1. PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):
   - To enable graduates to develop solutions to real world problems in the frontier areas of Applied Electronics.
   - To enable the graduates to adapt to the latest trends in technology through self-learning and to pursue research to meet out the demands in industries and Academia.
   - To enable the graduates to exhibit leadership skills and enhance their abilities through lifelong learning.
   - To become entrepreneurs to develop indigenous solutions.

2. PROGRAM OUTCOMES (POs)
   1. An ability to independently carry out research/investigation and development work to solve practical problems
   2. An ability to write and present a substantial technical report/document
   3. Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program
   4. To critically evaluate the design and provide optimal solutions to problem areas in advanced signal processing, Consumer and automotive systems, embedded systems and VLSI design.
   5. To enhance and develop electronic systems, protocols between circuits using modern engineering hardware and software tools.
   6. To acquire knowledge of fundamentals of power electronics, power management, wireless, power supply circuits, RF circuits and FPGA circuits
## M.E. Applied Electronics

### Regulations – 2021

#### Choice Based Credit System

#### I to IV Semesters Curricula and Syllabi

### Semester I

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**TOTAL NO. OF CREDITS:75**

### PROFESSIONAL ELECTIVES

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### AUDIT COURSES (AC)

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### SUMMARY

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MA4101  APPLIED MATHEMATICS FOR ELECTRONICS ENGINEERS  L T P C
3 1 0 4

COURSE OBJECTIVES:
- To introduce the fundamentals of fuzzy logic.
- To understand the basics of random variables with emphasis on the standard discrete and continuous distributions.
- To understand the basic probability concepts with respect to two dimensional random variables.
- To make students understand the notion of a Markov chain, and how simple ideas of conditional probability and matrices can be used to give a thorough and effective account of discrete – time Markov chains.
- To provide the required fundamental concepts in queueing models and apply these techniques in networks, image processing.

UNIT I   FUZZY LOGIC  12
Classical logic – Multivalued logics – Fuzzy propositions – Fuzzy qualifiers.

UNIT II   PROBABILITY AND RANDOM VARIABLES  12

UNIT III  TWO DIMENSIONAL RANDOM VARIABLES  12
Joint distributions – Marginal and conditional distributions – Functions of two dimensional random variables – Regression curve – Correlation.

UNIT IV   RANDOM PROCESSES  12

UNIT V    QUEUEING MODELS  12

COURSE OUTCOMES:
At the end of the course, students will be able to
- apply the concepts of fuzzy sets, fuzzy logic, fuzzy prepositions and fuzzy quantifiers and in relate.
- analyze the performance in terms of probabilities and distributions achieved by the determined solutions.
- use some of the commonly encountered two dimensional random variables and extend to multivariate analysis.
- classify various random processes and solve problems involving stochastic processes.
- use queueing models to solve practical problems.

TOTAL : 60 PERIODS
REFERENCES:

RM4151 RESEARCH METHODOLOGY AND IPR L T P C
2 0 0 2

UNIT I RESEARCH DESIGN
Overview of research process and design, Use of Secondary and exploratory data to answer the research question, Qualitative research, Observation studies, Experiments and Surveys.

UNIT II DATA COLLECTION AND SOURCES
Measurements, Measurement Scales, Questionnaires and Instruments, Sampling and methods. Data - Preparing, Exploring, examining and displaying.

UNIT III DATA ANALYSIS AND REPORTING
Overview of Multivariate analysis, Hypotheses testing and Measures of Association. Presenting Insights and findings using written reports and oral presentation.

UNIT IV INTELLECTUAL PROPERTY RIGHTS

UNIT V PATENTS

TOTAL:30 PERIODS

REFERENCES

AP4151 ADVANCED DIGITAL SIGNAL PROCESSING

L T P C
3 0 0 3

COURSE OBJECTIVES:
- To describe fundamental concepts of DSP and Discrete Transforms
- To design digital filters design
- To estimate power spectrum using non-parametric and parametric methods
- To analyze the Multirate Signal processing by decimation and interpolation.
- To apply the concept of multirate signal processing for various applications

UNIT I DIGITAL SIGNAL PROCESSING
Sampling of analog signals - Selection of sampling frequency - Frequency response - Transfer functions - Filter structures - Fast Fourier Transform (FFT) Algorithms - Image coding - DCT.

UNIT II DIGITAL FILTER DESIGN

UNIT III ESTIMATION OF POWER SPECTRUM

UNIT IV MULTI RATE SIGNAL PROCESSING
Decimation by a factor D - Interpolation by a factor I - Sampling rate conversion by a rational factor I/D, Multistage Implementation of Sampling Rate Conversion, Filter design and Implementation for sampling rate conversion. Up-sampling using All Pass Filter.

UNIT V APPLICATIONS OF MULTI RATE SIGNAL PROCESSING AND DSP INTEGRATED CIRCUITS

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon completion of the course, the students will be able to
CO1: Describe the basics of Digital Signal Processing and Discrete Time Transforms.
CO2. Design and implement FIR/IIR digital filters using various structures
CO3. Estimate power spectrum using appropriate parametric/non-parametric method.
CO4: Analyze discrete time system at different sampling frequencies using the concept of Multirate signal processing
CO5: Design discrete time system for the given application using Multi rate signal processing

REFERENCES:

AP4152 ADVANCED DIGITAL SYSTEM DESIGN L T P C
3 0 2 4

COURSE OBJECTIVES:
- To design asynchronous sequential circuits.
- To learn about hazards in asynchronous sequential circuits.
- To study the fault testing procedure for digital circuits.
- To understand the architecture of programmable devices.
- To design and implement digital circuits using programming tools.

UNIT I SEQUENTIAL CIRCUIT DESIGN
Analysis of Clocked Synchronous Sequential Circuits and Modelling- State Diagram, State Table, State Table Assignment and Reduction-Design of Synchronous Sequential Circuits Design of Iterative Circuits-ASM Chart and Realization using ASM.

UNIT II ASYNCHRONOUS SEQUENTIAL CIRCUIT DESIGN
Analysis of Asynchronous Sequential Circuit – Flow Table Reduction-Races-State Assignment-Transition Table and Problems in Transition Table- Design of Asynchronous Sequential Circuit - Static, Dynamic and Essential hazards – Mixed Operating Mode Asynchronous Circuits – Designing Vending Machine Controller.

UNIT III FAULT DIAGNOSIS AND TESTABILITY ALGORITHMS

UNIT IV SYNCHRONOUS DESIGN USING PROGRAMMABLE DEVICES

UNIT V SYSTEM DESIGN USING VERILOG
Hardware Modelling with Verilog HDL – Logic System, Data Types And Operators For Modelling

45 PERIODS

SUGGESTED ACTIVITIES:
1: Design asynchronous sequential circuits.
2: Design synchronous sequential circuits using PLA/PAL.
3: Simulation of digital circuits in FPGA.
4: Design digital systems with System Verilog.

PRACTICAL EXERCISES:
30 PERIODS
1. Design of Registers by Verilog HDL.
2. Design of Counters by Verilog HDL.
3. Design of Sequential Machines by Verilog HDL.
4. Design of Serial Adders, Multiplier and Divider by Verilog HDL.
5. Design of a simple Microprocessor by Verilog HDL.

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

CO1: Analyse and design synchronous sequential circuits.
CO2: Analyse hazards and design asynchronous sequential circuits.
CO3: Knowledge on the testing procedure for combinational circuit and PLA.
CO4: Able to design PLD and ROM.
CO5: Design and use programming tools for implementing digital circuits of industry standards.

TOTAL:75 PERIODS

REFERENCES
2. M.D.Ciletti , Modeling, Synthesis and Rapid Prototyping with the Verilog HDL, Prentice Hall, 1999

AP4153 SEMICONDUCTOR DEVICES AND MODELING

COURSE OBJECTIVES:
- To acquire the fundamental knowledge and to expose to the field of semiconductor theory and devices and their applications.
- To gain adequate understanding of semiconductor device modelling aspects, designing devices for electronic applications.
To acquire the fundamental knowledge of different semiconductor device modelling aspects.

UNIT I MOS CAPACITORS
Surface Potential: Accumulation, Depletion, and Inversion, Electrostatic Potential and Charge Distribution in Silicon, Capacitances in an MOS Structure, Polysilicon-Gate Work Function and Depletion Effects, MOS under Nonequilibrium and Gated Diodes, Charge in Silicon Dioxide and at the Silicon–Oxide Interface, Effect of Interface Traps and Oxide Charge on Device Characteristics, High-Field Effects, Impact Ionization and Avalanche Breakdown, Band-to-Band Tunneling, Tunneling into and through Silicon Dioxide, Injection of Hot Carriers from Silicon into Silicon Dioxide, High-Field Effects in Gated Diodes, Dielectric Breakdown.

UNIT II MOSFET DEVICES
Long-Channel MOSFETs, Drain-Current Model, MOSFET I–V Characteristics, Subthreshold Characteristics, Substrate Bias and Temperature Dependence of Threshold Voltage, MOSFET Channel Mobility, MOSFET Capacitances and Inversion-Layer Capacitance Effect, Short-Channel MOSFETs, Short-Channel Effect, Velocity Saturation and High-Field Transport Channel Length Modulation, Source–Drain Series Resistance, MOSFET Degradation and Breakdown at High Fields.

UNIT III CMOS DEVICE DESIGN

UNIT IV BIPOLAR DEVICES

UNIT V MATHEMATICAL TECHNIQUES FOR DEVICE SIMULATIONS
Poisson equation, continuity equation, drift-diffusion equation, Schroedinger equation, hydrodynamic equations, trap rate, finite difference solutions to these equations in 1D and 2D space, grid generation.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon completion of this course, the students will be able to
CO1: Explore the properties of MOS capacitors.
CO2: Analyze the various characteristics of MOSFET devices.
CO3: Describe the various CMOS design parameters and their impact on performance of the device.

CO4: Discuss the device level characteristics of BJT transistors.

CO5: Identify the suitable mathematical technique for simulation.

REFERENCES:

VL4152 DIGITAL CMOS VLSI DESIGN

COURSE OBJECTIVES:
- To introduce the transistor level design of all digital building blocks common to all cmos microprocessors, network processors, digital backend of all wireless systems etc.
- To introduce the principles and design methodology in terms of the dominant circuit choices, constraints and performance measures.
- To learn all important issues related to size, speed and power consumption.

UNIT I MOS TRANSISTOR PRINCIPLES AND CMOS INVERTER 12
MOSFET characteristic under static and dynamic conditions, MOSFET secondary effects, elmore constant, CMOS inverter-static characteristic, dynamic characteristic, power, energy, and energy delay parameters, stick diagram and layout diagrams.

UNIT II COMBINATIONAL LOGIC CIRCUITS 9
Static CMOS design, different styles of logic circuits, logical effort of complex gates, static and dynamic properties of complex gates, interconnect delay, dynamic logic gates.

UNIT III SEQUENTIAL LOGIC CIRCUITS 9
Static latches and registers, dynamic latches and registers, timing issues, pipelines, clocking strategies, nonbistable sequential circuits.

UNIT IV ARITHMETIC BUILDING BLOCKS 9
Data path circuits, architectures for adders, accumulators, multipliers, barrel shifters, speed, power and area tradeoffs.

UNIT V MEMORY ARCHITECTURES 6
Memory architectures and Memory control circuits: Read-Only Memories, ROM cells, Read-
Write Memories (RAM), dynamic memory design, 6 Transistor SRAM cell, sense amplifiers.

**COURSE OUTCOMES:**
At the end of this course, the students will be able to:

**CO1:** Use mathematical methods and circuit analysis models in analysis of CMOS digital circuits

**CO2:** Create models of moderately sized static CMOS combinational circuits that realize specified digital functions and to optimize combinational circuit delay using RC delay models and logical effort

**CO3:** Design sequential logic at the transistor level and compare the tradeoffs of sequencing elements including flip-flops, transparent latches

**CO4:** Understand design methodology of arithmetic building blocks

**CO5:** Design functional units including ROM and SRAM

**REFERENCES:**

**TOTAL:45 PERIODS**

**AP4111 ELECTRONICS SYSTEM DESIGN LABORATORY**

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**COURSE OBJECTIVES:**
- Design of instrumentation amplifier and voltage regulator
- Design of PCB layout
- Write a Verilog HDL coding of various combinational circuits
- Verify the design functionality for various memory modules
- Design of PLL circuits

**LIST OF EXPERIMENTS:**

1. Design of a 4-20 mA transmitter for a bridge type transducer.

   Design the Instrumentation amplifier with the bridge type transducer (Thermistor or any resistance variation transducers) and convert the amplified voltage from the instrumentation amplifier to 4 – 20 mA current using op-amp. Plot the variation of the temperature Vs output current.

2. Design of AC/DC voltage regulator using SCR

   Design a phase controlled voltage regulator using full wave rectifier and SCR, vary the conduction angle and plot the output voltage.
3. PCB layout design using CAD

Drawing the schematic of simple electronic circuit and design of PCB layout using CAD

4. HDL based design entry and simulation of Parameterizable cores of Counters, Shift registers, State machines, 8-bit Parallel adders and 8 – Bit multipliers.

5. HDL based design entry and simulation of Parameterizable cores on the simple Distributed Arithmetic system. Test vector generation and timing analysis.

6. HDL based design entry and simulation of Parameterizable cores on memory design and 4 – bit ALU. Synthesis, P&R and post P&R simulation, Critical paths and static timing analysis results to be identified. FPGA real time programming and I/O interfacing.

7. Interfacing with Memory modules in FPGA Boards. Verifying design functionality by probing internal signals.

8. Realization of Discrete Fourier transform/Fast Fourier Transform algorithm in HDL and observing the spectrum in simulation.

9. Invoke PLL module and demonstrate the use of the PLL for clock generation in FPGAs. Verify design functionality implemented in FPGA by capturing the signal in Oscilloscope

TOTAL :45 PERIODS

COURSE OUTCOMES:
CO1: Design an instrumentation amplifier and voltage regulator
CO2: Design a PCB layout using CAD tool
CO3: Write a Verilog code for various combinational and sequential circuits
CO4: Develop a memory module with FPGA
CO5: Design an PLL circuit

REFERENCES:
COURSE OBJECTIVES:

- To provide the student with the basic understanding of audio signal analysis using filters
- To provide the students with the understanding of the working of statistical method based approaches
- To impart the students with the design of filters
- To demonstrate the working of algorithms for different applications
- To provide knowledge of analyzing the images and video

LIST OF EXPERIMENTS:

1. Design of Adaptive channel equalizer
2. Realization of sub band filter using linear convolution
3. Realization of STFT using FFT
4. Demonstration of Bayes technique
5. Demonstration of Min-max technique
6. Realization of FIR Wiener filter
7. Generation of Multivariate Gaussian generated data with desired mean vector and the required co-variance matrix.
8. Design and Realization of the adaptive filter using LMS algorithm (solved using steepest-descent algorithm)
9. Representation of the 2D image signal as the linear combinations of PCA (Eigen faces)
10. Image compression using Discrete cosine transformation (DCT).
11. Multiple-input Multiple output (MIMO)
13. LMS filtering implementation using TMS320C6x processor
14. Face detection and tracking in video using OpenCV

TOTAL :45 PERIODS

COURSE OUTCOMES:

CO1: Obtain the ability to apply knowledge of linear algebra, random process and multirate signal processing in various signal processing applications.

CO2: Develop the student’s ability on conducting engineering experiments, analyze experimental observations scientifically

CO3: Become familiar to fundamental principles of linear algebra

CO4: Familiarize the basic operations of filter banks through simulations

CO5: Apply the principles of random process in practical applications

REFERENCES

3. V. Siahaan, R.H.Sianipar, Signal and Image processing with python GUI, Balige Publishing, 2021
COURSE OBJECTIVES:

- To study the concepts of MOS large signal model and small signal model
- To provide in-depth understanding of the analog integrated circuit and building blocks
- To learn the Analog and Digital layout design for mixed signal circuits
- To understand the methodologies for analysis and design of fundamental CMOS Analog and Mixed signal Circuits like Data Converters and filters.
- To study the integrated circuits like oscillators and PLLs.

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 SUBMICRON CIRCUIT 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. 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 IV ANALOG AND DIGITAL LAYOUT DESIGN FOR MIXED SIGNAL


UNIT V OSCILLATORS AND PLL

LC oscillators, Voltage Controlled Oscillators. Simple PLL, Charge pumps PLLs, Non ideal effects in PLLs, Delay Locked Loops. Applications of PLL frequency multiplication and synthesis. Introduction to RF IC Design, building blocks, applications.

SUGGESTED ACTIVITIES:

ICT/MOOCs Reference:
https://nptel.ac.in/courses/117/101/117101105/

COURSE OUTCOMES:
At the end of this course the students will be able to:
CO1: Carry out research and development in the area of analog and mixed signal IC design.
CO2: Well versed with the MOS fundamentals, small signal models and analysis of MOSFET based circuits.
CO3 Analyse and model data converters architecture
CO4: Understand and Design different mixed signal circuits for various applications as per the user specifications.
CO5: Analyze and design mixed signal circuits such as Comparator, ADCs, DACs, PLL.

TOTAL : 45 PERIODS

REFERENCES

AP4251 INDUSTRIAL INTERNET OF THINGS  L T P C 3 0 0 3

COURSE OBJECTIVES:
- To understand the fundamentals of Internet of Things
- To learn about the basics of IOT protocols
- To build a small low cost embedded system using IOT
- To apply the concept of IOT in the real world scenario

UNIT I INTRODUCTION AND ARCHITECTURE OF IoT

UNIT II INDUSTRIAL IoT

UNIT III IIOT ANALYTICS
Big Data Analytics and Software Defined Networks, Machine Learning and Data Science, Julia Programming, Data Management with Hadoop

UNIT IV IOT SECURITY
UNIT V CASE STUDY
Industrial IOT- Application Domains: Oil, chemical and pharmaceutical industry, Applications of UAVs in Industries, Real case studies: Milk Processing and Packaging Industries, Manufacturing Industries

TOTAL : 45 PERIODS

COURSE OUTCOMES:
Upon completion of this course, student will be able to
CO1: Understand the basic concepts and Architectures of Internet of Things.
CO2: Understand various IoT Layers and their relative importance.
CO3: Realize the importance of Data Analytics in IoT.
CO4: Study various IoT platforms and Security
CO5: Understand the concepts of Design Thinking.

REFERENCE BOOKS
1. Industry 4.0: The Industrial Internet of Things”, by Alasdair Gilchrist (Apress), 2017
3. Hands-On Industrial Internet of Things: Create a powerful Industrial IoT by Giacomo Veneri, Antonio Capasso, Packt, 2018.

AP4202 POWER CONSERVATION CIRCUITS FOR ELECTRONICS L T P C
3 0 0 3

COURSE OBJECTIVE:
- To provide the students a deep insight in to the working of different switching devices with respect to their characteristics
- To analyze different converters with their applications.
- To study advanced converters and switching techniques implemented in recent technology

UNIT I POWER ELECTRONIC DEVICES AND SEMICONDUCTOR SWITCHES

UNIT II SCR PERFORMANCE AND APPLICATIONS
Turn on circuits for SCR – triggering with single pulse and train of pulses synchronizing with supply – Thyristor turn off methods, natural and forced commutation, self-commutation series and parallel operations of SCRs. Rectifiers: Single phase and three phase controlled Rectifiers with inductive loads, RL load. Construction & Working of Opto- Isolators, Opto-TRIAC, Opto-SCR.

UNIT III INVERTERS AND VOLTAGE Controllers
Voltage and current source inverters, resonant, Series inverter, PWM inverter. AC and DC choppers – DC to DC converters – Buck, boost and buck – boost.
Single phase and three phase Cyclo-converters, Power factor control and Matrix Converters. Industrial applications DC and AC Drives DC Motor Speed control Induction Motor Speed Control.
UNIT IV  
TIMERS & DELAY ELEMENTS, HIGH FREQUENCY POWER HEATING, SENSOR AND ACTUATORS  

UNIT V  
AUTOMATION AND CONTROL  
Data Communications for Industrial Electronics, Telemetry, SCADA & Automation, AC & DC Drives, Voltage & Power Factor Control through Solid State Devices, Soft Switching, Industrial Robots.

COURSE OUTCOMES:
At the end of this course students will be able to:

CO1: Describe the characteristics, operation of power switching devices and identify their ratings and applications.

CO2: Understand the requirements SCR Protection, Describe the Functioning of SCR their Construction and Performance.

CO3: Analyze and Design the Converter Based on SCR for various Industrial Applications.

CO4: Demonstrate ability to understand High Frequency, Heating Systems, Timers, Relevant Sensors & Actuator and their Application in Industrial Setting.

CO5: Demonstrate the ability to understand and apply Data Communication, Telemetry & SCADA System in Industrial Applications.

REFERENCES:
5. M.S. Jamil Asghar, “Power Electronics” Prentice Hall of India Ltd., 2004

AP4203  
EMBEDDED SYSTEMS  
L T P C  
3 0 2 4

COURSE OBJECTIVES:
- Learn Embedded design challenges and design methodologies
- Study general and single purpose processor
• Understand bus structures
• Design a state machine and concurrent process models
• Know about Embedded software development tools and RTOS.

UNIT I    EMBEDDED SYSTEM OVERVIEW
Embedded System Overview, Design Challenges – Optimizing Design Metrics, Design Methodology, RT-Level Combinational and Sequential Components, Optimizing Custom Single-Purpose Processors.

UNIT II    GENERAL AND SINGLE PURPOSE PROCESSOR
Basic Architecture, Pipelining, Superscalar and VLIW architectures, Programmer’s view, Development Environment, Application-Specific Instruction-Set Processors (ASIPs) Microcontrollers, Timers, Counters and watchdog Timer, UART, LCD Controllers and Analog-to-Digital Converters, Memory Concepts.

UNIT III   BUS STRUCTURES

UNIT IV    STATE MACHINE AND CONCURRENT PROCESS MODELS

UNIT V    EMBEDDED SOFTWARE DEVELOPMENT TOOLS AND RTOS

TOTAL : 45 PERIODS

SUGGESTED ACTIVITIES:
1: Insist students to write a requirements form for a smart phone
2: Compare the use of different Microcontrollers for a particular ESD.
3: Application of a protocol for a specified application.
4: Write a Embedded C code for a given task.
5: design an embedded system for any type of real time application

PRACTICAL LIST:
Exercise – 1
Comparative study of software development tools and design steps with respect to FPGA based and Non – FPGA based (defined logic) embedded system development.
(For Example: consider any Spartan FPGA board for FPGA based Embedded System Consider any cortex- M based board for Non – FPGA based Embedded system)
Exercise – 2
Implement adder and decoder logic blocks in any one of the FPGA chip based development board.
Exercise – 3

Design and development of UART protocol logic block in any one of FPGA chip based development board.
Exercise – 4

Consider on board LEDs (any four) and timer logic block of cortex-M board. Write a program which enables LEDs to glow in different timing.
Exercise – 5

Consider on board switches and (2x16) LCD display develop a program which displays the status of switch activation.
Exercise – 6

Demonstrate GPIO based I/O interfacing by considering LM 35 temperature sensor and cortex-M board.
Exercise – 7

Development of one interfacing scheme which transmits data from one cortex-M board to another cortex-M board using on chip CAN logic blocks.
Exercise – 8

Consider on board EPROM IC of Cortex-M board by utilizing on chip I2c logic block transmit data to EPROM IC and receive stored data from EPROM IC.
Exercise – 9

Consider on board LEDs (4 Nos) of Cortex-M board. Demonstrate time management service concept of RTOS for glowing all four LEDs in different timings.
Exercise – 10

Consider two ultrasonic sensors which are interfaced with cortex-M board. Both are located some distance (2 meters) apart vertically so that the system can identify the movement of object in term of distance. consider data reception and display of each sensor as two different tasks by RTOS. Establish a RTOS based system to recognize the height of moving object.

Objective:

a. Able to understand embedded system design flow in FPGA chip based and Non – FPGA chip based embedded development boards.
b. Able to create simple logic blocks in FPGA chip based boards.
c. Able to understand interfacing scheme for Non – FPGA board scheme for Non – FPGA board
d. Able to utilize RTOS functions for interfacing practice

HARDWARE AND SOFTWARE REQUIREMENTS
1. Cortex-M board and simulation tools
2. FPGA EVM Board and simulation tools
3. Ultrasonic sensor
4. Any portable open source RTOS

COURSE OUTCOMES:
At the end of the course the student will be:
CO1: Able to design an Embedded system
CO2: Understand a general and single purpose processor
CO3: Explain different protocols
CO4: Discuss state machine and design process models
CO5: Outline embedded software development tools and RTOS

TOTAL: 45 + 30 = 75 PERIODS

REFERENCES


AP4211  VLSI DESIGN LABORATORY  L T P C 0 0 4 2

COURSE OBJECTIVE:
- Familiarize with different FPGA boards
- Analyze digital design using Front end Tools
- Analyze the CMOS circuits using CAD tools
- Analyze the interfacing of I/O devices with Arduino Boards using Embedded C

PRACTICAL EXPERIMENTS:
1. Synthesize and implement Combinational and Sequential Circuits in VERILOG / VHDL
2. Synthesize and implement MAC unit and GCD unit in Verilog / VHDL
3. Implementation of sampling of input signal and display in FPGA Synthesize and implement FIR filter and IIR filter Verilog / VHDL
4. Synthesize and implement 8 bit general purpose processor in Verilog/VHDL
5. Synthesize and implement UART and USART
6. Simulation and Analysis of CMOS combinational and sequential logic circuits using CAD tools

TOTAL : 60 PERIODS

COURSE OUTCOME:
At the end of the course, the students will be able to

CO1: Program in Verilog/VHDL for combinational and sequential circuits and implement the program in FPGA
CO2: Implement FIR and IIR filters in FPGA
CO3: Implement data path design and interfaces
CO4: Handle CAD tools to draw/edit, and analyze the CMOS circuits.
CO5: Program and interface the Arduino Boards using Embedded C
COURSE OBJECTIVE:
- To prepare the student to be an entry-level industrial standard ASIC or FPGA designer.
- To analyze the issues and tools related to ASIC/FPGA design and implementation.
- To understand basics of System on Chip and Platform based design.

UNIT I  INTRODUCTION TO ASICS, CMOS LOGIC AND ASIC LIBRARY DESIGN  9
Types of ASICs - Design flow - CMOS transistors - Combinational Logic Cell – Sequential logic cell
-Data path logic cell - Transistors as Resistors - Transistor Parasitic Capacitance- Logical effort.

UNIT II  PROGRAMMABLE ASICS, PROGRAMMABLE ASIC LOGIC CELLS AND
PROGRAMMABLE ASIC I/O CELLS  9
Anti-fuse - static RAM - EPROM and EEPROM technology - Actel ACT - Xilinx LCA –Altera FLEX -
Altera MAX DC & AC inputs and outputs - Clock & Power inputs - Xilinx I/O blocks.

UNIT III  PROGRAMMABLEASIC ARCHITECTURE  9
Architecture and configuration of Spartan / Cyclone and Virtex / Stratix FPGAs – Micro-Blaze /
Niosbased embedded systems – Signal probing techniques.

UNIT IV  LOGIC SYNTHESIS, PLACEMENT AND ROUTING  9
Logic synthesis - ASIC floor planning - placement and routing – power and clocking strategies.

UNIT V  HIGH PERFORMANCE ALGORITHMS FOR ASICs/ SOCS. SOC CASE STUDIES  9
DAA and computation of FFT and DCT. High performance filters using delta-sigma modulators.
Case Studies: Digital camera, SDRAM, High speed data standards.

TOTAL:45 PERIODS

COURSE OUTCOMES:
At the end of this course students will be able:
CO1: To architect ASIC library design
CO2: To develop programmable ASIC logic cells
CO3: To design I/O cells and interconnects
CO4: To understand logic synthesis, placement and routing
CO5: To identify new developments in SOC and low power design

REFERENCES:
2. Jose E. France, Yannis Tsividis, "Design of Analog - Digital VLSI Circuits for Telecommunication
4. Mohammed Ismail and Terri Fiez, "Analog VLSI Signal and Information Processing ",
5. Roger Woods, John McAllister, Dr. Ying Yi, Gaye Lightbod, “FPGA-based Implementation of
COURSE OBJECTIVES:
- Discuss the basic concepts and structure of computers.
- Explain the concepts of number representation and arithmetic operations.
- Explain different types of Memory architectures.
- Describe various parallel processing schemes and vector architecture.
- Summarize the Instruction execution stages and Memory hierarchy.

UNIT I
INTRODUCTION TO COMPUTER ORGANIZATION

UNIT II
DATA REPRESENTATION
Signed number representation, fixed and floating point representations, character representation. Computer arithmetic - integer addition and subtraction, ripple carry adder, carry look-ahead adder - multiplication - shift-and-add, Booth multiplier, carry save multiplier - Division - non-restoring and restoring techniques, floating point arithmetic.

UNIT III
PROCESSOR ARCHITECTURE AND CONTROL UNIT

UNIT IV
PARALLEL PROCESSING
Parallel processing challenges – Flyn’s classification – Single Instruction Single Data (SISD), Multiple Instruction Multiple Data (MIMD), Single Instruction Multiple Data (SIMD), Single Program Multiple Data (SPMD), and Vector Architectures - Hardware multithreading – Multi-core processors and other Shared Memory Multiprocessors - Introduction to Graphics Processing Units, Clusters, Warehouse Scale Computers and other Message-Passing Multiprocessors.

UNIT V
MEMORY & I/O SYSTEMS

COURSE OUTCOMES
Upon completion of this course, the student will be able to
CO1: Understand the basic organization of computer and different instruction formats and addressing modes. (K2)
CO2: Interpret the representation and manipulation of data on the computer. (K3)
CO3: Illustrate about implementation schemes of control unit and pipeline performance. (K2)
CO4: Summarize the various types of parallelism architectures. (K2)
CO5: Compare the various memory hierarchy and I/O systems. (K2)
REFERENCES

COURSE OBJECTIVES:
- To explain the principle of electronic management system and different sensors used in the systems.
- To know the concepts and develop basic skills necessary to diagnose automotive electronic problems.
- To know Starting, and charging, lighting systems, advanced automotive electrical systems.
- To include electronic accessories and basic computer control.
- To explore practically about the components present in an Automotive electrical and electronics system.

UNIT I FUNDAMENTALS
Components for electronic engine management system, open and closed loop control strategies, PID control, Look up tables, introduction to modern control strategies like Fuzzy logic and adaptive control. Switches, active resistors, Transistors, Current mirrors/amplifiers, Voltage and current references, Comparator, Multiplier. Amplifier, filters, A/D and D/A converters.

UNIT II MODERN SENSORS
Film sensors, micro-scale sensors, Particle measuring systems, Vibration Sensors, SMART sensors, Machine Vision, Multi-sensor systems Applications of Sensors: Applications and case studies of Sensors in Automobile Engineering, Aeronautics, Machine tools and Manufacturing processes.

UNIT III CHARGING SYSTEM

UNIT IV AUTOMOTIVE TRANSMISSION CONTROL SYSTEMS
Transmission control - Cruise control – Braking control – Traction control –Suspension control –
Steering control – Stability control – Integrated engine control.

UNIT V  ELECTRONICS SYSTEMS

Current Trends in Automotive Electronic Engine Management System- Types of EMS
Electromagnetic interference Suppression- Electromagnetic Compatibility- Electronic Dashboard
Instruments- Onboard Diagnostic System- Security - Warning System infotainment and Telematics.

TOTAL : 45 PERIODS

SUGGESTED ACTIVITIES:

1. Testing of battery, starting systems, charging systems, ignition systems and body controller systems
2. Study of various sensors and actuators used in two wheelers and four wheelers for electronic control.

COURSE OUTCOMES:
At the end of this course the students will be able to:
CO1: Explain the fundamentals, operation, function of various sensors and actuators in engine management systems.
CO2: Explain the Automotive Transmission Control Systems.
CO3: Enumerate the principles, application, construction and specification of different sensors and actuators usable in typical automobile by suitable testing.
CO4: List out the principles and characteristics of charging system components and demonstrate their working with suitable tools.
CO5: Describe the principles and architecture of electronics systems and its components present in an automobile related to instrumentation, control, security and warning systems.

REFERENCES

COURSE OBJECTIVES:

- To Introduce the concepts of Robotic systems
- To understand the concepts of Instrumentation and control related to Robotics
- To understand the kinematics and dynamics of robotics
- To explore robotics in Industrial applications

UNIT I  INTRODUCTION TO ROBOTICS  9
Robotics - History - Classification and Structure of Robotic Systems - Basic components - Degrees of freedom - Robot joints coordinates - Reference frames - workspace - Robot languages - Robotic sensors - proximity and range sensors, ultrasonic sensor, touch and slip sensor.

UNIT II  ROBOT KINEMATICS AND DYNAMICS  9

UNIT III  ROBOTICS CONTROL  9
Control of robot manipulator - state equations - constant solutions - linear feedback systems, single-axis PID control - PD gravity control - computed torque control, variable structure control and impedance control.

UNIT IV  ROBOT INTELLIGENCE AND TASK PLANNING  9
Artificial Intelligence - techniques - search problem reduction - predicate logic means and end analysis - problem solving - robot learning - task planning - basic problems in task planning - AI in robotics and Knowledge Based Expert System in robotics

UNIT V  INDUSTRIAL ROBOTICS  9
Robot cell design and control - cell layouts - multiple robots and machine interference - work cell design - work cell control - interlocks - error detection deduction and recovery - work cell controller - robot cycle time analysis. Safety in robotics, Applications of robot and future scope.

COURSE OUTCOMES:
At the end of the course the student will be able to

CO1: Describe the fundamentals of robotics
CO2: Understand the concept of kinematics and dynamics in robotics.
CO3: Discuss the robot control techniques
CO4: Explain the basis of intelligence in robotics and task planning
CO5: Discuss the industrial applications of robotics

REFERENCE:


VL4092 SOFT COMPUTING AND OPTIMIZATION TECHNIQUES L T P C
3 0 0 3

COURSE OBJECTIVE:
• To classify various soft computing frame works.
• To be familiar with the design of neural networks, fuzzy logic, and fuzzy systems.
• To learn mathematical background for optimized genetic programming.
• Be exposed to neuro-fuzzy hybrid systems and its applications.
• To understand the various evolutionary optimization techniques.

UNIT I FUZZY LOGIC: 9
Introduction to Fuzzy logic - Fuzzy sets and membership functions- Operations on Fuzzy sets- Fuzzy relations, rules, propositions, implications, and inferences- Defuzzification techniques- Fuzzy logic controller design- Some applications of Fuzzy logic.

UNIT II ARTIFICIAL NEURAL NETWORKS: 9

UNIT III GENETIC ALGORITHM: 9

UNIT IV NEURO-FUZZY MODELING 9

UNIT V CONVENTIONAL OPTIMIZATION TECHNIQUES 9

TOTAL :45 PERIODS

COURSE OUTCOMES:
Upon Completion of the course, the students will be able to:
CO1: Develop application on different soft computing techniques like Fuzzy, GA and Neural network
CO3: Implement machine learning through Neural networks.
CO4: Model Neuro Fuzzy system for clustering and classification.
CO5: Able to use the optimization techniques to solve the real world problems

REFERENCES:

CU4251 RF SYSTEM DESIGN L T P C 3 0 0 3

COURSE OBJECTIVES:
- Be familiar with RF transceiver system design for wireless communications
- Be exposed to design methods of receivers and transmitters used in communication systems
- Design RF circuits and systems using an advanced design tool.
- Exemplify different synchronization methods circuits and describe their block schematic and design criteria
- Measure RF circuits and systems with a spectrum analyzer.

UNIT I BASICS OF RADIO FREQUENCY SYSTEM DESIGN 9
Definitions and models of Linear systems and Non-linear system. Specification parameters: Gain, noise figure, SNR, Characteristic impedance, S-parameters, Impedance matching and Decibels. Elements of digital base band signalling: complex envelope of band pass signals, Average value, RMS value, Crest factor, Sampling, jitter, modulation techniques, filters, pulse shaping, EVM, BER, sensitivity, selectivity, dynamic range and, adjacent and alternate channel power leakages

UNIT II RADIO ARCHITECTURES AND DESIGN CONSIDERATIONS 9

UNIT III AMPLIFIER MODELING AND ANALYSIS 9
Noise: Noise equivalent model for Radio frequency device, amplifier noise model, cascade performance, minimum detectable signal, performance of noisy systems in cascade. Non-Linearity: Amplifier power transfer curve, gain compression, AM-AM, AM-PM, polynomial approximations,
Saleh model, Wiener model and Hammerstein model, intermodulation, Single and two tone analyses, second and third order distortions and measurements, SOI and TOI points, cascade performance of nonlinear systems.

UNIT IV MIXER AND OSCILLATOR MODELING AND ANALYSIS 9
Mixers: Frequency translation mechanisms, frequency inversion, image frequencies, spurious calculations, principles of mixer realizations. Oscillators: phase noise and its effects, effects of oscillator spurious components, frequency accuracy, oscillator realizations: Frequency synthesizers, NCO.

UNIT V APPLICATIONS OF SYSTEMS DESIGN 9
Multimode and multiband Superheterodyne transceiver: selection of frequency plan, receiver system and transmitter system design – Direct conversion transceiver: receiver system and transmitter system design.

TOTAL : 45 PERIODS

COURSE OUTCOMES:
Upon the completion of course, students will be able to
CO1: understand the specifications of transceiver modules
CO2: understand pros and cons of transceiver architectures and their associated design considerations
CO3: understand the impact of noise and amplifier non-linearity of amplification modules and also will learn the resultant effect during cascade connections
CO4: get exposure about spurs and generation principles during signal generation and frequency translations
CO5: understand the case study of transceiver systems and aid to select specification parameters

REFERENCES
COURSE OBJECTIVES:
- To gain broad conceptual understanding of the various aspects of electromagnetic (EM) interference and compatibility
- To develop a theoretical understanding of electromagnetic shielding effectiveness
- To understand ways of mitigating EMI by using shielding, grounding and filtering
- To understand the need for standards and to appreciate measurement methods
- To understand how EMI impacts wireless and broadband technologies

UNIT I  INTRODUCTION & SOURCES OF EM INTERFERENCE  9
Introduction - Classification of sources - Natural sources - Man-made sources - Survey of the electromagnetic environment.

UNIT II  EM SHIELDING  9
Introduction - Shielding effectiveness - Far-field sources - Near-field sources - Low-frequency, magnetic field shielding - Effects of apertures

UNIT III  INTERFERENCE CONTROL TECHNIQUES  9

UNIT IV  EMC STANDARDS, MEASUREMENTS AND TESTING  9
Need for standards - The international framework - Human exposure limits to EM fields - EMC measurement techniques - Measurement tools - Test environments.

UNIT V  EMC CONSIDERATIONS IN WIRELESS AND BROADBAND TECHNOLOGIES  9
Efficient use of frequency spectrum - EMC, interoperability and coexistence - Specifications and alliances - Transmission of high-frequency signals over telephone and power networks – EMC and digital subscriber lines - EMC and power line telecommunications.

SUGGESTED ACTIVITIES:
1. Investigate various case studies related to EMIC. Example: Chernobyl Disaster in 1986.
2. Develop some understanding about the design of EM shields in electronic system design and packaging.

COURSE OUTCOMES:
Upon completion of this course, the student will be able to
- CO1: Demonstrate knowledge of the various sources of electromagnetic interference
- CO2: Display an understanding of the effect of how electromagnetic fields couple through apertures, and solve simple problems based on that understanding
- CO3: Explain the EMI mitigation techniques of shielding and grounding
- CO4: Explain the need for standards and EMC measurement methods
- CO5: Discuss the impact of EMC on wireless and broadband technologies

TOTAL: 45 PERIODS

REFERENCES

AP4003 VLSI DESIGN TECHNIQUES L T P C 3 0 0 3

COURSE OBJECTIVES:
- To understand the basics I–V characteristics of MOS transistor
- To introduce the VLSI design flow
- To Design combinational and sequential circuits
- To introduce testing of VLSI circuits
- To explore system design using Verilog HDL

Unit I CMOS TECHNOLOGY

Unit II CIRCUIT DELAY, POWER, INTERCONNECT AND VERILOG HDL
Verilog: Procedural assignments – conditional statements – Design of combinational and sequential circuits using different types of modeling – Test benches.

Unit III COMBINATIONAL AND SEQUENTIAL CIRCUIT DESIGN
Circuit families – Circuit Pitfalls – Sequencing static circuits, Max-min delay constraints, Time borrowing, Clock Skew – circuit design of latches and flip flops – synchronizers, Metastability, communication between asynchronous clock domains.

Unit IV CMOS TESTING

UNIT V SYSTEM DESIGN USING VERILOG HDL
Basic concepts- identifiers- gate primitives- gate delays- operators timing controls- procedural assignments-conditional statements- Design of combinational and sequential circuits using Data flow- structural gate level- switch level modeling and Behavioral modeling- Test benches.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
After the completion of the course the students will be able to,
CO1: Analyze the characteristics of CMOS transistor
CO2: Identify the methods to distribute clock and reduce power dissipation in CMOS circuits.
CO3: Design combinational and sequential circuits
CO4: Analyze the methods to test the CMOS circuits
REFERENCES:

AP4004 NANO TECHNOLOGIES L T P C
3 0 0 3

COURSE OBJECTIVES:
- To introduce the basics of nano electronics
- To understand the basics of semiconductor materials
- To understand the basics of MOSFETS and its application in nano electronics
- To learn the advanced nanoscale devices
- To explore about Biosensors

UNIT I INTRODUCTION TO NANOELECTRONICS

UNIT II MATERIALS FOR NANOELECTRONICS

UNIT III SHRINK-DOWN APPROACHES
Moore’s Law- Technology Scaling and Reliability Challenges.Basic MOS Transistor-Types, Modes of operation, n-MOS operation, Drain Current, Threshold Voltage, Energy band diagram of MOSFET, nanoscale MOSFET, SCEs-limits to scaling, system integration limits.

UNIT IV ADVANCED NANOSCALE DEVICES
Double Gate MOSFETs, Tri-Gate MOSFETs, Tunnel FETs-Multi-Gate TFETs and Heterojunction TFETs- Graphene and Carbon Nanotube Transistors.

UNIT V FET BASED BIOSENSORS
Principles- Components of biosensor-Classification of Biosensors based on transducers, FET based Biosensor- ion-sensitive field effect transistor-operation and fabrication-Characteristics and Performance.

TOTAL: 45 PERIODS
COURSE OUTCOMES:
Upon completion of this course, the students will be able to
CO1: Understand the basic concepts of nano electronics and various aspects of nano electronics. (K2)
CO2: Summarize the basic knowledge of Semiconductor materials and carbon nano tubes. (K2)
CO3: Understand the basic concepts of MOS scaling. (K2)
CO4: understand the advanced nanoscale devices (K3)
CO5: Understand the Bio sensor devices. (K2)

REFERENCES
1. G.W. Hanson, Fundamentals of Nanoelectronics, Pearson, 2009.

VL4252 VLSI TESTING  L T P C  3 0 0 3

COURSE OBJECTIVES:
- to introduce the VLSI testing.
- to introduce logic and fault simulation and testability measures
- to study the test generation for combinational and sequential circuits
- to study the design for testability.
- to study the fault diagnosis

UNIT I INTRODUCTION TO TESTING  9

UNIT II LOGIC & FAULT SIMULATION & TESTABILITY MEASURES  9

UNIT III TEST GENERATION FOR COMBINATIONAL AND SEQUENTIAL CIRCUITS  9

UNIT IV DESIGN FOR TESTABILITY  9

UNIT V FAULT DIAGNOSIS  9
Introduction and Basic Definitions – Fault Models for Diagnosis – Generation of Vectors for Diagnosis – Combinational Logic Diagnosis - Scan Chain Diagnosis – Logic BIST Diagnosis.
COURSE OUTCOMES:
At the end of this course, the students will be able to:

CO1: Understand VLSI Testing Process
CO2: Develop Logic Simulation and Fault Simulation
CO3: Develop Test for Combinational and Sequential Circuits
CO4: Understand the Design for Testability
CO5: Perform Fault Diagnosis.

REFERENCES

AP4092 EDGE ANALYTICS AND INTERNET OF THINGS LT PC
3 0 0 3

COURSE OBJECTIVES:

- To Understand the basis for intersection of IOT and Edge Analytics
- To Understand the IOT protocols and standards
- To comprehend the use of Machine Learning in Edge Analytics
- To gain understanding on the use of Deep Learning techniques for analytics
- To gain insight into edge analytics models and deployment

UNIT I INTRODUCTION TO IOT
Importance and Need for IoT - Application and Use cases of IoT - Overview of Industrial IoT - Intersection of IoT and Edge Analytics.

UNIT II IOT PROTOCOLS AND SYSTEMS
IoT protocols and standards - Cloud IoT Infrastructure - Setup and program IoT device - Data Collection from IoT device.

UNIT III MACHINE LEARNING AND ARTIFICIAL INTELLIGENCE
Introduction to Machine Learning and Artificial Intelligence - Overview of Deep Learning and Neural Networks - Introduction to Convolution Neural Networks.

UNIT IV AUTO ENCODERS AND ITS PROGRAMMING
Introduction to Recurrent Neural Networks - Introduction to Auto Encoders - Programming Practice: Build Image Classifier, Build Anomaly Detector
UNIT V  EDGE ANALYTICS
Challenges with Edge Devices and Deployment - Need for Model Quantization
Quantization Aware Training- Post Model Quantization- Programming Practice: Model quantization, Deploying model on Edge Devices

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon completion of this course, student will be able to
CO 1: Use the foundational concepts in Edge Analytics for application design and development
CO 2: Use IOT protocols in cloud environments.
CO 3: Implement and use Machine Learning and Artificial Intelligence algorithms and tools
CO 4: implement and use Deep Learning techniques for applications
CO 5: Analyze Edge devices analytics models and and its challenges

REFERENCES:

AP4093  QUANTUM COMPUTING  L T P C
3  0  0  3

COURSE OBJECTIVES:
- To introduce the building blocks of Quantum computers and highlight the paradigm change between conventional computing and quantum computing
- To understand the Quantum state transformations and the algorithms
- To understand entangled quantum subsystems and properties of entangled states
- To explore the applications of quantum computing

UNIT I  QUANTUM BUILDING BLOCKS
The Quantum Mechanics of Photon Polarization, Single-Qubit Quantum Systems, Quantum State Spaces, Entangled States, Multiple-Qubit Systems, Measurement of Multiple-Qubit States, EPR Paradox and Bell’s Theorem, Bloch sphere

UNIT II  QUANTUM STATE TRANSFORMATIONS
Unitary Transformations, Quantum Gates, Unitary Transformations as Quantum Circuits, Reversible Classical Computations to Quantum Computations, Language for Quantum Implementations.

UNIT III  QUANTUM ALGORITHMS
Computing with Superpositions, Quantum Subroutines, Quantum Fourier Transformations, Shor’s Algorithm and Generalizations, Grover’s Algorithm and Generalizations
UNIT IV   ENTANGLED SUBSYSTEMS AND ROBUST QUANTUM COMPUTATION 9
Quantum Subsystems, Properties of Entangled States, Quantum Error Correction, Graph states and codes, CSS Codes, Stabilizer Codes, Fault Tolerance and Robust Quantum Computing

UNIT V   QUANTUM INFORMATION PROCESSING 9

TOTAL : 45 PERIODS

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

CO1: Understand the basic principles of quantum computing.
CO2: Gain knowledge of the fundamental differences between conventional computing and quantum computing.
CO3: Understand several basic quantum computing algorithms.
CO4: Understand the classes of problems that can be expected to be solved well by quantum computers.
CO5: Simulate and analyze the characteristics of Quantum Computing Systems.

REFERENCES:
1. John Gribbin, Computing with Quantum Cats: From Colossus to Qubits, 2021
2. William (Chuck) Easttom, Quantum Computing Fundamentals, 2021
3. Parag Lala, Quantum Computing, 2019

CU4076   VLSI FOR WIRELESS COMMUNICATION

COURSE OBJECTIVES:
- To understand the concepts of basic wireless communication concepts.
- To study the parameters in receiver and low noise amplifier design.
- To study the various types of mixers designed for wireless communication.
- To study and design PLL and VCO.
- To understand the concepts of transmitters and power amplifiers in wireless communication.

UNIT I   COMMUNICATION CONCEPTS 9
UNIT II RECEPTOR ARCHITECTURE & LOW NOISE AMPLIFIERS
Receiver front end – Filter design – Non-idealities – Design parameters – Noise figure & Input intercept point. LNA Introduction – Wideband LNA design – Narrow band LNA design: Impedance matching & Core amplifier.

UNIT III MIXERS

UNIT IV FREQUENCY SYNTHESIZERS
PLL – Phase detector – Dividers – Voltage Controlled Oscillators – LC oscillators – Ring Oscillators – Phase noise – Loop filters & design approaches – A complete synthesizer design example (DECT) – Frequency synthesizer with fractional divider.

UNIT V TRANSMITTER ARCHITECTURES & POWER AMPLIFIERS
Transmitter back end design – Quadrature LO generator – Power amplifier design.

COURSE OUTCOMES:
At the end of this course, the student should be able to
CO1: Able to recollect basic wireless communication concepts.
CO2: To understand the parameters in receiver and design a low noise amplifier
CO3: In a position to apply his knowledge on various types of mixers designed for wireless communication.
CO4: Design PLL and VCO
CO5: Understand the concepts of transmitters and utilize the power amplifiers in wireless communication.

TOTAL: 45 PERIODS

REFERENCES
COURSE OBJECTIVES:

- To understand the operation of sensors and actuators
- To understand the operation of major classes of MEMS devices/systems
- To give the fundamentals of standard micro fabrication techniques and processes
- To understand the unique demands, environments and applications of MEMS devices
- To understand RF MEMS, Bio MEMS and MOEMS

UNIT I  INTRODUCTION TO MEMS  9


UNIT II  SENSORS AND ACTUATORS  9


UNIT III  MICROMACHINING  9


UNIT IV  POLYMER AND OPTICAL MEMS  9


UNIT V  OVERVIEW OF MEMS AREAS  9

Bonding techniques for MEMS : Surface bonding , Anodic bonding , Silicon - on - Insulator , wire bonding , Sealing – Assembly of micro systems- RF MEMS - switches, active and passive components, Bio MEMS - Microfluidics, Digital Micro fluidics, Ink jet printer,- MOEMS - optical switch, optical cross-connect, tunable VCSEL, micro bolometers.

TOTAL : 45 PERIODS

SUGGESTED ACTIVITIES:

1. Expose the students to occupational environment related to semiconductor devices and MEMS
2. Create opportunity for acquiring practical skills of various field instruments in the area of
MEMS devices
3. Manage the issues arising during the execution of projects related to MEMS.

COURSE OUTCOMES:
At the end of the course the student will be able to:
   CO1: Understand the working principles of micro sensors and actuators
   CO2: Understand the application of scaling laws in the design of micro systems
   CO3: Understand the typical materials used for fabrication of micro machines
   CO4: Understand the principles of standard micro fabrication techniques
   CO5: Appreciate the challenges in the design and fabrication of RF, Bio, and MOEMS systems

REFERENCES

AP4006 HARDWARE SECURE COMPUTING L T P C
3 0 0 3

COURSE OBJECTIVES
• Describe the fundamental principles in Data security
• Discuss the watermarking algorithms and its usage
• Explain the physical attacks and Modular arithmetic security methods
• Describe the memory based attacks and vulnerabilities using deceptive mechanisms
• Discuss the methods of FPGA implementation of cryptographic algorithms

UNIT I INTRODUCTION TO CRYPTO ALGORITHMS 9
Cryptography basics, Cryptographic algorithms - Symmetric Key algorithms, Public Key algorithms and Hash Algorithms, Data Encryption Standards, Advanced Encryption Standards, RSA, BowFish.

UNIT II DESIGN INTELLECTUAL PROPERTY PROTECTION 9

UNIT III PHYSICAL ATTACKS AND MODULAR EXPONENTIATION 9
Physical Attacks (PA) Basics, Physical Attacks and Countermeasures, Building Secure Systems, Modular Exponentiation (ME) Basics, ME in Cryptography, ME Implementation and Vulnerability, Montgomery Reduction.
UNIT IV  ATTACKS AND COUNTER MEASURES  9
Introduction to Side Channel Attacks, Memory Vulnerabilities and Cache Attacks, Power Analysis, More Attacks and Countermeasures, Modified Modular Exponentiation, Hardware Trojan (HT) and Trusted IC, Hardware Trojan Taxonomy, Hardware Trojan Detection Overview, Hardware Trojan Detection Methods, Trusted IC Design with HT Prevention.

UNIT V  EMERGING TECHNOLOGIES  9
FPGA Implementation of Crypto algorithms, Vulnerabilities and Countermeasures in FPGA Systems, Role of Hardware in Security and Trust, Physical Unclonable Functions (PUF) Basics, Reliability, Trust Platform Modules

TOTAL : 45 PERIODS

COURSE OUTCOMES
Upon completion the students will be able to
CO1: Understand the basics of Cryptography (K2)
CO2: Identify the mechanism of Data Integrity protection mechanisms (K2)
CO3: Analyse the counter measures for physical attacks and the use of Modular exponentiation (K2)
CO4: Study side channel attacks and Trojan-based attacks (K2)
CO5: Challenges in Realisation using VLSI implementations (K2)

REFERENCES:

VL4072  CAD FOR VLSI DESIGN  L T P C
3 0 0 3

COURSE OBJECTIVES:
• to introduce the VLSI design methodologies and design methods.
• to introduce data structures and algorithms required for VLSI design.
• to study algorithms for partitioning and placement.
• to study algorithms for floor planning and routing.
• to study algorithms for modelling, simulation and synthesis.

UNIT I  INTRODUCTION  9
UNIT II DATA STRUCTURES AND BASIC ALGORITHMS 9

UNIT III ALGORITHMS FOR PARTITIONING AND PLACEMENT 9

UNIT IV ALGORITHMS FOR FLOORPLANNING AND ROUTING 9

UNIT V MODELLING, SIMULATION AND SYNTHESIS 9

TOTAL:45 PERIODS

COURSE OUTCOMES:
At the end of this course, the students should be able to:
CO1: use various VLSI design methodologies
CO2: understand different data structures and algorithms required for VLSI design.
CO3: develop algorithms for partitioning and placement.
CO4: develop algorithms for floorplanning and routing.
CO5: design algorithms for modelling, simulation and synthesis.

REFERENCES

AP4073 SENSORS AND ACTUATORS L T P C
3 0 0 3

COURSE OBJECTIVES:
- Understand static and dynamic characteristics of measurement systems.
- Study various types of sensors.
- Study different types of actuators and their usage.
- Study State-of-the-art digital and semiconductor sensors.

UNIT I INTRODUCTION TO MEASUREMENT SYSTEMS 9
Introduction to measurement systems: general concepts and terminology, measurement systems, sensor classification, general input-output configuration, methods of correction, performance
characteristics: static and dynamic characteristics of measurement systems, zero-order, first-order, and second-order measurement systems and response.

UNIT II RESISTIVE AND REACTIVE SENSORS
9
Resistive sensors: potentiometers, strain gages, resistive temperature detectors, magneto resistors, light-dependent resistors, Signal conditioning for resistive sensors: Wheatstone bridge, sensor bridge calibration and compensation, Instrumentation amplifiers, sources of interference and interference reduction, Reactance variation and electromagnetic sensors, capacitive sensors, differential, inductive sensors, linear variable differential transformers (LVDT), magneto elastic sensors, hall effect sensors, Signal conditioning for reactance-based sensors & application to LVDT.

UNIT III SELF-GENERATING SENSORS
9

UNIT IV ACTUATORS DRIVE CHARACTERISTICS AND APPLICATIONS
9
Relays, Solenoid drive, Stepper Motors, Voice-Coil actuators, Servo Motors, DC motors and motor control, 4-to-20 mA Drive, Hydraulic actuators, variable transformers: synchros, resolvers, Inductosyn, resolver-to-digital and digital-to-resolver converters.

UNIT V DIGITAL SENSORS AND SEMICONDUCTOR DEVICE SENSORS
9
Digital sensors: position encoders, variable frequency sensors – quartz digital thermometer, vibrating wire strain gages, vibrating cylinder sensors, Sensors based on semiconductor junctions: thermometers based on semiconductor junctions, magneto diodes and magneto transistors, MOSFET transistors, CCD imaging sensors, ultrasonic sensors, fiber-optic sensors.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon completion of the course the student will be able to:
CO1: Compare Actuators with various drive characteristics.
CO2: Evaluate digital sensors and semiconductor device sensors performance metrics.
CO3: Characterize the performance of Self-generating sensors.
CO4: Analyze the performance of self-generating Sensors.
CO5: Analyze the performance of resistive and reactive sensors.

REFERENCES:
AP4095 SIGNAL INTEGRITY FOR HIGH SPEED DESIGN L T P C
3 0 0 3

COURSE OBJECTIVES:
- To identify sources affecting the speed of digital circuits.
- To introduce methods to improve the signal transmission characteristics

UNIT I SIGNAL PROPAGATION ON TRANSMISSION LINES
Transmission line equations, wave solution, wave vs. circuits, initial wave, delay time, Characteristic impedance, wave propagation, reflection, and bounce diagrams Reactive terminations – L, C, static field maps of micro strip and strip line cross-sections, per unit length parameters, PCB layer stackups and layer/Cu thicknesses, cross-sectional analysis tools, Zo and Td equations for microstrip and stripline Reflection and terminations for logic gates, fan-out, logic switching, input impedance into a transmission-line section, reflection coefficient, skin-effect, dispersion.

UNIT II MULTI-CONDUCTOR TRANSMISSION LINES AND CROSS-TALK
Multi-conductor transmission-lines, coupling physics, per unit length parameters, Near and far-end cross-talk, minimizing cross-talk (stripline and microstrip) Differential signalling, termination, balanced circuits, S-parameters, Lossy and Lossless models.

UNIT III NON-IDEAL EFFECTS
Non-ideal signal return paths – gaps, BGA fields, via transitions, Parasitic inductance and capacitance, Transmission line losses – Rs, tanδ, routing parasitic, Common-mode current, differential-mode current, Connectors.

UNIT IV POWER CONSIDERATIONS AND SYSTEM DESIGN
SSN/SSO, DC power bus design, layer stack up, SMT decoupling, Logic families, power consumption, and system power delivery, Logic families and speed Package types and parasitics, SPICE, IBIS models, Bit streams, PRBS and filtering functions of link-path components, Eye diagrams, jitter, inter-symbol interference Bit-error rate, Timing analysis.

UNIT V CLOCK DISTRIBUTION AND CLOCK OSCILLATORS
Timing margin, Clock slew, low impedance drivers, terminations, Delay Adjustments, canceling parasitic capacitance, Clock jitter.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of the course the student will be able to
CO1: identify sources affecting the speed of digital circuits.
CO2: identify methods to improve the signal transmission characteristics
CO3: characterise and model multi-conductor transmission line
CO4: analyse clock distribution system and understand its design parameters
CO5: analyse nonideal effects of transmission line

REFERENCES

TOOLS REQUIRED
1. SPICE, source - [http://www-cad.eecs.berkeley.edu/Software/software.html](http://www-cad.eecs.berkeley.edu/Software/software.html)
3. SPECTRAQUEST from Cadence, [http://www.specctraquest.com](http://www.specctraquest.com) or any equivalent open source tool

AP4007 CONSUMER ELECTRONICS L T P C 3 0 0 3

COURSE OBJECTIVES:
- To acquaint the students with the construction, theory and operation of the basic electronic devices such as PN junction diode, Bipolar and Field Effect Transistors, Power control devices etc.,
- To know about the working principle of LED, LCD and other Opto-electronic devices.
- To introduce the concept of Sensors and voice controls.
- To provide the knowledge on Smart home devices.
- To gain knowledge on current communication technology.

UNIT I CONSUMER ELECTRONICS FUNDAMENTALS 9

UNIT II ENTERTAINMENT ELECTRONICS 9

UNIT III SMART HOME - SENSORS 9
UNIT IV HOME APPLIANCES
Home Enablement Systems: RFID Home, Lighting control, Automatic Cleaning Robots, Washing Machines, Kitchen Electronics- Microwave, Dishwasher, Induction Stoves, Smart Refrigerators, Smart alarms, Smart toilet, Smart floor, Smart locks.

UNIT V INTRODUCTION TO SMART OS AND COMMUNICATION
Introduction to Smart OS- Android and iOS. Video Conferencing Systems- Web/IP Camera, Video security, Internet Enabled Systems, Wi-Fi, IoT, Li-Fi, GPS and Tracking Systems. Cordless Telephones, Fax Machines, PDAs- Tablets, Smart Phones and Smart Watches.

COURSE OUTCOMES:
Upon successful completion of this course students will be able to
CO1: Explain the V-I characteristic of diode, UJT and SCR. Describe the equivalence circuits of transistors.

CO2: Operate the basic electronic devices such as PN junction diode, Bipolar and Field Effect Transistors, Power control devices, LED, LCD and other Opto-electronic devices.

CO3: Gain knowledge on sensors and controls.

CO4: Emphasize the need for communication systems.

CO5: Explore the current technology and apply on home applications.

REFERENCES:
5. Nick vandome, Smart homes in easy steps, - Master smart technology for your home 2018.

AP4008 ADVANCED MICROPROCESSORS AND MICROCONTROLLERS ARCHITECTURES

COURSE OBJECTIVES:
- To expose the students to the fundamentals of microprocessor architecture.
- To explore the high performance features in CISC architecture.
- To familiarize the high performance features in RISC architecture.
- To introduce the basic features in Motorola microcontrollers.
- To enable the students to understand PIC Microcontroller.

UNIT I MICROPROCESSOR ARCHITECTURE

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 MSP430 16-BIT MICROCONTROLLER

UNIT V PIC MICROCONTROLLER

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of the course the student will be able to
CO1: To understand the fundamentals of microprocessor architecture.
CO2: To know and appreciate the high performance features in CISC architecture.
CO3: To know and appreciate the high performance features in RISC architecture.
CO4: To perceive the basic features in Motorola microcontrollers.
CO5: To interpret and understand PIC Microcontroller.

REFERENCES:

AP4009 BIOMEDICAL SIGNAL PROCESSING
3 0 0 3

COURSE OBJECTIVES:
- Describe the properties and suitable models of biomedical signals
- Introduce the basic signal processing techniques in analyzing biomedical signals
- Develop computational skills in filtering of biomedical signals
- Develop an understanding on ECG signal compression algorithms
- Develop an understanding on feature extraction of biomedical signals
UNIT I  INTRODUCTION TO BIOMEDICAL SIGNALS

Introduction to Biomedical Signals: The nature of Biomedical Signals, Examples of Biomedical Signals, Objectives and difficulties in Biomedical analysis. Electrocardiography: Basic electrocardiography, ECG lead systems, ECG signal characteristics. Signal Conversion : Simple signal conversion systems, Conversion requirements for biomedical signals, Signal conversion circuits

UNIT II  SIGNAL AVERAGING

Signal Averaging: Basics of signal averaging, signal averaging as a digital filter, a typical averager, software for signal averaging, limitations of signal averaging. Adaptive Noise Cancelling: Principal noise canceller model, 60-Hz adaptive cancelling using a sine wave model, other applications of adaptive filtering

UNIT III  DATA COMPRESSION TECHNIQUES

Data Compression Techniques: Turning point algorithm, AZTEC algorithm, Fan algorithm, Huffman coding, data reduction algorithms The Fourier transform, Correlation, Convolution, Power spectrum estimation, Frequency domain analysis of the ECG

UNIT IV  CARDIOLOGICAL SIGNAL PROCESSING

Cardiological signal processing: Basic Electrocardiography, ECG data acquisition, ECG lead system, ECG signal characteristics (parameters and their estimation), Analog filters, ECG amplifier, and QRS detector, Power spectrum of the ECG, Bandpass filtering techniques, Differentiation techniques, Template matching techniques, A QRS detection algorithm, Realtime ECG processing algorithm, ECG interpretation, ST segment analyzer, Portable arrhythmia monitor

UNIT V  NEUROLOGICAL SIGNAL PROCESSING

Neurological signal processing: The brain and its potentials, The electrophysiological origin of brain waves, The EEG signal and its characteristics (EEG rhythms, waves, and transients), Correlation. Analysis of EEG channels: Detection of EEG rhythms, Template matching for EEG, spike and wave detection

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of this course the student will be able to

CO1: Possess skills necessary to analyze ECG and EEG Signals
CO2: Apply classical and modern filtering techniques for ECG and EEG Signals
CO3: Apply classical and modern compression techniques for ECG and EEG Signals
CO4: Develop an understanding on ECG feature extraction
CO5: Develop an understanding on EEG feature extraction

REFERENCES


AP4010 MODELING AND SYNTHESIS WITH HDL L T P C 3 0 2 4

COURSE OBJECTIVES:
- To know the basic language features of Verilog HDL and its role in digital logic design.
- To know the behavioural modeling of combinational and sequential circuits.
- To know the behavioural modeling of algorithmic state machines.
- To know the synthesis of combinational and sequential descriptions.
- To know the architectural features of programmable logic devices.

UNIT I INTRODUCTION TO LOGIC DESIGN WITH VERILOG 07

Overview of Digital Design with Verilog HDL - Hierarchical Modeling Concepts: Top-down and bottom-up design methodology, differences between modules and module instances, parts of a simulation, design block, stimulus block - Basic Concept: Modules and Ports: Module definition, port declaration, connecting ports, hierarchical name referencing. Tasks and Functions

UNIT II LEVELS OF MODELING 12

Gate-Level Modeling: Modeling using basic Verilog gate primitives, description of and/or and buf/not type gates, rise, fall and turn-off delays, min, max, and typical delays. Dataflow Modeling: Continuous assignments, delay specification, expressions, operators, operands, operator types. Behavioral Modeling: Structured procedures, initial and always, blocking and nonblocking statements, delay control, generate statement, event control, conditional statements, multiway branching, loops, sequential and parallel blocks.

UNIT III DESIGN OF DIGITAL LOGIC USING HDL 12

Design of combinational logic: adders, multiplexers, de-multiplexers, encoders and decoders, comparators, multipliers - Design of Sequential logic: Flip-flops, synchronous and Asynchronous counters, shift registers, Universal shift register, FSM and LFSR. (Using various Levels of Modeling)

UNIT IV LOGIC SYNTHESIS AND DESIGN FLOW 07

Logic Synthesis with verilog HDL-Synthesis Design flow, RTL and Test Bench Modeling Techniques and Timing and Path Delay Modeling, Timing Checks, Switch Level Modeling

UNIT V PROGRAMMABLE LOGIC DEVICES 07

Programmable logic devices, storage devices, programmable logic array programmable array logic, programmability of PLDs CPLDs.

45 PERIODS
PRACTICAL EXERCISES: 30 PERIODS

1. Design Entry Using VHDL Or Verilog Using HDL Languages of
   I. Combinational Circuits Namely 8:1 Mux/Demux, Full Adder, 8-Bit Magnitude Comparator, Encoder/Decoder, Priority Encoder.
   II. Sequential Circuits Namely D-FF, 4-Bit Shift Registers (SISO, SIPO, PISO, Bidirectional), 3-Bit Synchronous Counters.
2. Test Vector Generation And Timing Analysis of Sequential And Combinational Logic Design for exercise (1) above.
3. FPGA Implementation of PCI Bus & Arbiter.
   Verifying Design Functionality Using Either Chipscope Feature (Xilinx) /the Signal Tap Feature (Altera)/Other Equivalent Feature. Invoke the PLL And Demonstrate the Use of the PLL Module for Clock Generation in FPGAs.

COURSE OUTCOMES:
After successful completion of the course, the students are able to
CO1: demonstrate knowledge on HDL design flow and digital circuits design.
CO2: design and develop the combinational and sequential circuits using various modeling
CO3: solving algorithmic state machines using hardware description language
CO4: analyze the process of synthesizing the combinational and sequential descriptions
CO5: know the advantages of programmable logic devices and their description in Verilog

TOTAL : 45 +30=75 PERIODS

REFERENCES

IF4071 DEEP LEARNING L T P C
3 0 2 4

COURSE OBJECTIVES:
- Develop and Train Deep Neural Networks.
- Develop a CNN, R-CNN, Fast R-CNN, Faster-R-CNN, Mask-RCNN for detection and recognition
- Build and train RNNs, work with NLP and Word Embeddings
- The internal structure of LSTM and GRU and the differences between them
- The Auto Encoders for Image Processing

UNIT I DEEP LEARNING CONCEPTS
Video Data.

**UNIT II  NEURAL NETWORKS**


**UNIT III  CONVOLUTIONAL NEURAL NETWORK**


**UNIT VI  NATURAL LANGUAGE PROCESSING USING RNN**


**UNIT V  DEEP REINFORCEMENT & UNSUPERVISED LEARNING**


**LIST OF EXPERIMENTS:**

1: Feature Selection from Video and Image Data
2: Image and video recognition
3: Image Colorization
4: Aspect Oriented Topic Detection & Sentiment Analysis
5: Object Detection using Autoencoder

**COURSE OUTCOMES:**

**CO1:** Feature Extraction from Image and Video Data  
**CO2:** Implement Image Segmentation and Instance Segmentation in Images  
**CO3:** Implement image recognition and image classification using a pretrained network (Transfer Learning)  
**CO4:** Traffic Information analysis using Twitter Data  
**CO5:** Autoencoder for Classification & Feature Extraction

**TOTAL : 45+30=75 PERIODS**

**REFERENCES**

1. Deep Learning A Practitioner’s Approach Josh Patterson and Adam Gibson O'Reilly Media, Inc.2017
2. Learn Keras for Deep Neural Networks, Jojo Moolayil, Apress, 2018
4. Deep Learning with Python, FRANÇOIS CHOLLET, MANNING SHELTER ISLAND, 2017

AP4011 ADVANCED DIGITAL IMAGE PROCESSING L T P C
3 0 2 4

COURSE 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, 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, Run length features, Fractal model-based features, Gabor filter, wavelet features.

UNIT IV REGISTRATION AND IMAGE FUSION

Registration- Pre-processing, 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 transforms, Curvelet transform. Region based fusion.

UNIT V 3D IMAGE VISUALIZATION

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.
PRACTICALS:
1. Wavelet and DCT based Image Compression
2. Geometrical transformations and Interpolation of Images
3. Edge Detection using Canny edge detector
4. Region based, threshold based and Watershed Segmentation
5. Image filtering using DFT
6. Texture, Gabor and Wavelet Feature Extraction
7. Image fusion using Wavelets
9. Segmentation of Lungs from 3D Chest Scan.

COURSE OUTCOMES:
Upon Completion of the course, the students will be able to
CO1: To understand image formation and the role of human visual system plays in perception of gray and color image data.
CO2: To apply image processing techniques in both the spatial and frequency (Fourier) domains.
CO3: To design image analysis techniques in the form of image segmentation and to evaluate the methodologies for segmentation.
CO4: To conduct independent study and analysis of feature extraction techniques.
CO5: To understand the concepts of image registration and image fusion.
CO6: To analyze the constraints in image processing when dealing with 3D data sets and to apply image processing algorithms in practical applications.

TOTAL: 45+30=75 PERIODS

REFERENCES

AP4072 PCB DESIGN L T P C 3 0 2 4

COURSE OBJECTIVES:
• Understand the need for PCB Design and steps involved in PCB Design and Fabrication process.
• Familiarize Schematic and layout design flow using Electronic Design Automation (EDA)
Tools.

- Understand basic concepts of transmission line, crosstalk and thermal issues
- Design (schematic and layout) PCB for analog circuits, digital circuits and mixed circuits.
- Schematic creation & interpretation

UNIT I  INTRODUCTION TO PRINTED CIRCUIT BOARD  9

**Introduction to Printed circuit board:** fundamental of electronic components, basic electronic circuits, Basics of printed circuit board designing: Layout planning, general rules and parameters, ground conductor considerations, thermal issues, check and inspection of artwork.

UNIT II  DESIGN RULES FOR PCB  9

**Design rules for PCB:** Design rules for Digital circuit PCBs, Analog circuit PCBs, high frequency and fast pulse applications, Power electronic applications, Microwave applications,

**PCB Technology Trends:** Multilayer PCBs. Multiwire PCB, Flexible PCBs, Surface mount PCBs, Reflow soldering, Introduction to High-Density Interconnection (HDI) Technology.

UNIT III  INTRODUCTION TO ELECTRONIC DESIGN AUTOMATION(EDA) TOOLS FOR PCB DESIGNING  9

**Introduction to Electronic design automation(EDA) tools for PCB designing:** Brief Introduction of various simulators,SPICE and PSPICE Environment, Selecting the Components Footprints as per design, Making New Footprints, Assigning Footprint to components, Net listing, PCB Layout Designing, Auto routing and manual routing. Assigning specific text (silkscreen) to design, Creating report of design, creating manufacturing data (GERBER) for design.

UNIT IV  INTRODUCTION PRINTED CIRCUIT BOARD PRODUCTION TECHNIQUES  9

**Introduction printed circuit board production techniques:** Photo printing, film-master production, reprographic camera, basic process for double sided PCBs photo resists, Screen printing process, plating, relative performance and quality control, Etching machines, Solders alloys, fluxes, soldering techniques, Mechanical operations

UNIT V  PCB DESIGN FOR EMI/EMC  9

**PCB design for EMI/EMC:** Subsystem/PCB Placement in an enclosure, Filtering circuit placement, decoupling and bypassing, Electronic discharge protection, Electronic waste; Printed circuit boards Recycling techniques, Introduction to Integrated Circuit Packaging and footprints, NEMA and IPC standards.

**SUGGESTED ACTIVITIES:**

1. Using any Electronic design automation (EDA) software, Practice following PCB Design steps (Open source EDA Tool KiCad Preferable or equivalent ) Example circuit: Basic RC Circuit  Schematic Design: Familiarization of the Schematic Editor, Schematic creation, Annotation, Netlist generation  Layout Design: Familiarization of Footprint Editor, Mapping of components, Creation of PCB layout Schematic  Create new schematic components Create new component footprints.

2. Fabricate single-sided PCB, mount the components and assemble in a cabinet for any one of the circuits mentioned below.
4. Astable or Monostable multivibrator using IC555
5. RC Phase-shift or Wein-bridge Oscillator using transistor.
6. 4 bit binary /MOD N counter using D-Flip flops.
7. Design a 8051 Development board having Power section consisting of IC7805, capacitor, resistor, headers, LED, Serial communication section consisting of MAX 232, Capacitors, DB9 connector, Jumper, LEDs, Reset & Input/ output sections consisting of 89C51 Microcontroller, Electrolytic Capacitor, Resistor, Jumper, Crystal Oscillator, Capacitors.
8. Touch plate switches – transistorized or 555 based
9. Doorbell/cordless bell
10. Clapping switch and IR switch
11. Blinkers
12. Cell charger, battery charger, mobile charger
13. Fire/smoke/intruder alarm
14. Liquid level controller
15. Audio amplifiers

COURSE OUTCOMES:
Upon the completion of this course, students will demonstrate the ability to:
CO1: Appreciate the necessity and evolution of PCB, types and classes of PCB.
CO2: Understand the steps involved in schematic, layout, fabrication and assembly process of PCB design.
CO3: Apply advanced techniques, skills and modern tools for designing and fabrication of PCBs.
CO4: Apply the knowledge and techniques to fabricate Multilayer, SMT and HDI PCB.
CO5: Design (schematic and layout) and fabricate PCB for simple circuits.

TOTAL : 45+30=75 PERIODS

REFERENCES
1. Printed circuit board design, fabrication assembly and testing By R. S. Khandpur, Tata McGraw Hill 2006
5. EMC and Printed circuit board, Design theory and layout, Mark I Montrose IEEE compatibility society
AUDIT COURSES

AX4091 ENGLISH FOR RESEARCH PAPER WRITING

COURSE OBJECTIVES:
- Teach how to improve writing skills and level of readability
- Tell about what to write in each section
- Summarize the skills needed when writing a Title
- Infer the skills needed when writing the Conclusion
- Ensure the quality of paper at very first-time submission

UNIT I INTRODUCTION TO RESEARCH PAPER WRITING
Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

UNIT II PRESENTATION SKILLS

UNIT III TITLE WRITING SKILLS
Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check

UNIT IV RESULT WRITING SKILLS
Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions

UNIT V VERIFICATION SKILLS
Useful phrases, checking Plagiarism, how to ensure paper is as good as it could possibly be the first-time submission

TOTAL: 30 PERIODS

COURSE OUTCOMES:
CO1 – Understand that how to improve your writing skills and level of readability
CO2 – Learn about what to write in each section
CO3 – Understand the skills needed when writing a Title
CO4 – Understand the skills needed when writing the Conclusion
CO5 – Ensure the good quality of paper at very first-time submission

REFERENCES:

AX4092 DISASTER MANAGEMENT

COURSE OBJECTIVES:
- Summarize basics of disaster
- Explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- Illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- Describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- Develop the strengths and weaknesses of disaster management approaches

UNIT I INTRODUCTION
Disaster: Definition, Factors and Significance; Difference between Hazard And Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

UNIT II REPERCUSSIONS OF DISASTERS AND HAZARDS

UNIT III DISASTER PRONE AREAS IN INDIA
Study of Seismic Zones; Areas Prone To Floods and Droughts, Landslides And Avalanches; Areas Prone To Cyclonic and Coastal Hazards with Special Reference To Tsunami; Post-Disaster Diseases and Epidemics

UNIT IV DISASTER PREPAREDNESS AND MANAGEMENT
Preparedness: Monitoring Of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological And Other Agencies, Media Reports; Governmental and Community Preparedness.

UNIT V RISK ASSESSMENT
Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People’s Participation in Risk Assessment. Strategies for Survival

TOTAL : 30 PERIODS

COURSE OUTCOMES:
CO1: Ability to summarize basics of disaster
CO2: Ability to explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.
CO3: Ability to illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
CO4: Ability to describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.

CO5: Ability to develop the strengths and weaknesses of disaster management approaches

REFERENCES:

AX4093 CONSTITUTION OF INDIA L T P C
2 0 0 0

COURSE OBJECTIVES:
Students will be able to:
- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence nation hood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik Revolutionin1917and its impact on the initial drafting of the Indian Constitution.

UNIT I HISTORY OF MAKING OF THE INDIAN CONSTITUTION
History, Drafting Committee, (Composition & Working)

UNIT II PHILOSOPHY OF THE INDIAN CONSTITUTION
Preamble, Salient Features

UNIT III CONTOURS OF CONSTITUTIONAL RIGHTS AND DUTIES

UNIT IV ORGANS OF GOVERNANCE
Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions.

UNIT V LOCAL ADMINISTRATION
UNIT VI  ELECTION COMMISSION

Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners - Institute and Bodies for the welfare of SC/ST/OBC and women.

TOTAL: 30 PERIODS

COURSE OUTCOMES:
Students will be able to:
- Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
- Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
- Discuss the circumstances surrounding the foundation of the Congress Socialist Party[CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
- Discuss the passage of the Hindu Code Bill of 1956.

SUGGESTED READING
1. The Constitution of India, 1950(Bare Act), Government Publication.

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<th>AX4094</th>
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UNIT I  சங்க இலக்கியம் 6

1. தமிழின் துவக்க நூல் ததொல்கொப்பியம் - நியூநாட், புதுக்கோட்டை
2. கட்டாசம் (82) - தமிழக தரசினமார் அரங்கம்
3. குறிஞ்சிப் பொட்டின் மலர்க்கொட்சி
4. புறநொனூறு (95,195) - பராக திகசல்லு சட்டாம்பர்

UNIT II  அறநநறித் தமிழ் 6

1. அறநநறித் வகுத்த திருவள்ளுவர் - அறம் வலியுறுத்தல், அன்புகடகம், ஒப்புறவு அறிதல், ஈகக், புகழ்
2. பிற அறநூல்கள் - இலக்கியமார், நூல் தூய்கமகய (வலியுறுத்தும் நூல்)

UNIT III  கணினியின் புரட்சி 6

1. கணினியின் புரட்சி

60
UNIT IV அங்கைத் தமிழ்
1. சிறப்பதிகொர்வழக்குகரகொகத
   - பார்வை பல்லைக்கல் தொழில்நுட்பத்துறை, பாட்டுக்கொடுத்தது பார்வை பல்லைக்கல் நேர்வைத்தது ஆற்றியின் தரமழைக் கொகத
2. மூகப்பிள்ளையிலக்கியம்
   - அண்டசத்திகரம் பல்லை குடி
3. திருமந்திரம் (617, 618)
   - விளக்கம் விளக்கம் மிதியர்
4. புறநொனூறு
   - நொட்டு விடுத்தகல
5. புறநொனூறு
   - நொட்டு விடுத்தகல
6. அகனொனூறு (4)
   - விளக்கம்
   1. மேசை (11)
   - தரமழைக் கொகத
   2. மாகாண், போட்ட விளக்கம் 50 (27)
   - உடநெருக்கம் புருஷோதரம்

UNIT V நவீனதமிழ் தகவலில்பனம்
1. பார்வைக் குடியிருப்ப
   - தொழில்நுட்பத்துறைப்
   - தொழில்நுட்பப் பிள்ளை
   - காட்சியும் தொழில்நுட்ப
   - பல்லை தொழில்நுட்ப
   - நூற்றல்
2. விளக்கம் விளக்கம் பல்லைக்கல் தொழில்நுட்பம்
3. பார்வை பல்லைக்கல் தொழில்நுட்பம்
4. பார்வை பல்லைக்கல் தொழில்நுட்ப தொழில்நுட்பங்கள் விளக்கம் தொழில்நுட்பம்
5. அமைதியும் குடியிருப்ப
6. விளக்கம் விளக்கம்
7. காட்சியும் தொழில்நுட்ப தொழில்நுட்பம்

TOTAL: 30 PERIODS

தமிழ் தொழில்நுட்பத்துறை / பதிகத்துறை
1. தமிழ் விளக்கம் தொழில்நுட்பத்துறை (Tamil Virtual University) - www.tamilvu.org
2. தமிழ் விக்கிப்பீட்டுவர் (Tamil Wikipedia) -https://ta.wikipedia.org
3. டர்மபுர அணித அமைப்பிடம்
4. வோச்வியல் கல்லூரிக்கழகம்
   - நூர்பூர் பல்கலைக்கழகம், சென்னை
5. வளர்சித் கல்லூரிக்கழகம்
   - நூர்பூர் மாநிலாட்சிக் கடை (thamilvalarchithurai.com)
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