SEMESTER I

15EA01/15EE01/15ED01/15EM01

SYSTEMS ENGINEERING MATHEMATICS

2 2 0 3

CALCULUS OF VARIATIONS: Introduction **-** Variational problems of fixed boundaries: Variations and its properties - simplest variational problems – Euler equation – Brachistochrone problem – Variational problems involving several unknown functions – Functional involving first and second order derivatives. (6+6)

VECTOR SPACES: Real vector spaces, subspaces, linear independence – basis and dimension of a vector space – row space, column space and null space - inner product space, orthonormal bases, Gram-Schmidt process. Best approximation: Least squares. (7+7)

LINEAR TRANSFORMATION: Introduction to linear transformations – linear transformations, kernel and range – matrices of linear transformations. (2+2)

STOCHASTIC PROCESSES: Introduction – classification of Stochastic processes. Markov chain: Introduction - transition probability matrices – Chapman Kolmogorov equations - classification of states, limiting probabilities, Poisson process - continuous time Markov chains, Chapman Kolmogorov equations. (6+6)

GRAPH THEORY: Basic concepts**:** Graphs - directed and undirected, subgraphs, graph models, degree of a vertex, degree sequence, Hand-shaking lemma. Walk, trail, path, connectedness, distance, diameter - common classes of graphs, regular, complete, petersen, cycle, path, tree, k-partite, planar, hypercube, mesh- Isomorphic graphs - representation of graphs, adjacency list, incidence list , adjacency matrix and incidence matrix, Spanning trees – Matrix tree theorem (statement only) – Minimum spanning tree using Prim's and Kruskal's algorithms. (6+6)

FINITE ELEMENT METHOD: The Rayleigh-Ritz method, the Collocation and Galerkin method - Finite element method - ordinary differential equations. (3+3)

Total L: 30 + T: 30 = 60

REFERENCES:

1. Elsgolts .L, "Differential Equation and Calculus of Variation", MIR Publication, Moscow, 1977.
2. Howard Anton and Chris Rorres, "Elementary Linear Algebra : Applications Version", Wiley India, New Delhi, 2010.
3. Saeed Ghahramani, "Fundamentals of Probability with Stochastic processes", Pearson, Prentice Hall, New Jersey, 2012.
4. Curtis F, Gerald & Patrick O Wheatly, "Applied Numerical Analysis", Pearson Education, New Delhi, 2011.
5. Narsingh Deo, "Graph Theory with Applications to Engineering and Computer Science", Prentice Hall, New Delhi, 2005.
6. Yellen J and Gross J, "Graph Theory and its Applications", Chapman & Hall, Boca Raton, 2006.

15EA02 FUNDAMENTALS OF LINEAR SYSTEMS AND SIGNAL PROCESSING

3 0 0 3

MODERN CONTROL THEORY: Limitations of conventional control theory - Concepts of state, State variables and state model - state model for linear time invariant systems: State space representation using physical-Phase and canonical variables - Transfer function from state model - State space representation of discrete system. (9)

SYSTEM RESPONSE: Solution of state equation - State transition matrix computation - solution of discrete time system - state transition matrix - Discretisation of continuous time state equations. (8)

CONCEPTS OF CONTROLLABILITY AND OBSERVABILITY: Kalman's and Gilbert's tests - Controllable and observable phase variable forms - Effect of pole-zero cancellation on controllability and observability. (4)

SPECTRAL ANALYSIS OF SYSTEMS: Fourier Series and Fourier Transform – - Discrete Fourier Transform (DFT) – Properties - FFT Algorithms – Linear Convolution and Circular Convolution – FFT Applications (9)

DESIGN OF DIGITAL FILTERS: Characteristics of IIR and FIR filters - Design techniques for analog filters-frequency transformation-Digital IIR filter design: impulse invariant and bilinear transform methods - FIR filter design using Window functions - Realization structures of filters: direct, cascade and parallel forms. (10)

FINITE WORD LENGTH EFFECTS: A/D quantization noise – Product round off errors - Finite word length effects in IIR and FIR filters. (5)

Total L: 45

REFERENCES :
1. Gopal M, “Digital Control and State Variable Methods”, Tata McGraw-Hill Publishing Company Limited, New Delhi, India, 2003.
2. Emmanuel C Ifeachor, Barrie W Jervis, “Digital Signal Processing : A practical approach”, Pearson Education, New Delhi, 2004.
3. Katsuhiko Ogata, "Modern Control Engineering", Prentice Hall of India Private Ltd., New Delhi, 2002.
4 Nagrath I.J. and Gopal M., "Control Systems Engineering", New Age International Publisher, New Delhi, 2006.
5. Nise S. Norman, “Control Systems Engineering”, John Wiley & Sons, Inc, Delhi, 2000.

15EA03 / 15EE03 / 15ED04 MICROCONTROLLERS AND APPLICATIONS

3 0 0 3

INTEL 8051 : Architecture of 8051 - Memory organization - Register Banks - Bit addressable area - SFR area – Addressing modes – Instruction set - Programming examples. (9)

8051 Interrupt structure -Timer modules - Serial features - Port structure - Power saving modes - MCS51 Family features: 8031/8051/8751. (7)

TYPICAL APPLICATIONS: Stepper Motor Control - DC Motor Control – Servo motor control - AC Power Control. (6)

ARM PROCESSORS: ARM Programmer’s Model – Registers – Processor Modes – State of the processor – Condition Flags – ARM Pipelines – Exception Vector Table – ARM Processor Families – Typical 3 stage pipelined ARM organization–Introduction to ARM Memory Management Unit. (9)

ARM Addressing Modes – ARM Instruction Set Overview – Thumb Instruction Set Overview – LPC210X ARM Processor Features. (7)

MICROCONTROLLER DEVELOPMENT TOOLS: Compiler – Assembler – Linker/Locator – Intel Hex file format – Emulators: ROM Emulators – In-circuit Emulators – Logic Analyzer. (7)

Total L: 45

REFERENCES:
1. "8-bit Embedded Controllers", Intel Corporation, 1990.
2. William Hohl “ARM Assembly Language Fundamental and Techniques” CRC Press Taylor & Francis, 2009.
3. Andrew Sloss, “ARM System Developer’s Guide”, Morgan Kaufmann Publishers, 2005.
4. Steve Furber, “ARM System-on-Chip Architecture”, Pearson Education, 2009.
5. “ARM7TDMI Technical Reference Manual”, ARM Ltd., UK, 2004.
6. David E Simon “An Embedded Software Primer”, Pearson Education, 2007 .

15EA04 / 15EE05 DIGITAL SYSTEM DESIGN AND TESTING

3 0 0 3

REVIEW OF DIGITAL SYSTEM DESIGN: Designing combinational circuit using multiplexer, decoder – Finite State Machines – Mealy Machine- Moore Machine – State Diagram – State table (3)

SYSTEM DESIGN USING PLDS: Basic concepts – Programming technologies - Programmable Logic Element (PLE) - Programmable Array Logic (PLA) - Programmable Array Logic (PAL) – Programmable Logic Architectures – 16L8 – 16R4 – 22V10 – - Design of combinational and sequential circuits using PLDs – Complex PLDs (CPLDs) –Xilinx cool runner architecture - Design of state machines using Algorithmic State Machines (ASM) chart as a design tool. (6)

FIELD PROGRAMMABLE GATE ARRAYS: Types of FPGA - Xilinx XC3000 series - Logic Cell Array (LCA) – Configurable Logic Blocks (CLB) - Input/Output Blocks (IOB) - Programmable Interconnection Points (PIP) - Xilinx XC4000 Series – FPGA – Design examples. (7)

INTRODUCTION TO VHDL: Design process flow - Software tools – Hardware Description Languages – VHDL : Data Objects - Data types - Operators – Entities and Architectures – Components and Configurations – Concurrent signal assignment – Conditional signal assignment - Selected signal assignment – Concurrent statements – Sequential statements – Transport and Inertial delays – Delta delays – Behavioral, Data flow and Structural modeling – Attributes – Generics – Packages and Libraries – Multivalued logic and Signal resolution – IEEE 1164 std logic – Subprograms: Functions and Procedures – Design examples. (10)

FAULT MODELING: Defects, errors, faults, Levels of Fault models, Types, Fault Detection in Combinational Logic circuits: Path sensitization method, Boolean difference method. Fault Detection in sequential logic circuit, Design for Testability: Scan path Testing, Boundary Scan Test, Built in Self Test. (12)

FAULT - TOLERANT SYSTEMS: Fault avoidance and fault - tolerance - Techniques of fault - tolerance - Hardware fault - tolerance : Static, Dynamic and Hybrid redundancy - Fault - tolerance in memories. Software Fault - tolerance : Design of fault tolerant software - N-version programming - Recovery block - Reliability models for fault tolerant software. (7)

Total L: 45

REFERENCES:

1. Palmer, J.E., Perlman, D.E., "Introduction to Digital Systems",Tata McGraw Hill, New Delhi, Reprint 1996.
2. Nelson, V.P., Nagale, H.T., Carroll, B.D., and Irwin, J.D., "Digital Logic Circuit Analysis and Design", PrenticeHall International, Inc., New Jersey, 1995.
3. Bhaskar J., " A VHDL Primer", Prentice Hall of India learinng,2012.
4. Charles H Roth and Lizy Kurian John "Digital Systems Design Using VHDL," Cengage Learning,2013.
5. Michael L Bushnell, Vishwani D Agrawal, "Essentials of Electronic Testing For digital memory and mixed signal VLSI circuits", Springer, 2002.P
6. Pradhan, D K., "Fault - Tolerant Computing - Theory and Techniques", Vol. I & II, Prentice Hall, 1986.

15EA05 VLSI DESIGN

3 0 0 3

OVERVIEW OF VLSI DESIGN METHODOLOGY: VLSI design process - Architectural design - Logical design - Physical design - Layout styles - Full custom - Semicustom approaches. (4)

REVIEW OF MOS FIELD EFFECT TRANSISTORS : Introduction to MOS devices – n channel and p channel MOS transistors – Types – Symbol and Physical operation of enhancement type transistors, current – voltage characteristics – symbol and physical operation of depletion type transistor, current – voltage characteristics. (4)

BASIC ELECTRICAL PROPERTIES OF MOS AND CMOS CIRCUITS : MOS transistor - Threshold voltage equations - Basic DC equations - Second order effects - MOS models - Small signal AC characteristics - NMOS inverter - Depletion mode and enhancement mode pull ups – CMOS inverter - DC characteristics - Inverter delay - Pass transistor - Transmission gate – Power consumption in CMOS gates – Static dissipation – Dynamic Dissipation. (7)

VLSI FABRICATION TECHNIQUES : An overview of wafer fabrication – Wafer processing - Oxidation - Patterning - Diffusion - Ion implantation - Deposition – Silicon gate NMOS process - CMOS processes - NWell - PWell - Twintub - Silicon on insulator - CMOS process enhancements - Interconnect - Circuit elements- Latch up - Latchup prevention techniques. (7)

LAYOUT DESIGN RULES : Need for design rules - Mead Conway design rules for the silicon gate NMOS process - CMOS based design rules -Simple layout examples - Sheet resistance - Area capacitance - Wiring capacitance - Driving large capacitive loads. (6)

LOGIC DESIGN : Switch logic - Pass transistor and transmission gate based design - Gate logic - Inverter - Two input NAND gate - NOR gate - Other forms of CMOS logic – Dynamic CMOS logic - Clocked CMOS logic - Precharged domino CMOS logic - Structured design - Simple combinational logic design examples - Parity generator - Multiplexers – Clocked sequential circuits - Two phase clocking - Charge storage - Dynamic register element - NMOS and CMOS - Dynamic shift register - Semistatic register - JK flip flop circuit. (9)

SUBSYSTEM Design Process : General arrangement of a 4-bit arithmetic processor - Design of a 4bit shifter - Design of a ALU subsystem - Implementing ALU functions with an adder - Carry look ahead adders - Multipliers - Serial parallel multipliers – Pipelined multiplier array – Modified Booth's algorithm. (8)

Total L: 45

REFERENCES:

1. Kamran Eshraghian, Douglas A Pucknell, and Sholeh Eshraghian, "Essentials of VLSI Circuits and Systems", Prentice Hall of India, New Delhi, 2005.
2. Neil H E West and Kamran Eshranghian, "Principles of CMOS VLSI Design: A System Perspective", Addision-Wesley, 2004.
3. Sung-Mo Kang and Yusuf Leblebici," CMOS Digital Integrated Circuits",Tata McGraw-Hill,, New Delhi,2008.
4. Jan M Rabaey, Chandrasekaran A and Nikolic B, "Digital Integrated Circuits," Pearson Education,, 2004.
5. Amar Mukherjee, "Introduction to nMOS and CMOS VLSI System Design", Prentice Hall, USA, 1986.
6. WayneWolf," Modern VLSI Design: Systems on Chip Design" , Pearson Education Inc., Indian Reprint, 2007.

15EA51 CIRCUITS AND SYSTEMS SIMULATION LABORATORY

0 0 4 2

LIST OF EXPERIMENTS:

1. Simulation of CMOS Digital Circuits using PSPICE
2. Simulation of CMOS Analog circuits using PSPICE

3. Generation of Basic Signals and Basic Operations on Signals using MATLAB
4. Simulation of Digital Circuits using Xilinx ISE
5. Time response analysis of state space systems using SIMULINK
6. Mini Project

Total P: 60

15EA61 INDUSTRIAL VISIT AND TECHNICAL SEMINAR

0 0 4 2

The student will make atleast two technical presentations on current topics related to the specialization. The same will be assessed by a committee appointed by the department. The students are expected to submit a report at the end of the semester covering the various aspects of his/her presentation together with the observation in industry visits. A quiz covering the above will be held at the end of the semester.

Total P: 60

SEMESTER II

15EA06 ANALOG VLSI DESIGN

3 0 0 3

ANALOG CIRCUIT BUILDING BLOCKS: Switches, Active Resistors, Current Sources and Sinks, Current Mirrors – Simple. Wilson, Cascode, Folded – Cascode. Voltage and Current References – General biasing circuits for analog design – Supply Independent biasing, Temperature independent biasing, Bandgap voltage references , Comparators, Multipliers (10)

CMOS SINGLE STAGE AMPLIFIERS : MOS inverting amplifier, Improving the performance of inverting amplifer. Single stage MOS amplifiers. T- CS stage, CG stage , Source Follower, Frequency response of amplifiers (8)

CMOS MULTI STAGE AMPLIFIERS: Cascode and Folded cascode stage, Current amplifiers, output amplifiers, Differential amplifiers, CMOS operational amplifiers, uncompensated and compensated Op Amps, Noise performance of OpAmps, OpAmp design techniques with examples. High performance CMOS OpAmps. (9)

ACTIVE FILTERS & SWITCHED CAPACITOR FILTERS: Active RC Filters for monolithic filer design: First & Second order filter realizations - universal active filter (KHN) - self tuned filter - programmable filters - Switched capacitor filters: Switched capacitor resistors. (8)

DATA CONVERTERS: Data Converter fundamentals, DAC Architectures: Current Switched, Resistive, charge redistribution, Hybrid, Segmented D/A Converters. ADC architectures: Flash, Pipeline, Integrating, Successive Approximation and folding A/D Converters. (10)

Total L : 45

REFERENCES:

1. Phillip Allen and Douglas Holberg, “CMOS Analog Circuit Design”, Oxford University Press, 2000, 3rd Edition, September, 2011.
2. Behzad Razavi, “Design of CMOS Integrated Circuits”, Tata McGraw Hill, New Delhi, 2003.
3. Roubik Gregorian, Gabor C. Temes, “Analog MOS Integrated Circuits for Signal processing”, John Wiley & Sons, 2013.
4. Randall L Geiger, Phillip E Allen and Noel R Strader, "VLSI Design Techniques for Analog and Digital Circuits", McGraw Hill, International Edition, 1990.
5. David A Johns and Ken Martin, “Analog Integrated Circuit Design”, John Wiley and Sons, 2002, 2nd Edition, 2011.
6. Jacob Baker R, Lee H W and Boyce D E, “CMOS Circuit Design, Layout and Simulation”, Prentice Hall of India, 1998.

15EA07 / 15ED05 / 15EE08 OBJECT COMPUTING AND DATA STRUCTURES

3 2 0 4

PRINCIPLES OF OBJECT ORIENTED PROGRAMMING: Software Crisis - Software Evolution - Procedure Oriented Programming, Object Oriented Programming paradigm - Basic concepts and benefits of OOP - Object Oriented Language - Application of OOP - Structure of C++ - Applications of C++ - Operators in C++ - Manipulators (4+2)

FUNCTIONS IN C++: Call by Reference - Return by reference - Inline functions - Default, Const Arguments - Function Overloading - Friend Functions - Classes and Objects - Member functions - Nesting of Member functions -Private member functions - Memory allocation for Objects - Static data members - Static Member Functions - Arrays of Objects -Objects as Function Arguments - Friend Functions - Pointers to Members. (5+4)

CONSTRUCTORS: Parameterized Constructor-Copy constructor - Multiple Constructors in a Class – Destructors. (4+2)

INHERITANCE: Defining Derived Classes - Single Inheritance - Making a Private Member Inheritable - Multiple Inheritance - Hierarchical Inheritance – Hybrid Inheritance. (4+4)

POLYMORPHISM: Compile and Run Time Polymorphism – Operator Overloading - Virtual function. (4+4)

DATA STRUCTURES: Abstract data Types - Primitive data structures - Analysis of algorithms - Best, worst and average case time complexities – Notation. (4+0)

ARRAYS: Operations - Implementation of one, two, three and multi dimensioned arrays - Sparse and dense matrices - Applications. (4+3)

STACKS: Primitive operations - Sequential implementation - Applications: Subroutine handling, Recursion. (4+3)

QUEUES: Primitive operations - Sequential implementation - Dequeues - Applications: Job Scheduling. (4+3)

LISTS: Primitive Operations - Singly linked lists, Doubly linked lists, Circular lists – Applications: Addition of Polynomials, Sparse Matrix representation and Operations - Linked Stacks - Linked queues. (5+3)

SORTING: Insertion sort - Selection sort - Bubble sort - Radix sort - Algorithms and their time complexities. (3+2)

Total L: 45 + T: 30 = 75

REFERENCES:

1. Stanley B Lippman, Josee Lajoie and Barbara E Moo, “The C++ Primer”, Pearson Education, New Delhi, 2009.
2. Sahni Sartaj, "Data Structures, Algorithms and Applications in C++", Universities Press, Hyderabad, 2005.
3. Aaron M Tanenbaum, Moshe J Augenstein and Yedidyah Langsam, "Data structures using C and C++", Pearson Education, New Delhi, 2009.
4. Harvey M Deitel,and Paul J Deitel, “C++ How to Program”, Prentice Hall, New Delhi, 2010.
5. Herbert Schildt, “C++ - The Complete Reference", Tata McGraw Hill, New Delhi, 2012.
6. Nell Dale, “C++ Plus Data Structures”, Jones & Bartlett, Massachusetts, 2011.

15EA08 / 15EA10 COMPUTER ARCHITECTURE AND PARALLEL PROCESSING

3 0 0 3

REGISTER TRANSFER LANGUAGE AND MICRO-OPERATIONS: Register transfer language – Inter-register transfer –- Arithmetic micro - operations – Logic micro-operations – Shift micro-operations – Control functions. (3)

DATAPATH AND CONTROL:– Data path Organisation - Binary arithmetic unit – BCD arithmetic unit – Floating point arithmetic unit – Processor bus configuration – Data transfer and manipulation – Hardwired and micro-programmed control. (5)

MEMORY UNIT: Memory hierarchy – Main memory – Back-up storage units – Multiple module memories – Interleaved memory – Associative memory - Virtual memory systems – Structure – Paging – TLB – Segmentation – Replacement strategies – Cache memory: Basic cache structure – Direct, fully associative and set associative mapping – Replacement policies – Multiple caches – Memory management hardware. (7)

INPUT-OUTPUT UNIT: Characteristics of I/O subsystem – Interrupt mechanisms and special hardware – Direct Memory Access – I/O processors and I/O channels – Asynchronous data transfer. (5)

PARALLEL PROCESSING: Basic uniprocessor architecture – Parallel processing mechanisms – Levels of parallelism – Balancing of subsystem bandwidth – Parallel computer structures – Architectural classifications – Parallel processing applications. (3)

PIPELINING AND OTHER HIGH PERFORMANCE ARCHITECTURES: Linear pipelining – Pipeline processors – Instruction and Arithmetic pipelines – Organization of pipelined units – Instruction pre-fetch and branch handling – Pipeline hazards – Reducing branch penalties – Branch prediction strategies – Vector processing: requirements and characteristics – Superscalar Architecture – VLIW Architecture. (5)

ARRAY PROCESSING: SIMD array processors– Masking and data routing mechanisms – Parallel algorithms for array processors: SIMD Matrix multiplication – SIMD Interconnection networks – Associative array processing. (6)

MULTIPROCESSOR ARCHITECTURE: Functional structures: Loosely and Tightly coupled Multiprocessors – Processor characteristics for multiprocessing – Symmetric Multiprocessors (SMP) – Non Uniform Memory Access (NUMA) – Interconnection structures for multiprocessors – Cache coherence – Thread level parallelism – Multithreading – Clusters. (7)

RISC ARCHITECTURE: Main characteristics of RISC architectures – RISC-CISC trade-offs – RISC pipelining. (4)

Total L : 45

REFERENCES :

1. Mano, M.M., "Computer System Architecture", Prentice Hall of India, 3rd Edition, 1993.
2. Kai Hwang and Faye A Briggs., "Computer Architecture and Parallel Processing", McGraw Hill Book Company, 1985.
3. Stallings W., "Computer Organisation and Architecture – Designing for performance", Prentice Hall of India, 2006.
4. John Hennessy and David Patterson, "Computer Architecture: A Quantitative approach", Morgan Kaufmann Publishers, 2007.
5. Dezso Sima, Terence Fountain, Peter Kacsuk, "Advanced Computer Architectures: A Design Space Approach" Addison Wesley, 1997.
6. Moreshwar R.Bhujade, " Parallel Computing", New Age International Pvt. Ltd., 1995.

15EA09 / 15EE25 ADVANCED DIGITAL SIGNAL PROCESSING

3 0 0 3

MULTIRATE DIGITAL SIGNAL PROCESSING: Decimation by an integer factor-Interpolation by an integer factor-Sampling rate conversion by rational factor-Decimation with poly phase filters-Interpolation with poly phase filters – Multistaging – Realization of Transversal and Polyphase Decimation and Interpolation Filters. (10)

TWO CHANNEL FILTER BANKS: Analysis and Synthesis Filter Banks-Quadrature Mirror Filter (QMF) banks-Filter bank with perfect reconstruction- Paraunitary filter banks -Biorthogonal and Linear phase filter banks-Transmultiplexer filter banks. (9)

UNIFORM - M - CHANNEL FILTER BANKS: Filter banks with tree structures, parallel structure-Complex modulated filter banks-Cosine modula ted filter banks-Transmultiplexer filter banks-Polyphase QMF banks – Paraunitary polyphase and DFT polyphase filter banks-Subband coding. (10)

WAVELET TRANSFORM: Short-Time Fourier Transform – limitations - time-frequency scaling- Heisenberg's uncertainty – Continuous Wavelet Transform – Discrete Wavelet Transform – Haar, Daubechy's wavelets – Multi Resolution Analysis of audio signal. (6)

POWER SPECTRUM ESTIMATION: Estimation of spectra from finite duration observation of signals: Periodogram-use of DFT in power spectrum estimation - Non-parametric Methods: Bartlett-Welch-Blackman and Tuckey - Parametric Methods: Unconstrained least squares method. (10)

Total L: 45

REFERENCES:

1. N.J.Fliege, "Multirate Digital Signal Processing" John wiley & sons Ltd., Reprinted with correction, Jan 2000.
2. Fredric J Harris, "Multirate Signal Processing for Communication Systems", Prentice Hall, May 2004.
3. John G Proakis and Dimitris G Manolakis, "Digital Signal Processing-Principles, Algorithms and Applications", Prentice Hall of India, April 2009.
4. Rao, R.M and A.S.Bopardikar,"Wavelet Transforms: Introduction to Theory and Applications, Addison Wesley, Reprint 2003.
5. Soman K.P. and Ramachandran K.I. "Insight into Wavelets-From Theory to Practice", Prentice Hall of India, 2010.
6. Stephane Mallat "A Wavelet Tour of Signal Processing", Published by Elsevier, a division of Reed Elsevier India Private Limited, 2008.

15EA10 EMBEDDED SYSTEM DESIGN

3 0 0 3

EMBEDDED SYSTEMS: Introduction – Embedded systems versus general computing systems – Classification – Major application areas – Core of embedded systems – Memory – Sensors and actuators – Communication interface – Firmware, other system components – Characteristics and quality attributes. (7)

EMBEDDED SYSTEM DEVELOPMENT ENVIRONMENT: The integrated development environment (IDE) – Cross-compilation output – Disassembler/decompiler, simulator and emulator – Debugging, hardware debugging and boundary scan – Hardware-software co-design and program modeling- Issues in co-design – computational models – Introduction to UML – Hardware-software trade-offs. (10)

FIRMWARE DESIGN AND DEVELOPMENT: Firmware design approaches : Super loop based approach, embedded OS based approach – Embedded Firmware Development languages : Assembly language based development, high level language based development, mixing assembly and high level languages – Integration and Testing (6)

SOFTWARE DESIGN ASPECTS: Components of an OS – Tasks/Processes- Scheduling algorithms – Threads-Interrupt handling – Interprocess communication – Task synchronisation –Semaphores-Priority inversion-Real-Time Operating Systems: Types of real-time tasks-Real-time OS- Real-time scheduling algorithms, (10)

PRODUCT DEVELOPMENT: Design tools – Development techniques – Embedded product development cycle (EDLC) – Objectives – Phases –Modeling EDLC – Trends in the embedded industry (8)

DESIGN CASE STUDIES: Smartcard reader – Automated meter reading system – Digital Camera. (4)

Total L: 45

REFERENCES:

1. Shibu K. V., "Introduction to Embedded Systems", Tata McGraw Hill, New Delhi, 2009.
2. Lyla B. Das, "Embedded Systems-An Integrated Approach", Pearson India, 2013.
3. Han-way Huang, "Embedded System Design with C8051", Cengage, New Delhi, 2009.
4. David E Simon, "An Embedded Software Primer", Pearson India, 2008.

15EA52 APPLIED ELECTRONICS LABORATORY

0 0 4 2

LIST OF EXPERIMENTS:

1. Design and Simulation of Digital Circuits using VHDL and Porting them into FPGA.
2. Interfacing using 8051 Microcontrollers
3. Experiments using ARM Processor
4. Interfaces using RS232C Bus
5. Layout of Simple NMOS/CMOS Circuits
6. Mini Project

Total P: 60

SEMESTER III

15EA53 ELECTRONIC SYSTEM DESIGN LABORATORY

0 0 4 2

LIST OF EXPERIMENTS:

1. Study of Dynamically programmed Analog Signal Processers
2. Implementation of Digital Circuit Testing Algorithms using C
3. Applications using DSP Processors
4. Implementation of DSP Algorithms using MATLAB
5. Simple RTOS Experiment to view multitasking using Keil IDE
6. Mini Project

Total P: 60

15EA71 PROJECT WORK – I
IV SEMESTER

15EA72 PROJECT WORK – II

ELECTIVE COURSES

PROFESSIONAL ELECTIVE I (WITH LAB COMPONENT)

15EA21 VIRTUAL INSTRUMENTATION SYSTEMS

3 0 2 3

FUNDAMENTALS OF VIRTUAL INSTRUMENTATION: Concept of Virtual Instrumentation-Block diagram and Architecture of a virtual instrument-Role of Hardware and Software in virtual instrumentation-Comparison of Graphical programming technique with conventional programming technique. (4)

GRAPHICAL PROGRAMMING ENVIRONMENT: Introduction to LabVIEW- Advantages of using LabVIEW in Virtual Instrumentation - Graphical Data Flow programming- Menus and Palettes-Front Panel Controls and Indicators-Block Diagram Functions-Data types in LabVIEW -Developing simple VI's- sub-VI creation-formula nodes – Debugging techniques in LabVIEW. (9)

PROGRAMMING STRUCTURE IN LabVIEW: loops - case and sequence structures –arrays and clusters-graphs and charts- local and global variables- string & file I/O-examples. (10)

DATA ACQUISITION BASICS: ADC, DAC, DIO -counters & timers - PC Hardware structure-timing- Interrupts DMA- software and hardware installation. (4)

COMMON INSTRUMENT INTERFACES: Motion Control- Image Acquisition and Processing- Serial Communication: RS 232C/ RS485- GPIB – system interface buses: USB, PXI and VISA. (8)

ADVANCED LabVIEW FEATURES: Sound VI's**-** VI server-Web server -Web publishing tool- Multithreading in LabVIEW – LabVIEW Interface for Arduino. (5)

OBJECT ORIENTED PROGRAMMING IN LabVIEW: Object Oriented Programming Concepts- LabVIEW classes and objects- Methods: members VI's-Special methods: Constructors and Destructors- Encapsulation- inheritance-Dynamic dispatch. (5)

LAB COMPONENT:

1. Data Acquisition and Processing using LabVIEW
2. Interfacing Ardnino with LabVIEW
3. Web Publishing in LabVIEW
4. System Identification and Control of DC Motor
5. Machine Vision Systems for Automation

Total L : 45 + P : 30 = 75

REFERENCES:

1. Garry W Johnson, "LabView Graphical Programming", Tata McGraw Hill, 2001.
2. Sanjay Gupta and Joseph John, "Virtual Instrumentation Using LabVIEW", Tata McGraw-Hill, 2008.
3. Rick Bitter, Taqi Mohiuddin and Matt Nawrocki, "LABVIEW Advanced Programming Techniques", CRC Press, 2009.
4. Barry Paron, "Sensors, Transducers and LabVIEW", Prentice Hall , 2000.

15EA22 RF CIRCUITS AND MEASUREMENTS

3 0 2 4

PASSIVE RF COMPONENTS AND TRANSMISSION LINE ANALYSIS: High frequency Resistors, Capacitor and Inductors – Transmission Line Analysis: Line equation, Micro strip line, Voltage Reflection Co-efficient, propagation constant phase velocity and special termination - Smith Chart-Impedance transformation - Analysis of parallel RL circuit and parallel RC circuit. (9)

SINGLE AND MULTI PORT NETWORK THEORY AND RF FILTER DESIGN: Definition - properties - interconnection of networks - ABCD parameters and S parameters - RF Filter Resonator and filter configuration - Butterworth and chebyshev filters. Design of micro strip filters. (9)

DESIGN OF MATCHING NETWORK: Matching by Discrete Components - Design of two-component matching network, Design of T and π matching network- Matching by micro strip line - Design of matching network - Design of stub matching. (9)

MEASUREMENTS USING VECTOR NETWORK ANALYZER: Operating principles of VNA-Calibration of VNA- Specification of N and SMA connectors-Inferences of VNA Measurements. (9)

MEASUREMENTS USING SPECTRUM ANALYZER: Operating principles of spectrum analyzer- measurement categories- Characteristics of Spectrum analyzer-applications of spectrum analyzer. (9)

LAB COMPONENT: Design, Simulation, Fabrication and testing of any one of RF passive circuits.(Couplers,filters.)

Total L : 45 + P : 30 = 75

REFERENCES:

1. Reinhold Ludwig and Pavel Bretchko, "RF Circuit Design", Pearson Education Asia Publication, 2011.
2. Matthew M Radmanesh, "Radio Frequency and Microwave Electronics Illustrated", Pearson Education ,Asia Publication, 2001.
3. David M Pozar, "Microwave Engineering", John Wiley and Sons, Inc., 2011.
4. Les Besser and Rowan Gilmore, " Practical RF Circuit Design for Modern Wireless Systems", Vol I, Passive Circuit and Systems, Artech house, London, 2003.

15EA23 INDUSTRIAL DRIVES AND CONTROL

3 0 2 3

CONVERTER FED DC DRIVES: Introduction to Electrical drives, Fundamental torque equations, Speed torque conventions and multiquadrant operation, Components of load torques, Nature and classification of load torques, Single-phase and Three-phase drives: Semi converter, Full converter and Dual converter fed drives. (8)

CHOPPER FED DC DRIVES: Introduction, Chopper control of separately excited and series motor drives - Two quadrant and four quadrant chopper controlled drives – Closed loop control of dc drives. (6)

INDUCTION MOTOR DRIVES: Performance characteristics, Stator Control: Stator voltage control, Rotor voltage control, Frequency control, Voltage and frequency control, Current control, Voltage, current and frequency control - Rotor resistance control: Conventional methods, Static rotor resistance control - Slip power recovery: Static kramer drive, Static scherbius drive. (9)

VECTOR CONTROL OF INDUCTION MOTOR DRIVES: Principle of vector control – Direct vector control - Flux vector estimation – Indirect vector control – Vector control of line-side PWM rectifier – Stator flux oriented vector control. (9)

SYNCHRONOUS AND SPECIAL DRIVES: Synchronous Motor Drives: Open loop volts/hertz control, Self control mode – Permanent magnet ac motor drives, Brushless dc motor drives, Sensorless control - Stepper motor and Switched reluctance motor drives. (8)

MOTOR CONTROL USING FPGA : Digital Block Diagram for Robot Axis Control, Case studies for motor control - stepper motor, permanent magnet DC motor, Brushless DC Motor, Permanent Magnet Synchronous Motor. (5)

LAB COMPONENT :

- Design & Implementation of DSP Processor based Power Electronic Systems
- Modelling and Control of Drives using dSpace.

Total L : 45 + P : 30 = 75

REFERENCES:

1. Gopal K Dubey, “Fundamentals of Electric Drives”, Narosa Publishing House, New Delhi, 2005.
2. Bimal K Bose, “Power Electronics and Variable Frequency Drives - Technology and Application”, IEEE Press, New York, 2011.
3. Ion Boldea and Nasar S A, “Electric Drives”, CRC Press LLC, New York, 2006.
4. Krishnan R, “Electric Motor Drives: Modelling, Analysis and Control”, Prentice Hall of India, New Delhi, 2010.
5. Muhammad H Rashid, “Power Electronics Handbook”, Academic Press, 2001.
6. Rahul Dubey, “Introduction to Embedded System Design Using Field Programmable Gate Arrays”, Springer Publication, 2009.

PROFESSIONAL ELECTIVE

15EA24 ALGORITHM FOR VLSI DESIGN AUTOMATION

3 0 0 3

INTRODUCTION TO DESIGN METHODOLOGIES: VLSI Design problem-The Design Domains-Design methods and Technologies. (4)

ALGORITHMIC GRAPH THEORY AND COMPUTATIONAL COMPLEXITY: Data structures for the representation of graphs - Computational Complexity - Graph Algorithms - Depth first search - Breadth first search - Dijkstra's shortest path algorithm - Prim's algorithm. (8)

PLACEMENT, PARTITIONING AND FLOOR PLANNING: Circuit representation - Types of Placement problem - Iterative Improvement - Partitioning - Kernighan - Lin Partitioning algorithm - Floor Planning - Representation - Shape functions and floor plan sizing. (10)

ROUTING: Local routing problems - Area routing - Channel routing - Global routing. (9)

SIMULATION: Gate level modeling and simulation - Compiler driven simulation - Event driven simulation - Switch-level modeling and simulation. (7)

HIGH LEVEL SYNTHESIS: Hardware models - Allocation - Assignment - Scheduling - Assignment Problem - High level transformation. (7)

Total L: 45

REFERENCES :

1. Sabih H.Gerez, "Algorithms for VLSI Design Automation", John Wiley & Sons, 2011.
2. WayneWolf," Modern VLSI Design: Systems on Chip Design", Pearson Education Inc., Indian Reprint, 2007.
3. Naveed Sherwani, " Algorithms For VLSI Physical Design Automation ", Springer-Verlag, 2010.
4. Sadiq M Sait and Habib Youssef, "VLSI Physical Design Automation", IEEE Press, New York., 2010.
5. Abramovici M, Brever A and Friendman D, "Digital Systems Testing and Testable Design", Jaico Publishing House, 2013.

15EA25 VLSI TESTING AND TESTABILITY

3 0 0 3

TESTING AND TESTABLE DESIGN OF DIGITAL SYSTEMS : Need for testing - Fault models - Fault detection and redundancy - Combinational circuits – Sequential circuits - Fault equivalence - Fault dominance – Logic simulation - Compiler driven Simulation - Event driven Simulation - Fault simulation techniques - Serial, parallel, deductive. (10)

TESTING FOR SINGLE STUCK AT - FAULTS: Test generation algorithms for combinational circuits - Fault oriented ATG – D-algorithm – Examples – PODEM – Fault independent ATG - Random test generation – ATG for SSFs in sequential circuits -TG using iterative array models - Random test generation. (10)

DELAY TEST : Delay test problem – Path delay test – Transition faults – Delay test methodologies. (7)

ANALOG AND MIXED SIGNAL TEST : DSP based analog and mixed signal test – Static ADC and DAC testing methods - Model based Analog and Mixed signal Test - Analog fault models-Analog fault simulation – Analog ATPG (10)

DESIGN FOR TESTABILITY: Adhoc design for testability techniques - Controllability and Observability by means of scan registers – Storage cells for scan designs – Level Sensitive Scan Design - LSSD - Partial Scan – Boundary scan – BIST concepts and architectures. (8)

Total L: 45

REFERENCES:

1. Abramovici M., Brever A., and Friedman D., "Digital Systems Testing and Testable Design", Jaico Publishing House, 2013.
2. Michael L Bushnell and Vishwani D Agarwal, “Essentials of Electronic Testing for Digital, Memory and Mixed Signal Circuits”, Springer, 2002.
3. Stanley L Hurst “VLSI Testing : Digital and Mixed Analogue Digital Techniques”, Institute of Electrical Engineers,1998.
4. Xiaoqing Wen, Cheng Wen Wu and Laung Terng Wang “VLSI Test Principles and Architectures: Design for Testability”, Morgan Kaufmann, 2011.
5. Parag K Lala, “Fault Tolerant and Fault Testable Hardware Design” BS Publications, 2002.

15EA26 MIXED SIGNAL VLSI DESIGN

3 0 0 3

INTRODUCTION TO ACTIVE FILTERS AND SWITCHED CAPACITOR FILTERS: Active RC Filters for monolithic filer design : First and Second order filter realizations - Universal active filter (KHN) – Self tuned filter – Programmable filters – Switched capacitor filters: Switched capacitor resistors – amplifiers – comparators – sample and hold circuits – Integrator – Biquad. (9)

CONTINUOUS TIME FILTERS & DIGITAL FILTERS: Introduction to Gm - C filters - bipolar transconductors - CMOS Transconductors using Triode transistors, active transistors - BiCMOS transconductors – MOSFET C Filters - Tuning Circuitry - Dynamic range performance - Digital Filters: Sampling – decimation – interpolation - implementation of FIR and IIR filters. (8)

SIGMA DELTA CONVERTERS: Over sampled converters - over sampling without noise & with noise - implementation imperfections - first order modulator - decimation filters - second order modulator - sigma delta DAC & ADC’s. (8)

PHASE LOCKED LOOPS: Simple PLL, Charge Pump PLL, Non-ideal effects in PLLs, Applications. (7)

ANALOG AND MIXED SIGNAL EXTENSIONS TO VHDL: Introduction - Language design objectives - Theory of differential algebraic equations - the 1076 .1 Language - Tolerance groups - Conservative systems - Time and the simulation cycle - A/D and D/A Interaction - Quiescent Point - Frequency domain modeling and examples. (8)

MIXED LAYOUT: CMOS design rules – Layout of CMOS – BJT – Capacitors – Resistors – Mixed layout issues: Floor planning, power supply and ground, fully differential matching, Guard rings and shielding. (5)

Total L : 45

REFERENCES:

1. David A Johns and Ken Martin, “Analog Integrated Circuit Design”, John Wiley and Sons, 2002, 2nd Edition, 2011.
2. Rudy van de Plassche “Integrated Analog-to-Digital and Digital-to-Analog Converters”, Springer, 2007.
3. Antoniou, “Digital Filters Analysis and Design”, Tata McGraw Hill, 1998, 2nd Edition, September 2004.
4. Phillip Allen and Douglas Holberg “CMOS Analog Circuit Design”, Oxford University Press, 2000, 3rd Edition, September 2011.
5. Benhard Razavi, “Data Converters”, Kluwer Publishers, 1999.
6. JacobBake R, Harry W Li, and David E Boyce “CMOS, Circuit Design Layout and Simulation”, Wiley- IEEE Press, 1st Edition Aug, 1997.
7. Tsividis Y P, “Mixed Analog and Digital VLSI Devices and Technology”, Mc-Graw Hill, 1996.

15EA27 HARDWARE DESIGN VERIFICATION TECHNIQUES

3 0 0 3

HARDWARE DESIGN VERIFICATION : Introduction – Testing Versus Verification – Design and Verification reuse. (2)

VERIFICATION TECHNIQUES : Techniques based on simulation – Analytical and Formal approaches – Function verification – Timing verification – Formal verification – Basic of equivalence checking and model checking. (8)

VERIFICATION TOOLS : Linting Tools – Simulators – Waveform viewers – Code Coverage – Functional Coverage – Metrics. (9)

VERITIFCATION PLAN : Levels of verification – Verification Strategies – Test cases – Test benches. (9)

STIMULUS AND RESPONSE : Reference signals – Simple stimulus – Simple output – Complex Stimulus and response – Transaction Level Interface. (9)

ARCHITECTING TEST BENCHES : Test Hardness – VHDL Test Hardness – Design Configuration – Self Checking Test benches – Directed stimulus – Random stimulus – VHDL configuration management. (8)

Total L: 45

REFERENCES:

1. Janick Bergeron, “Writing Test Benches: Functional Verification of HDL Models” Springer 2003.
2. Andreas Meyer, “Principles of Functional Verification” Newnes, 2009.
3. Samir Palnitkar, “Design Verification with e”, Pearson Education, 2008.
4. Thomas Kropf “Introduction to Formal Hardware Verification”, Springer Verlag, 1999.
5. M Kerrel Iran and Robert P Kustbern, “Verification of Digital and Hybrid Systems”, Springer Verlag, 2000.

15EA28 / 15EE37 SYSTEM ON CHIP

3 0 0 3

INTRODUCTION: System trade offs and evolution of ASIC Technology – System on chip concepts and methodology – SoC design issues – SoC challenges and components. (5)

DESIGN METHODOLOGIC FOR LOGIC CORES : SoC Design Flow – On-chip buses – Design process for hard cores – Soft and firm cores – Designing with hard cores, soft cores – Core and SoC design examples. (10)

DESIGN METHODOLOGY FOR MEMORY AND ANALOG CORES : Embedded memories – Simulation modes – Specification of analog circuits – A to D converter – D to A converter – Phase-located loops – High speed I/O (10)

DESIGN VALIDATION : Core level validation – Test benches- SoC design validation – Cosimulation – Hardware/software coverification. (10)

SOC TESTING : SoC Test issues – Testing of digital logic cores – Cores with boundary scan – Test methodology for design resuse – Testing of microprocessor cores – Built in self test method – Testing of embedded memories. (10)

Total L: 45

REFERENCES:

1. Rochit Rajsuman, “System-on-a-chip: Design and Test”, Artech House, London, 2000.
2. Laung-Terng Wang, Charles E Stroud and Nur A Toubq, “System on Chip Test Architectures: Nanometer Design for Testability”, Morgan Kaufmann, 2008.
3. Wgel Badawy, Graham A Jullien, “System-on-Chip for Real-Time Applications”, Kluwer Academic Press, 2003.
4. Rajanish K Kamat, Santosh A Shinde, Vinod G Shelake, “Unleesh the System-on-Chip using FPGAs and Handle C, Spinger 2009.

15EA29 ASIC DESIGN

3 0 0 3

INTRODUCTION TO ASICS, CMOS LOGIC AND ASIC LIBRARY DESIGN: Types of ASICs - Design flow - CMOS transistors CMOS Design rules - Combinational Logic Cell – Sequential Logic cell - Data path logic cell - Transistors as Resistors - Transistor Parasitic Capacitance- Logical effort - Library cell design - Library architecture . (10)

PROGRAMMABLE ASICS :Anti fuse - static RAM - EPROM and EEPROM technology - PREP benchmarks - Actel ACT - Xilinx LCA - Altera FLEX - Altera MAX DC & AC inputs and outputs - Clock & Power inputs - Xilinx I/O blocks. (9)

PROGRAMMABLE ASIC INTERCONNECT, PROGRAMMABLE ASIC DESIGN SOFTWARE AND LOW LEVEL DESIGN ENTRY: Actel ACT -Xilinx LCA - Xilinx EPLD - Altera MAX 5000 and 7000 - Design systems - Logic Synthesis - Half gate ASIC - Schematic entry - Low level design language – Introduction to PLA tools. (10)

LOGIC SYNTHESIS, SIMULATION AND TESTING : VHDL and logic synthesis - types of simulation -boundary scan test - fault simulation automatic test pattern generation. (8)

ASIC CONSTRUCTION, FLOOR PLANNING, PLACEMENT AND ROUTING : System partition - FPGA partitioning - partitioning methods - floor planning - placement - physical design flow - global routing - detailed routing - special routing - circuit extraction - DRC. (8)

Total L: 45

REFERENCES:

1. Smith M.J.S, - " Application - Specific Integrated Circuits " - Addison -Wesley Longman Inc., 2010.
2. Chu P., "FPGA Prototyping by VHDL Examples", Wiley, 2008.
3. Andrew Brown, - " VLSI Circuits and Systems in Silicon", McGraw Hill, 1991.
4. Francis R.J., Rose J., Vranesic Z.G., Brown S.D., "Field Programmable Gate Arrays " - Springer Verleg, 2007.
5. Mohammed Ismail and Terri Fiez, " Analog VLSI Signal and Information Processing ", Mc Graw Hill, 1994.
6. Kung S. Y., Whilo House H. J., Kailath T., " VLSI and Modern Signal Processing ", Prentice Hall, 1985.

15EA30 OPERATING SYSTEMS

3 0 0 3

INTRODUCTION : Objectives and Functions – Evolution and Types of Operating Systems – Structure of Operating System – Components of Computers. (2)

PROCESSES AND THREADS: Process Creation - Process states – Process Description – Process Control Block - process scheduling: Types of Scheduling – Scheduling Criteria – Scheduling Algorithms -Relationship between process and threads – Thread State – Thread synchronization – Types of Threads. (6)

PROCESS SYNCHRONIZATION: Concurrent Processes – Principles of Concurrency – Mutual Exclusion – Software Support – Hardware Support – Operating System support -Deadlock - Deadlock Prevention, Avoidance, and Detection and recovery. (9)

MEMORY MANAGEMENT: Fixed partitioning - Dynamic partitioning – Buddy Systems – Simple paging – Multilevel paging – Inverted paging – Simple Segmentation – segmentation and paging. (6)

VIRTUAL MEMORY MANAGEMENT: Need for Virtual Memory management – Demand Paging - Page Fault Routine – Demand Segmentation – Combined demand segmentation and paging – Page Replacement policies. (6)

FILE MANAGEMENT: Files – File management Systems – File System Architecture – Functions of File Management –Directory Structure – Secondary Storage Management – File Allocation Methods. (7)

I/O MANAGEMENT AND DISK SCHEDULING: Organization of I/O function –Logical Structure of I/O functions – I/O Buffering – Disk I/O – Disk Scheduling algorithms – Disk Cache. (5)

CASE STUDIES: Windows XP, Linux, Android. (4)

Total L : 45

REFERENCES:

1. Silberschatz. A, Galvin. P and Gagne.G, "Operating System Concepts", John Wiley and Sons, Singapore, 2010.
2. William Stallings, "Operating Systems", Prentice-Hall, 2007.
3. Dhamdhere D. M., "Operating Systems- A Concept Based Approach", Tata McGraw Hill, 2006.
4. David A Solomon and Mark E Russinovich, " Inside Microsoft Windows 2000 ", WP Publishers and Distributors,2004.
5. Andrew S. Tanenbaum, "Modern OS", Pearson Education Pvt Ltd., New Delhi, 2007.
6. Rick Rogers, John Lombardo, Zigurd Mednieks, "Android : Application Development", 2011.

15EA31 REAL-TIME EMBEDDED SYSTEMS

3 0 0 3

INTRODUCTION: Introduction to Embedded Systems and Real-Time Embedded Systems – Embedded System Software Development Process–Make Utility- Mapping Executable Images into Target Embedded Systems – Embedded System Initialization - Concept of Super loop Design Approach and Operating System based Approach (9)

REAL-TIME OPERATING SYSTEMS: RTOS Definition – Structure of a Typical RTOS - Key Characteristics of an RTOS – Task Definition – Types of Real-time Tasks- Task States and Scheduling – Typical Task Structure and Operations (8)

SYNCHRONIZATION and COMMUNICATION: Critical Sections – Atomic Operation – Concept of Re-entrancy – Semaphores- Intertask Communication Methods – Shared Memory Technique - Mutex – Mail Box - Message Queues – Pipes – Event Registers, Signals and Condition Variables (9)

EXCEPTIONS AND INTERRUPTS: Introduction to Exceptions and Interrupts – Applications –Processing General Exceptions – Real-Time Clocks and System Clocks – Programmable Interval Timer – Timer Interrupt Service Routines (5)

I/O AND MEMORY: Basic I/O Concepts – The I/O Sub-system – Memory Management – Dynamic Memory Allocation and Fixed-size Memory Allocation in Embedded Systems – Blocking and Non-Blocking Memory Functions – Hardware Memory Management Units (6)

COMMON DESIGN PROBLEMS – Resource Synchronization Problems – Premature Task Deletion – CPU Starvation – Deadlocks – Priority Inversion (5)

APPLICATION MODULARIZATION FOR CONCURRENCY: Need for Concurrency – Pseudo Concurrency and True Concurrency – Outside-In Approach – Guidelines for Identifying Concurrency – Design Example: Mobile Phone (3)

Total L : 45

REFERENCES:

1. Qing Li, “Real-Time Concepts for Embedded Systems”, CMP Books, 2003.
2. Albert Cheng, “Real-Time Systems: Scheduling, Analysis and Verification”, Wiley Interscience, 2002.
3. Hermann Kopetz, “Real-Time Systems: Design Principles for Distributed Embedded Applications”, Kluwer, 1997.
4. Insup Lee, Joseph Leung, and Sang Son, “Handbook of Real-Time Systems”, Chapman and Hall, 2008.
5. Krishna and Kang G Shin, “Real-Time Systems”, McGraw Hill, 2001.

15EA32 LINUX ARCHITECTURE

3 0 0 3

INTRODUCTION: Evolution of Linux OS – Main characteristics of Linux – Typical Linux distributions – Linux directory structure – User and super/root users – access rights – Home directory – Overview of shell and GUI. (9)

LINUX KERNAL ARCHITECTURE: Layer diagram of OS - Hardware Abstraction Layer (HAL) – Memory manager – scheduler – file system – I/O subsystem – Networking subsystem – IPC – user space. (10)

LINUX FILE SYSTEM: Layers of Linux file system – structure of inode – process file system – System programming concepts – API & ABIs – C library and compiler. (8)

DEVICE DRIVER: PC I/O architecture – classification of Linux devices: character and block devices – port I/O – PCI and ISA bus – polling, interrupt, and waiting queue – Device Files - Device driver Registration – Device driver initialization – I/O operation - typical Linux driver – dynamic and static drivers. (11)

System start up (Booting) Methods - kernel modules – Linking and unlinking of modules – On Demand modules linking. (7)

Total L : 45

REFERENCES:

1. Michael beck, Harald bohme, Mirko dziadzka, Ulrich Kunitz "Linux Kernel Programming", Pearson Education, 2002.
2. Raghavan P., Amol Lad, Sriram Neelakandan “Embedded Linux System Design and Development”, Tailor & Francis Group, 2006.
3. Daniel P.Bovet, Marco Cesati “Understanding the Linux kernel”, Shroff publishers & distributors Pvt Ltd, 2005.
4. Robert Love “ LINUX System Programming” Shroff publishers & distributors Pvt Ltd, 2007.
5. Tim jones M. “ GNU/Linux Application Programming”, Wiley Dreamtech india Pvt. Ltd, New Delhi, 2005.

15EA33 ADVANCED MICROPROCESSORS

3 0 0 3

EVALUATION OF 16/32 BIT PROCESSORS : 8086 processor Architecture – Programming model – Memory organization – Interrupt structure – Instruction set. (8)

80X86 PROCESSOR FAMILY : 80286 processor – Functional block diagram – Memory organization – Modes of operation – Real and Protected modes – Address translation techniques – Virtual memory. (9)

80386 PROCESSOR : Basic programming model – Memory organization – Data types – Instruction set - Addressing mode – Address translation – Interrupts – Assembly language programming - 80486 Processor : Architecture and Programming model. (9)

PENTIUM PROCESSOR : Introduction to Pentium processor architecture – Special Pentium Registers – Pentium Memory Management – Introduction to Pentium pro processor – Pentium Pro Special Features, introduction to multicore processor and its features. (10)

INTRODUCTION TO RISC ARCHITECTURES : RISC Versus CISC – RISC Case studies : MIPS R4000 – SPARC – Intel i860 - IBM RS/6000. (9)

Total L : 45

REFERENCES :

1. Barry B Brey, "The Intel Microprocessor 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium and Pentium Pro-Processor, Architecture Programming and Interfacing", Prentice Hall of India, 2009.
2. Intel, "Microprocessors, Vol-I & Vol-II", Intel Corporation, USA, 1992.
3. Daniel Tabak, "Advanced Microprocessors", McGraw Hill Inc., 2012.
4. Mohammed Rafiquzzaman, "Microprocessors and Microcomputer Based System Design", Universal Book Stall, New Delhi, 2001.
5. William Stallings, "Computer Organisation & Architecture: Designing for Performance", Prentice – Hall of India, 2014.
6. Kai Hwang, "Advanced Computer Architecture: Parallelism, Scalability and Programmability", Tata McGraw Hill, 2006.

15EA34 ELECTRONIC PRODUCT DESIGN

3 0 0 3

INTRODUCTION: The basic product development process-product planning-design and engineering-procurement-manufacturing - functionality-performance-user interface-form factor- battery life- cost- time to market (TTM)- reliability-marketing and distribution-service and support. (6)

SYSTEM DESIGN: Top down design-product concept-innovation-creativity- validation -communication-product requirements-system architecture development-trade-off analysis-cost modeling-circuit design-physical and mechanical design-Tolerance and reliability. (6)

ELECTRONIC PACKAGING: IC packaging: Leaded package, TABITCP package**-**COB, flip-chip, BGA, CSP-Discrete components-Board to board connectors-substrates-Escape routing-PCA/module design metrics-Electronic packaging metrics-I/O hardware : buttons, switches, dials and touch screens, speakers , microphones, antennas, and external connectors. (8)

MECHANICAL DESIGN : Housings**-**EMI shielding-Thermal management: High level thermal analysis, thermal issues in notebook computers-mechanical integration-DFMA analysis. (6)

QUALITY IN THE DESIGN PROCESS : Quality control -quality assurance-quality functional deployment-assignment matrices-checklist-quality in the design process-concurrent design-risk analysis-quality in production. (5)

PORTABLE ELECTRONICS : Digital and analog processing: microprocessor, logic devices, microcontrollers, DSP, analog devices, sensors, wireless communication, system memory and mass storage-Displays: Display technologies-LCD-micro display-pen input**-** power sources- Battery technologies: Ni-Cd, alkaline,Ni-MH,lithium ion, lithium polymer, photovoltaic cells, fuel cells-product implementation-high level power analysis-Case study**:** Cellular phones-portable PCs-Personal digital assistants-digital imaging products. (14)

Total L : 45

REFERENCES:

1. Tony Ward and James Angus, "Electronic Product Design", Chapman and Hall publications,1996.
2. Bert Haskell, " Portable Electronics Product Design and Development: For Cellular Phones, PDAs, Digital Cameras, Personal Electronics and More", McGraw-HILL, 2010.

15EA35 / 15EE29 DIGITAL IMAGE PROCESSING

3 0 0 3

DIGITAL IMAGE FUNDAMENTALS: Elements of digital image processing system-Image sensing and acquisition- Image sampling and quantization – Basic relationship between Pixels. (4)

IMAGE TRANSFORMS: Need for image transforms- Discrete Wavelet transform- Harr & Daubechies Wavelets- Sub band coding of images using Harr & Daubechies Wavelets. (4)

IMAGE ENHANCEMENT: Spatial domain methods- Frequency domain methods- Histogram modification techniques- Neighborhood averaging-median filtering- Low pass filtering- averaging of multiple images-images sharpening by differentiation- high pass filtering. (9)

IMAGE FILTERING AND RESTORATION: Image observation models- restoration in the presence of noise only- spatial filtering: mean filters, order statistics filters, adaptive filters- Inverse filtering- Wiener filtering – Constrained least squares filtering- blind deconvolution. (9)

IMAGE SEGMENTATION AND REPRESENTATION : Edge detection: Gradient operators-edge linking and boundary detection: Global processing via Hough transform, Graph theoretic techniques-Thresholding: Global thresholding, adaptive threshold-Representation: Chain codes, Polygonal approximations, Signatures, boundary segments, skeletons-Boundary descriptors: Shape numbers, Fourier descriptors, Statistical moments-Regional descriptors: Texture-Relational descriptors. (11)

IMAGE COMPRESSION: JPEG-MPEG-Quantization: scalar Quantization and vector Quantization-code word assignment: uniform length and variable length codeword assignment – differential pulse code modulation, two channel coders, pyramid coding; hybrid transform coding – wavelet coding (8)

Total L: 45

REFERENCES:

1. Gonzalez R.C. Woods R.E, "Digital Image Processing", Third edition ,Prentice Hall; 2008
2. Jain A.K., "Fundamentals of Digital Image Processing", Prentice Hall of India,2010.
3. Jae S. Lim, "Two-Dimensional Signal and Image Processing", Prentice Hall,Inc.,1990.
4. Kenneth R Castleman, "Digital Image Processing", Prentice Hall International, Inc., 2007.
5. Milan Sonka, VaclauHlavac, Roger Boyle, "Image Processing, Analysis, and Machine Vision", Cengage Learning India Pvt Ltd. Publishing Company, 2014
6. William K.Pratt,"Digital Image Processing", John Wiley & Sons, 2007.

15EA36 DIGITAL VIDEO PROCESSING

3 0 0 3

BASICS OF DIGITAL VIDEO: Representation of digital video-spatial sampling-Temporal sampling-Frames and fields. Video formats-CCIR-601 standard-common intermediate format(CIF)-Quarter common intermediate format(QCIF). (9)

THREE DIMENSIONAL SPATIOTEMPORAL PROCESSING :3D signals and systems-3D Fourier transform-properties-3D sampling and reconstruction-spatial and frequency domain processing. (8)

MOTION ESTIMATION AND MOTION COMPENSATION: Optical flow-Block matching methods-multiresolution motion estimation-subpixel motion compensation-Region based motion compensation. (10)

VIDEO CODING: Overview of coding systems-inter frame and intra frame coding-scalable video coding-video coding standards – H.261,H.263,H.264,MPEG1,MPEG2,MPEG4. (9)

VIDEO ANALYTICS: Object detection 2D and 3D motion tracking-contour based object tracking-feature point based object tracking-Viola Jones algorithm-Bayesian object tracking-video segmentation-mean shift algorithm-Active shape model. (9)

Total L : 45

REFERENCES:

1. Bovik.A.,"The essential guide to video processing", Academic Press,USA,2009.
2. Richard Szeliski,"Computer Vision:Algorithms and Applications",Springer-Verlag,London,2011.
3. Wang.Y.,Ostermann.J and Zhang.Y.Q,"Video Processing and Communications",,Prentice Hall,New Jersey,USA,2002.
4. John W.Woods,"Multidimensional Signal,Image and Video Processing",Academic Press,USA,2012.
5. Iain E.Richardson.G.,"H.264 and MPEG-4 Video Compression",John Willey and Sons,Great Britain,2013.
6. Oge Marques,"Practical Image and Video Processing using MATLAB",Willey-IEEE Press,USA,2011.

15EA37 / 15EE32 WAVELETS AND APPLICATIONS

3 0 0 3

INTRODUCTION: Vector spaces-properties-dot product-basis-dimension, orthogonality and orthonormality-relationship between vectors and signals-signal spaces-concept of convergence-Hilbert spaces for energy signals-Generalized Fourier expansion. (8)

FOURIER ANALYSIS: Fourier Transform-drawbacks of Fourier analysis-Short-time Fourier Transform (STFT) analysis-spectrogram plot-phase-space plot in time-frequency plane-Time and frequency limitations-uncertainty principle-Tilling of the time-frequency plane for STFT. (8)

CONTINUOUS WAVELET TRANSFORM: Wavelet transform-properties-concept of scale and its relation with frequency-Continuous Wavelet Transform (CWT)-scaling function and wavelet functions: Daubechies, Haar, Coiflet, Mexican hat, Sine, Gaussian, Tilling of time scale plane for CWT. (7)

DISCRETE WAVELET TRANSFORM: Discrete Wavelet Transform (DWT)-Filter bank and sub-band coding principles-Multi-resolution analysis-Time scale difference equations for wavelets and scaling functions-Wavelet filters-scale variation in discrete domain-Mallet's algorithm for DWT-Inverse DWT computation by filter banks-multi-band wavelet transform. (9)

ADVANCED TOPICS: Wavelet packets, Bi-orthogonal basis, Lifting scheme of wavelet generation, Multiwavelets, Ridgelets, Curvelets. (6)

APPLICATIONS OF WAVELETS : Sub-band coding of images-Image compression-Image de-noising-Detection of sag, tilt, swells and surge in power signal-Fractal signal analysis. (7)

Total L: 45

REFERENCES:

1. K.P.Soman and K.I.Ramachandran "Insight into Wavelets-From Theory to Practice", Prentice Hall of India, 2010.
2. Rao .R.M and Bopardikar.A.S, "Wavelet Transforms- Introduction to theory and applications", Pearson Education Asia New Delhi, 2003.
3. Strang G Nguyen T., "Wavelets and Filter Banks", Wellesley Cambridge Press, 1996.
4. Vetterli M, Kovacevic J., "Wavelets and Sub-band Coding", Prentice Hall, 1995.
5. Mallat S., "A Tour on Wavelet Signal Processing", Elsevier, New Delhi, December 2008.

15EA38 BIO-MEDICAL SIGNAL PROCESSING

3 0 0 3

BIOMEDICAL SIGNALS: Nature of Biomedical signals, Types: Action Potential, Electroneurogram (ENG), Electromyogram (EMG), Electrocardiogram (ECG), Electroencephalogram (EEG), Event related potentials, Electrogastrogram (EGG), Phonocardiogram (PCG), Speech signals. (6)

FILTERING: Stationary versus non-stationary processes, Time domain filters, Frequency domain filters, Optional filters, Adaptive filters for removal of Interference, Selection of Appropriate filters, Applications. (7)

MODELING BIOMEDICAL SYSTEMS: Parametric System modeling, Autoregressive or All-pole modeling, Pole-zero modeling, Electromechanical Models of Signal Generation, Application: Heart – rate variability – Spectral modeling and Analysis of ECG signals. (6)

ANALYSIS OF NON STATIONARY SIGNALS: EEG rhythms and waves, characterization of nonstationary signals and dynamic systems, Fixed segmentation, Adaptive segmentation. (6)

PATTERN CLASSIFICATION AND DIAGNOSTIC DECISION: Supervised, Unsupervised Pattern classification, Probabilistic models and Statistical Decision, Regression analysis. (6)

COMPRESSION OF DIGITAL BIOMEDICAL SIGNALS: Direct Digital compression Techniques, Transformation Compression Techniques, Other Compression Techniques and Comparison. (7)

ADVANCED TOPICS: Introduction to Wavelet Transforms, Application of Wavelet Transform on Biomedical Signals, Multi Resolution Analysis. Neural Networks in Processing and Analysis of Bio medical Signals, Image Processing Algorithms for MRI Images. VLSI in Biosignal processing. (7)

Total L : 45

REFERENCES:

1. Rangaraj M. Rangayyan, "Biomedical Signal Analysis, A case study Approach," IEEE Press, 2002.
2. Joseph D Bronzino, "The Biomedical Engineering Handbook, CRC Press, IEEE Press, 2000, 3rd Edition, May 2006.
3. D.C. Reddy, "Biomedical Signal Processing, Principles and Techniques",Tata McGraw Hill, New Delhi, 2005.
4. KennethE Banner and Gonzalo R Arce "Nonlinear Signal & Image Processing – Theory methods & Applications" CRC Press, New York, 2003.
5. Metin Akay " Nonlinear Bio Medical Signal Processing' IEEE Press, 2000.
6. Willis J Tompkins, "Bio Medical Digital Signal Processing": C language examples and lab experiments for IBGPC, Prentice Hall PTR, March 1993.

15EA39/15EE40 MEDICAL INSTRUMENTATION SYSTEMS

3 0 0 3

MEDICAL INSTRUMENTATION BASICS: Generalized Systems, Constraints. Classification of Biomedical Instruments, Bio statistics, Generalized static and Dynamic Characteristics, Regulation of Medical Devices. (7)

SENSORS, TRANSDUCERS AND AMPLIFIERS: Resistive, Capacitive, Inductive, Piezoelectric, Thermocouple, Thermistors, Fiber, Optic Sensors, Radiation Sensors, Smart Sensors, Electro Chemical Sensors, Electrical Fibrosensors, Blood-Glucose Sensors.

Operational Amplifiers, Inverting, Noninverting, Differential, Instrumentation Amplifiers, Pre amplifiers, Isolation Amplifiers, Active Filters. (7)

BIOELECTRIC SIGNALS AND ELECTRODES: Origin of Bioelectric Signals, Electrical Activity, Volume Conductor Fields, ECG, EEG, EMG, MEG. Electrode- Electrolyte Interface, Polarizable and Nonpolarizable Electrodes, Electrode Model, Recording Electrodes, Internal Electrodes, Micro Electrodes. (7)

MEASUREMENT SYSTEMS: Patient Monitoring Systems, Measurement of Blood Pressure, Heart Rate, Pulse Rate, Temperature, Heart Sounds, Blood Flow and Volume, Respiratory Systems, Measurements, Cardiac Output Measurement, Blood pH, pO_2 Measurement, Oximeters, Audiometers, Spectrophotometers. (7)

MEDICAL IMAGING SYSTEMS: Information content of an Image, Radiography, Computed Radiography, Computed Tomography, Magnetic Resonance Imaging, Nuclear Medicine, Single Photon Emission Computed Tomography, Positron Emission Tomography, Ultrasonagraphy. (7)

THERAPEUTIC AND PROSTHETIC DEVICES: Cardiac Pacemakers, Defibrillators, Hemodialysis, Lithotripsy, Ventilators, Incubators, Drug Delivery devices, Artificial Heart Valves, Heart Lung Machine, Applications of Laser. (6)

ELECTRICAL SAFETY: Physiological Effects of Electricity, Important susceptibility parameters, Distribution of Electric Power. Macroshock Hazards, Microshock Hazards, Electrical safety codes and Standards, Basic Approaches to Protection against shock, Equipment Design, Electrical Safety Analyzers, Testing. (4)

Total L : 45

REFERENCES:

1. John G.Webster, Editor, "Medical Instrumentation application and Design", John Wiley & Sons, Inc Noida. 3rd Edition, 2001, 4th Edition, Feb 2009.
2. R.S.Khandpur, "Handbook of Biomedical Instrumentation,", Tata McGraw Hill, New Delhi, 2nd Edition, 2003, 3rd Edition, June 2014.
3. Joseph J. Carr and John M. Brown, "Introduction to Biomedical Equipment Technology," Pearson Education, 2003.

15EA40 INTERNET WORKING AND ITS APPLICATIONS

3 0 0 3

INTRODUCTION : Overview of the Internet – Protocol layering – standard client-server models – peer-to-peer paradigm – LAN Fundamentals – Wired LANS : ETHERNET Protocol – Wireless LANS : 1EEE 802.11, Bluetooth, WiMax - Connecting Devices : Repeaters, Hub, Switches, Routers. (8)

INTERNETWORKING: Transport layer introduction – Transport - layer protocols – User Datagram Protocols (UDP) – Transmission Control Protocol (TCP) – Network layer introduction - Network layer protocols : IPV4 Datagram Format, IPV4 Addresses, Forwarding IP packets, ICMPV4 – Unicast Routing - Multicast Routing – Next Generation IP. (11)

NETWORK MANAGEMENT : Areas of Network Management – SNMP – SMI – MIB - ASN.1. (6)

NETWORK SECURITY : Introduction – Confidentiality – Message Integrity - Message Authentication - Digital Signature - Entry Authentication - Key management – Internet Security – Firewalls. (8)

MULTIMEDIA COMMUNICATIONS : Compression – Multimedia data – Multimedia in the Internet – Real-time Interactive protocols - Quality of Service. (7)

NETWORK APPLICATIONS : Electronic Mail : Simple Mail Transfer Protocol (SMTP) – Multipurpose Internet Mail Extension (MIME) – World Wide Web and HTTP – Remote login : Telnet. (5)

Total L: 45

REFERENCES:

1. Behrouz A Forouzan and Firouz Mosharraf, "Computer Network – a Top Down Approach", Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2012.
2. Behraouz A Forouzan, "TCP/IP Protocol Suite", Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2011.
3. Doughlas Comer, "Internetworking with TCP/IP : Principles, Protocols and Architecture", Prentice Hall, New Delhi, 2006.

15EA41 / 15EE30 SOFT COMPUTING

3 0 0 3

FEED FORWARD NETWORKS AND SUPERVISED LEARNING: Fundamentals – Biological neural network – Artificial neuron – Activation function – Learning rules - Perceptron Networks – Adaline – Madaline – Back propagation networks – Learning factors – Linear separability. (6)

SINGLE LAYER FEEDBACK NETWORKS: Hopfield network – Discrete Hopfield networks – Associative memories – Recurrent auto association memory – Bi-directional associative memory – Boltzman machine (6)

UNSUPERVISED LEARNING NETWORKS: Hamming networks – Self-organising feature maps – Adaptive resonance theory network – Instar model – Outstar model – Counter propagation network – Radial basis function networks (8)

CLASSICAL AND FUZZY SETS AND RELATIONS: Properties and Operations on Classical and Fuzzy Sets - Crisp and Fuzzy Relations - Cardinality, Properties and Operations, Composition, Tolerance and Equivalence Relations - Fuzzy Ordering - Simple Problems. (6)

MEMBERSHIP FUNCTIONS: Features of membership function - Standard forms and Boundaries - fuzzification - membership value assignments - Fuzzy to Crisp Conversions - Lambda Cuts for fuzzy sets and relations – Defuzzification methods (6)

APPLICATIONS OF NEURAL NETWORKS AND FUZZY LOGIC: Application of Neural Networks - Pattern Recognition - Image compression – Communication - Control systems - Applications of Fuzzy Logic - Fuzzy Pattern Recognition - Fuzzy Image compression - Fuzzy Logic controllers. (6)

GENETIC ALGORITHMS: Introduction – Terminologies – Genetic operators – Selection, cross-over and mutation – Fitness function – A simple genetic algorithm – Applications. (7)

Total L: 45

REFERENCES:

1. Sivanandam S N, and Deepa S. N., "Principles of Soft Computing", Wiley India (P) Ltd.,New Delhi,2nd Edition, June2011.
2. Sivanandam S N, Sumathi S., and Deepa S. N., "Introduction to Neural Networks using Matlab 6.0", Tata McGrawHill Publications, New Delhi, 20th reprint 2014.
3. Laurene Fausett, "Fundamentals of Neural Networks", Pearson Education India, New Delhi, 2004.
4. Timothy Ross, "Fuzzy Logic with Engineering Applications", McGraw Hill, Singapore, 3rd Edition, 2010.
5. Zimmermann H.J., "Fuzzy set Theory and its Applications", Springer India (P) Ltd, New Delhi, Nov. 2001.
6. David E Goldberg, "Genetic Algorithms in Search, Optimisation and Machine Learning:, Pearson Education, New Delhi, 2004.

15EA42 INTERNET OF THINGS

3 0 0 3

FUNDAMENTALS OF IoT: Introduction to Internet of Things (IoT) – Machine to Machine (M2M) – Functional Characteristics – Recent Trends in the Adoption of IoT – Societal Benefits of IoT (6)

IoT ARCHITECTURE: Functional Requirements - Components of IoT: Sensors – Actuators – Embedded Computation Units – Communication Interfaces – Software Development. (9)

COMMUNICATION PRINCIPLES: RFID – ZigBEE – Bluetooth – Internet Communication- IP Addresses - MAC Addresses - TCP and UDP – IEEE 802 Family of Protocols – Cellular-Introduction to EtherCAT. (12)

SECURITY IN IoT: IEEE 802.11 Wireless Networks Attacks: Basic Types, WEP Key Recovery Attacks, Keystream Recovery Attacks against WEP – RFID Security – Security Issues in ZigBEE: Eavesdropping Attacks, Encryption Attacks – Bluetooth Security: Threats to Bluetooth Devices and Networks. (10)

OVERVIEW OF IoT APPLICATIONS: Health Care – Smart Transportation – Smart Living – Smart Cities- Smart Gri. (8)

Total L:45

REFERENCES

1. Adrian McEwen and Hakim Cassimally, "Designing the Internet of Things", John Wiley and Sons Ltd, UK, 2014.
2. Olivier Hersent, David Boswarthick and Omar Elloumi, "The Internet of Things: Key Applications and Protocols", John Wiley and Sons Ltd., UK 2012.
3. Dieter Uckelmann, Mark Harrison, Florian Michahelles, "Architecting the Internet of Things", Springer, New York, 2011.

4. Johnny Cache, Joshua Wright and Vincent Liu, “Hacking Exposed Wireless: Wireless Security Secrets and Solutions”, Tata McGraw Hill, New Delhi, 2010.
5. Himanshu Dwivedi, Chris Clark and David Thiel, “Mobile Application Security”, Tata McGraw Hill, Nw Delhi, 2010.
6. Vijay Madisetti, Arshdeep Bahga, “Internet of Things (A Hands-on Approach), Universities Press, 2015.

ONE CREDIT COURSE

15EK01 CAD TOOLS FOR VLSI DESIGN AUTOMATION

1 0 0 1

INTRODUCTION TO VLSI DESIGN PROCESS: Design flow – Role of CAD tools in the design process. (3)

DESIGN CAPTURE: Features of Mentor Graphics Design Architect IC a tool for schematic capture, netlisting, simulation setup and results viewing - Creating an Inverter using DA_IC- ELDO simulator. (3)

SIMULATION: Features of Advance MS simulator a tool for verification platform for AMS design and verification - Exercises. (3)

PHYSICAL LAYOUT: Features of the IC Station Tool Suite for full custom IC design flow editing, Schematic-driven layout and top-level floor planning/routing – Exercises. (3)

PHYSICAL VERIFICATION: Features of Calibre LVS for physical verification tool, for layout versus schematic – Exercises. (3)

Total L: 15

REFERENCE :

1. Michael John Sebastian Smith, “Application-Specific Integrated Circuits” Addison-Wesley Publishing Company.
2. WayneWolf," Modern VLSI Design: Systems on Chip Design" , Pearson Education Inc., Indian Reprint, 2007.
3. http://www.mentor.com/products/ic_nanometer_design

15EK02 DIGITAL DESIGN WITH VERILOG HDL

1 0 0 1

INTRODUCTION : Digital Design, Verification, and Hardware description languages. (1)

VERILOG FOR DESIGN: Introduction to Logic Synthesis, Synthesizable Constructs - Inferring Combinational Circuit elements - Inferring Sequential Circuit elements - State Machines - Counters -Encoders/Decoders - Synthesis of Loops - Data Path - Design Partitioning / Methodology - Synthesizable Code-care about, Sensitivity list and Simulation Synthesis mismatch conditions. (3)

VERILOG FOR VERIFICATION: Delay Modeling in Verilog on Briefly behavioral constructions, Fork-join, Events - Clock Generation - Data Generation, Deterministic, Random - Some Systems Tasks - Test Bench Architecture. (2)

DESIGN EXAMPLES: RISC Stored Program Machine - UART Design (2)

Mini Projects Specification and Scope Discussions (3)

Review of Projects - Presentation by student groups (3)
(15 min per student group)

Feedback on the Design Project (1)

Total L : 15

REFERENCE:

1. Michael D. Ciletti, “Advanced Digital Design with the Verilog HDL”, Pearson Education, 2003.
2. Samir Palnitkar, “Verilog HDL: A Guide to Digital Design and Synthesis”, Prentice Hall NJ, USA, 2003.

15EK08 AUTOMOTIVE ELECTRICAL SYSTEM

1 0 0 1

INTRODUCTION: Major components of an Automobile Systems and its functions - Overview of four stroke I.C.engine -Four Cylinder Engine – Spark firing sequence. (2)

AUTOMOBILE ELECTRICAL AND ELECTRONIC SYSTEMS AND COMPONENTS: Block diagram of Automobile electrical system - Typical wiring diagram - Starter system: General layout - Basic starting circuit - Ignition system: Battery and magneto types

- Battery ignition system for four cylinder engine - Ignition system circuit - Distributed ignition coil and ignition advance. Charging system: Typical alternator in common use - cut-out and regulator - Lighting & accessories system - Wiper motor – circuit diagram of wind screen wiper motor and washer. (5)

SENSORS AND ACTUATORS: Physical Variables to be measured in automobiles: Position sensor: Magnetic reluctance and Hall effect sensor - Temperature sensor: Coolant temperature - Speed sensor – Fuel level sensor - Acceleration sensor - Actuator: Principle of solenoid and Fuel injector. (4)

DIAGNOSTICS AND COMMUNICATION BUS: Block diagram of Engine control unit **-**Diagnostics procedure: Introduction – Diagnostics theory – On board and Off-board diagnostics – Diagnostics Link Connector – Vehicle condition monitoring - CAN bus - topology – Data transmission – CAN Protocol – Overview of CAN controller - LIN bus: overview – Data Transmission System – LIN protocol. (4)

Total L : 15

REFERENCES:

1. Tom Denton, “Automobile Electrical and Electronics systems”, Routledge Taylor & Francis Group London & New York, 2002.
2. KK Jain , RB Sharma “Automobile engineering”, Tata McGraw Hill Publications, 2011
3. William B. Ribbens, Norman P. Mansour, “Understanding of Automotive Electronics”, Butterworth-Heinemann, United Kingdom 2003.
4. “Automotive Electrics / Automotive Electronics - Ed5”, Robert Bosch GmbH, 2004.
5. EdMay, “Automotive Mechanics Vol -2”, McGraw Hill Publications, Australia 2004.
6. Ronald K.J, “Automotive Electronics Handbook”, McGraw Hill Publications, USA, 2009.

15EK11 FIELD PROGRAMMABLE ANALOG ARRAY FOR ANALOG SYSTEM DESIGN

1 0 0 1

INTRODUCTION: Overview of Analog Design - Introduction to Field Programmable Analog Array (FPAA) and its advantages - Role of EDA tool in Analog Design process. (2)

CONFIGURABLE ANALOG MODULES: Introduction to Anadigm`s inbuilt Analog Functions (CAM) - Generation of Clock Signals - Signal Delay - Performance of CAM. (3)

SIMULATION and PHYSICAL REALIZATION: Features of ANADIGMDESIGNER2 EDA tool for simulating the analog design- Configuring the FPAA with analog design - Real time verification. (2)

FPAA IO INTERFACING: Interfacing of input and output signals to the FPAA - Rauch Filter - Output Buffer. (2)

STATIC CONFIGURATION: Full Wave Rectifier - Tone Generation and Notch filter - Voltage Controlled Oscillator - Pulse Width Modulation - Phase Detector. (3)

DYNAMIC RECONFIGURATION: Reconfigurable Analog design using FPAA, Various methods of Reconfiguration - Real time verification. (3)

REFERENCES:

1. Thomas L. Floyd “Electronic devices Conventional Current Version” Pearson Education Ltd, Ninth Edition, 2012.
2. Thomas L. Floyd “Instructor’s Resource Manual to Accompany Electronic Devices” Pearson Education Ltd, Eighth Edition, 2008.
3. Thomas L. Floyd “Electronic Devices” Pearson Education Ltd, Eighth Edition, 2008.
4. www.anadigm.com **–** Anadigm’s official website.

15EK12 AUTOMOTIVE SOFTWARE TESTING

1 0 0 1

BASICS OF AUTOMOTIVE SOFTWARE TESTING: Introduction – Conventional Software Testing Vs Automotive Software Testing - Need for Automotive Software Testing - Major recalls and impact of recalls – Case study. (3)

FUNDAMENTALS OF SOFTWARE TESTING: Basics of Software Development Life Cycle – Model Based - Modular - Reusable Design - Static Analysis, Dynamic Analysis - Code Coverage including MC/DC (Modified Condition/Decision Coverage) and LCSAJ (Linear Code Sequence and Jump) - Data Flow and Control Flow analysis- Unit/System/Integration Testing - Code Quality - Software Quality metrics - test management - Importance of using qualified software for software testing. (6)

CODING STANDARDS: Coding Standards - important - Coding Standard for Automotive Industry – MISRA C: 2012 with Security Amendments - Top 10 secure coding best practices - Advantages of adhering to coding standards. (3)

PROCESS STANDARD: Introduction to ISO 26262 – Functional Safety Standard - Details about ASIL (Automotive Safety Integrity Level) - Details about Part 4 and Part 6 of ISO 26262 – Failure Mode Effective analysis (FMEA). (3)

Lab Session (along with Theory Class)

- Practical Implementation of Fundamentals of software testing using LDRA Software.
- Adhering to MISRA C coding guidelines using LDRA Software.
- Achieving compliance to ISO 26262 using LDRA Software.
- In case of non-availability of MISRA C document, students may refer to CERT C standard.
- Example of Code Coverage and Executing Test Cases on Raspberry Pi or Arduino.

REFERENCES:

1. Pradeep Oak and Renu Rajani , "Software Testing – Effective Methods, Tools and Techniques " Tata McGraw Hill Publications, 2004.
2. MISRA Online Resources available at https://www.misra.org.uk/
3. MISRA C:2012 Amendments
   URL: https://www.misra.org.uk/Publications/tabid/57/Default.aspx
4. CERT C Programming Language Secure Coding Standard
   URL: http://www.open-std.org/jtc1/sc22/wg14/www/docs/n1255.pdf
5. White papers and Technical Videos on MISRA C & ISO 26262 available at www.ldra.com

ONE CREDIT COURSES

For the detailed syllabi of the electives and one credit courses offered by other departments refer to the syllabi of M.E- Automotive Engineering offered by Automobile Engineering Department.