 2005.

Subject (Pr): □ETp5 U□F & MICROWAVES – LAB

Course Requisite:

1. (3ET5) Electromagnetic fields.
2. (8ET1)UHF & Microwave

Course Objectives:
1. To study various microwave components and devices.
2. To understand transmission characteristics of microwave.
3. To understand measurement of various microwave parameters.
4. To study and analyze performance metric of microwave antenna.

Course Outcomes:

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

1. Identify various microwave components.
2. Demonstrate characteristics of microwave generated by various microwave sources and propagated through rectangular/circular waveguide.
3. Measure transmission parameters of microwave propagation through rectangular/circular waveguide.
4. Measure various parameters of microwave antenna.

E□PERIMENT LIST :

Expt-1 Study of Microwave components commonly used in Microwave systems.
Expt -2 Measurement of guide wavelength of microwave signal in a rectangular/circular waveguide.
Expt -3 To determine the characteristics of Reflex Klystron.
Expt -4 To find the characteristics of Gunn Diode Oscillator.
Expt -5 To measure directivity and coupling factor of directional coupler.
Expt -6 To determine the microwave power measurement of Reflex Klystron.
Expt -7 Measurement of gain of Horn antenna.
Expt -□To verify measurement of impedance of Horn antenna with that obtained using smith chart.
Expt-9 Measurement of VSWR using slotted line with open / short load conditions.
Expt-10 Measurement of insertion loss and isolation loss of circulator.
Expt-11 Measurement of dielectric constant of a given substrate.

(* Minimum 08 experiments based on/relevant to the above list.)

Subject (Pr): □ETp6 S□ILL DEVELOPMENT LAB-VI (Networ□ing)

Course Requisite: (8ET3) Data Communication Network

Course Objectives:
1. To make aware about the partitioning and formatting of Hard disk and installation of Operating System.
2. To analyze the performance of Networking devices.
3. To develop the ability to install and configure Wired and Wireless Routers.
4. To become familiar with the Networking topologies through simulation.
5. To experiment with the basic protocols of computer networks.

Course Outcomes: After successful completion of the course, the student will be able to:

1. Install, configure and operate various computer networks, networking devices and protocols.
2. Analyze the performance of computer networks using simulation softwares.

Practical Of Data Communication Networ□:

Unit-1 □ard Dis□ Drive installation and upgrading: Objectives of Disk Drive Partitioning; Preparing a Bootable CD; FDISK; Types of Partition; Partition Operations: Delete, Copy, Merge, Format, Resize and Move Partition; NTFS to FAT32 Converter; Installation of Operating System. **Ethernet Technologies:** Ethernet Cabling Types; Overview of Twisted-Pair Cabling; Categories of Ethernet. (08)

Unit-2 Setting Up a Router and Devices: Installing Hardware and Drivers; Interacting with External Devices through Device Stage; Preparing to Install and Configure a Router; Installing and Configuring a Wireless Router. **Creating the Wireless Networ□:** Configuring, Enabling or Disabling Network Adapters; Connecting to a Hidden Wireless Network; Setting Up an Ad Hoc Wireless Network between Computers; Exporting and Importing Wireless Network Settings; Setting the Network Location. **Pac□et Capture Software:** Installation of Wireshark; Interface overview; Sniffing and analysis of Packets. (08)

Unit-3 Sharing and Wor□ing with Devices: Sharing a Printer with Computers on Home Network; Sharing a Removable Disk Drive; Transferring Files via Bluetooth. **□eeping the Networ□ Secure:** Windows Defender; Windows Firewall; Protecting Your Computer from Viruses and Other Security Threats. **Pac□et Tracer:** Installation of Packet Tracer; Interface overview; Configuration of various networking devices; Creating a Simple Network Topology; Configuring Routing with Packet Tracer. (08) [**Total 24□(L** - No. of Lectures required)

Text Boo□s:
1. Todd Lammle, “CCNA Routing and Switching Study Guide”, John Wiley & Sons, Inc. 2013.
2. Jesin A., “Packet Tracer Network Simulator Simulate an unlimited number of devices on a network using Packet Tracer”, Packt Publishing Ltd. 2014.
3. Anish Nath, “Packet Analysis with Wireshark”, Packt Publishing Ltd. 2015.
4. Ciprian Adrian Rusen and 7 Tutorials, “Network Your Computers & Devices Step by Step”, Octal Publishing, Inc. 2010.

E□PERIMENT LIST :
Expt-1 Format and partition the hard disk of Personal Computer (PC). Check Network Interface Card and install network driver.
Expt-2 Study various Components of the Computer Network. Crimping practice with straight and cross CAT 5 cables and Create a simple LAN with two PCs using a single crossover cable. Check the network connection with the Ping command.
Expt-3 Create a simple LAN with multiple PCs using an Ethernet switch/hub and a straight-through cable to connect each PC. Check the network connection with the Ping command.
Expt-4 Installation and accessing Remote Computer desktop and share printer between PCs on local area network.
Expt-5 Map a logical Drive and use Universal Naming Convention (UNC) to share available resources.
Expt-6 Sharing File and Folder with various security levels between two PCs.
Expt-7 To telnet from one PC to another PC on Local area network and to remotely shutdown the other PC.
Expt-□Configuration of different networking devices using Packet tracer software. a) Hub b) Switches c) Bridges d) Router e) Gateway.
Expt-9 To configure various Network topology using Packet Tracer Software. a) Bus b) Ring c) Mesh d) Star
Expt-10 To configure Network using Dijkstra’s algorithm using Packet tracer software.
Expt-11 Dynamic Host Configuration Protocol (DHCP) Router Configuration.
Expt-12 To create scenario and study the performance of network with CSMA/CA protocol and compare with CSMA/CD protocols.
Expt-13 To install and configure wireless access points.
Expt-14 To install any one open source packet capture software like Wireshark and analyze traffic with it.

[* Minimum 12 experiments based on/relevant to the above list.]

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