SEMESTER I

18EA01/18EE01/18ED01/18EM01 MATHEMATICS OF SYSTEMS ENGINEERING

2 2 0 3

VECTOR SPACES: Real vector spaces, subspaces, linear independence – basis and dimension of a vector space - inner product space, orthonormal bases, Gram-Schmidt process. (8+7)

LINEAR TRANSFORMATIONS: General linear transformations, kernel and range, inverse linear transformations, matrices of general linear transformations, eigenvalues and eigenvectors, diagonalization. (8+7)

CALCULUS OF VARIATIONS: 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. (8+7)

STOCHASTIC PROCESSES: Classification. Markov chain: Transition probability matrices – Chapman Kolmogorov equations - classification of states, limiting probabilities, Poisson process - continuous time Markov chains: Birth-death processes. (8+7)

Total L:32 + T:28 = 60

REFERENCES:

1. Howard Anton and Chris Rorres, “Elementary Linear Algebra: Applications Version”, Wiley India, New Delhi, 2018.
2. David C Lay, “Linear Algebra and its Applications”, Pearson Education, New Delhi, 2017.
3. Medhi J., “Stochastic Processes”, New Age International Publishers, New Delhi, 2017.
4. Saeed Ghahramani, “Fundamentals of Probability with Stochastic Processes”, Pearson, New Delhi, 2016.
5. Elsgolts L., “Differential Equation and Calculus of Variation”, MIR Publication, Moscow, 1977.

18EA02 / 18EE02 / 18EM02 EMBEDDED CONTROLLERS AND APPLICATIONS

3 0 0 3

8051: 8051 microcontroller – Architecture – Instruction sets – Addressing modes – I/O ports – Timer/Counter – Serial Communication – Interrupts – Assembly language programming. (11)

PIC18F: PIC18f Micro-controller – Device overview – Pin diagrams. PIC18f micro-controller memory organization – Special Function Registers - I/O ports – Timers – Capture/ Compare/ PWM modules (CCP). Analog to Digital Converter module – Instruction set – Oscillator selection – Reset – Interrupts – Watch dog timer – PIC microcontroller programming. (11)

ARM7: ARM7TDMI – Architecture overview - Processor modes – Data types – Registers – Program status registers – ARM Instruction Set – Thumb Instruction Set – Simple programs. (11)

REAL WORLD INTERFACING: Master Synchronous Serial Port ((MSSP) structure - Detail study of UART, SPI, I2C, ADC and Comparators, Interfacing of PIC18F serial port - ADC using I2C. - RTC using I2C. – Design of data acquisition System - frequency counter with display on LCD - Digital Multimeter - DC motor control using PWM with signal. (12)

Total L: 45

REFERENCES:

1. William Hohl and Christopher Hinds, “ARM Assembly Language Fundamentals and Techniques”, CRC Press, second edition, 2015.
2. Danny Causey, Muhammad Ali Mazidi, and Rolin D. McKinlay, “PIC Microcontroller & Embedded System: Using Assembly and C for PIC18”, Pearson Education India, 2008.
3. MykePredko, “Programming and Customizing the PIC Microcontroller”, Tata McGraw-Hill, 3rd Edition, 2008.
4. M.A. Mazidi, J.G. Mazidi and R.D. McKinlay, “The 8051 Microcontroller and Embedded Systems”, Prentice Hall India, 2nd Edition, New Delhi, 2007.
5. ARM System Developer's Guide, “Designing and Optimizing System Software”, Andrew Sloss Dominic Symes Chris Wright, 1st Edition, 2004.
6. John B. Peatman, “Design with PIC Microcontrollers”, Prentice Hall, 2003.

18EA03 / 18EE04 DIGITAL SYSTEM DESIGN AND TESTING

3 2 0 4

REVIEW OF DIGITAL LOGIC CIRCUITS: Designing combinational circuit using multiplexer, decoder – Finite State Machines – Mealy Machine- Moore Machine – State Diagram – State table - Design of state machines using Algorithmic State Machines (ASM) chart as a design tool. 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. (12+5)

VERILOG: Signals, Identifier, Net and variable types, Operators, Gate instantiations, Modules and ports, data flow, gate level, Behavioral level ,Switch level and state machine modeling , Concurrent and procedural statements, UDP, sub circuit parameters, function and task, timing and delays - test benches-- design of combinational and sequential circuits using Verilog. (11+10)

CPLD and FIELD PROGRAMMABLE GATE ARRAYS: Complex PLDs (CPLDs) –Xilinx cool runner architecture. Types of FPGA - Xilinx XC4000 series - Logic Cell Array (LCA) – Configurable Logic Blocks (CLB) - Input/output Blocks (IOB) - Programmable Interconnection Point(PIP) Implementing Functions in FPGAs Dedicated Memory in FPGAs – Dedicated Multipliers in FPGAs - Mapping, Placement ,and Routing - Verilog based design flow for FPGA. . (11+10)

HARDWARE TESTING AND DESIGN FOR TESTABILITY: 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. (11+5)
(11+10)

Total L: 45 + T: 30 = 75

REFERENCES:

1. Samir Palnitkar, "Verilog HDL : A Guide to Digital Design and Synthesis", Pearson Education Asia, 2014. .
2. Charles H Roth and Lizy Kurian John, "Digital Systems Design Using VHDL", Cengage Learning, 2013.
3. Bhaskar J., "A Verilog Primer", Prentice Hall of India Learning, 2012.
4. Micheal D.Ciletti, "Advance Digital Design with the Verilog HDL", Prentice Hall of India Learning, 2012.
5. Wayne Wolf, "FPGA - Based System Design", Prentice Hall, New Jersey, 2012.
6. Michael L Bushnell, Vishwani D Agrawal, "Essentials of Electronic Testing for Digital Memory and Mixed Signal VLSI Circuits", Springer, 2002.

18EA04 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. (2)

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. (3)

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. (6)

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. (11)

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. (10)

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, 2013.
2. Sung-Mo Kang and Yusuf Leblebici," CMOS Digital Integrated Circuits", Tata McGraw Hill,, New Delhi, 2011.
3. Wayne Wolf," Modern VLSI Design: Systems on Chip Design", Pearson Education Inc., Indian Reprint, 2007.
4. Neil H E West and Kamran Eshranghian, "Principles of CMOS VLSI Design: A System Perspective", Addision-Wesley, 2004.
5. Jan M Rabaey, Chandrasekaran A and Nikolic B, "Digital Integrated Circuits," Pearson Education, 2004.
6. Amar Mukherjee, "Introduction to nMOS and CMOS VLSI System Design", Prentice Hall, USA, 1986.

18EA05 / 18EE05 / 18ED05 OBJECT COMPUTING AND DATA STRUCTURES

3 2 0 4

PRINCIPLES OF OBJECT ORIENTED PROGRAMMING: Procedure Oriented Programming, Object Oriented Programming paradigm - Basic concepts and benefits of OOP - Object Oriented Language - Applications of C++ - Operators in C++ - Classes and Objects - Manipulators. Functions in C++- Call by Reference - Return by reference - Inline functions - Default, Const Arguments - Function Overloading - Friend Functions - Member functions - Nesting of Member functions - Private member functions - Static data members - Static Member Functions - Arrays of Objects - Objects as Function Arguments - Friend Functions. (10+7)

CONSTRUCTORS: Parameterized Constructor - Copy constructor - Multiple Constructors in a Class – Destructors. **INHERITANCE:** Defining Derived Classes - Single Inheritance - Making a Private Member Inheritable - Multiple Inheritance - Hierarchical Inheritance – Hybrid Inheritance. **POLYMORPHISM:** Compile and Run Time Polymorphism – Operator Overloading - Virtual function. (11+7)
DATA STRUCTURES: Abstract data Types - Primitive data structures - Analysis of algorithms - Best, worst and average case time complexities – Notation. **ARRAYS:** Operations - Implementation of one, two, three and multi dimensioned arrays - Sparse and dense matrices - Applications. **SORTING:** Insertion sort - Selection sort - Bubble sort - Radix sort - Algorithms and their time complexities. (12+7)

LINEAR DATA STRUCTURES: STACKS: Primitive operations - Sequential implementation - Applications: Subroutine handling, Recursion-**Queues-**Primitive operations - Sequential implementation - Applications: Job Scheduling. **LISTS:** Primitive Operations - Singly linked lists, Doubly linked lists, Circular lists – Applications: Addition of Polynomials (10+7)

NON-LINEAR DATA STRUCTURES: TREES: Terminologies - Binary Tree traversal. (2+2)

Total L: 45 + T: 30 = 75

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

18EA51 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. Experiments using 8051 Microcontrollers
4. Interfacing using 8051 Microcontrollers
5. Experiments using ARM Processor
6. Mini Project

18EA06 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 (11)

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 (11)

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 Op-Amps, Op-Amp design techniques with examples. High performance CMOS Op-Amps. (9)

SWITCHED CAPACITOR FILTERS: Introduction to Switched capacitor filters, Switched capacitor resistors. (3)

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. (8)

FIELD PROGRAMMABLE ANALOG ARRAY (**FPAA):** Overview of analog design – Introduction to Field Programmable analog array (FPAA) and its advantages – Role of EDA tool in Analog Design process. (3)

Total L: 45

REFERENCES:
1. Phillip Allen and Douglas Holberg, “CMOS Analog Circuit Design”, Oxford University Press, 3rd Edition, Reprint September, 2014.
2. Behzad Razavi, “Design of CMOS Integrated Circuits”, Tata McGraw Hill, New Delhi, 2011.
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, 2nd Edition, 2010.

18EA07 ADVANCED DIGITAL SIGNAL PROCESSING

3 2 0 4

MULTIRATE DSP: Sampling – Spectral representation: DFT and FFT – Review of Digital filters - Decimation and Interpolation by an integer and rational factors – Multistaging – Decimation and Interpolation with poly phase filters – Realizations – Applications of multirate signal processing. (11+7)

FILTER BANKS: Analysis and Synthesis of Filter Banks – Quadrature Mirror Filter (QMF) banks – Filter bank with perfect reconstruction – 2-Channel and M-channel – Paraunitary filter banks – Biorthogonal and Linear phase filter banks – Tree and parallel structured filter banks – Transmultiplexer filter banks – Multi resolution analysis – Subband coding and its applications. (12+8)

ADAPTIVE FILTERS: FIR adaptive filters – adaptive filters based on steepest descent method – LMS algorithm – Variants of LMS algorithm – adaptive channel equalization – adaptive echo cancellation – RLS adaptive algorithm. (11+7)

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. (11+8)

Total L: 45 + T: 30 = 75

REFERENCES:

1. Fliege N.J., “Multirate Digital Signal Processing” John Wiley & Sons Ltd., Reprinted with Correction, 2000.
2. Vaidyanathan P P., “Multirate Systems and Filter Banks”, Pearson Education, 2011.
3. John G Proakis and Dimitris G Manolakis, “Digital Signal Processing-Principles, Algorithms and Applications”, Prentice Hall of India, 2013.
4. Rao R.M. and Bopardikar A.S., “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.

18EA08 / 18EE24 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 - 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. (12)

MEMORY UNIT AND INPUT-OUTPUT 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 - Characteristics of I/O subsystem – Interrupt mechanisms and special hardware – Direct Memory Access – I/O processors and I/O channels – Asynchronous data transfer. (10)

PARALLEL PROCESSING AND PIPELINING: Basic uniprocessor architecture – Parallel processing mechanisms – Levels of parallelism – Balancing of subsystem bandwidth – Parallel computer structures – Architectural classifications – Parallel processing applications -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 – High performance Architectures: Superscalar Architecture – VLIW Architecture. (11)

ARRAY PROCESSING AND MULTIPROCESSOR ARCHITECTURE: SIMD array processors – Masking and data routing mechanisms – SIMD Interconnection networks - 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. (12)

Total L: 45

REFERENCES:

1. John Hennessy and David Patterson, "Computer Architecture: A Quantitative approach", Elsevier India Publishers, 5th Edition, 2017.
2. Kai Hwang and Faye A Briggs, "Computer Architecture and Parallel Processing", McGraw Hill Book Company, 2016.
3. Stallings W, “Computer Organisation and Architecture – Designing for performance”, Pearson Publishers, 9th Edition, 2014.
4. Mano M.M., "Computer System Architecture", Pearson Publishers, 3rd Edition, 2013.

18EA09 EMBEDDED SYSTEM DESIGN

3 2 0 4

EMBEDDED SYSTEMS: Introduction – Embedded systems versus general computing systems – Classification – Major application areas – Hardware and Software components: CPU of an embedded system – Memory – Input/Output devices, Sensors and actuators – Communication interfaces : I2C, SPI, CAN, and LIN - Firmware, other system components–Characteristics and quality attributes. (12+8)

EMBEDDED FIRMWARE DEVELOPMENT: Integrated development environment (IDE) – Cross-compiler - Cross Assembler – Software debugging techniques – In Circuit Emulator – Hardware-software co-design and program modeling - Issues in co-design – Introduction to UML – Hardware-software trade-offs – Code optimization, Fixed point and floating point implementation of algorithms – Analysis and Optimization of CPU Power Consumption. (12+8)

RTOS FOR EMBEDDED SYSTEMS: Interrupt driven systems - Need for Real-time Operating System – RTOS Concepts – Tasks, Context switching, Interrupt latency, Memory management, Scheduling, Task synchronization, Shared data issues – Introduction to RTOS APIs – Power optimization strategies for processes – Basic design using RTOS – Response time calculation – Performance Comparison of commercial RTOSs. (12+8)

EMBEDDED PRODUCT DEVELOPMENT: Design tools – Development techniques – Embedded product development cycle (EDLC) – Objectives – Phases –Modeling EDLC – Trends in the embedded industry.
DESIGN CASE STUDIES: Smartcard reader – Automated meter reading system – Digital Camera – Advanced Driver Assistance Systems. (9+6)

Total L: 45 + 30 = 75

REFERENCES:

1. Marilyn Wolf, “Computers as components: Principles of Embedded Computing Design, 4th Edition, Morgan Kaufmann, 2016.
2. Jonathan W Valvano, “Embedded Microcomputer Systems, Real Time Interfacing”, 3rd Edition, CENGAGE Learning, 2012.
3. Shibu K. V., “Introduction to Embedded Systems”, Tata McGraw Hill, 2009.
4. David E Simon, “An Embedded Software Primer”, Pearson India, 2008.

18EA52 ELECTRONIC SYSTEM DESIGN LABORATORY

0 0 4 2

LIST OF EXPERIMENTS:

1. Design and Simulation of Digital Circuits using VHDL / Verilog and porting them into FPGA.
2. Layout of Simple NMOS/CMOS Circuits.
3. Study of Dynamically programmed Analog Signal Processers.
4. Applications using DSP Processors.
5. Implementing a basic computer on FPGA (implementing and simulating a common bus/ Data Path block/ control unit)
6. Mini Project.

18EA61 INDUSTRIAL VISIT & TECHNICAL SEMINAR

0 0 4 2

The student will make at least 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

18EA53 APPLIED ELECTRONICS LABORATORY

0 0 4 2

LIST OF EXPERIMENTS:

1. Implementation of Digital Circuit Testing Algorithms using C.
2. Implementation of Interprocess communication mechanisms.
3. Design simple placement, partitioning and routing algorithms using C.
4. Simple RTOS Experiment to view multitasking using Keil IDE.
5. Implementation of Image/ Video Processing algorithms using Matlab.
6. Mini Project

18EA71 PROJECT WORK – I

0 0 6 3

- Identification of a problem.
- Literature survey of identified problem.
- Finalization of project specification and requirements
- Presentation / Demonstration of sub block(s) of the Project (Hardware / Software / both)

IV SEMESTER

18EA72 PROJECT WORK – II

0 0 28 14

- Project Implementation (Hardware / Software / both)
- Presentation / Demonstration about the work done
- Consolidated report preparation

PROFESSIONAL ELECTIVE (ELECTIVE 3 Associated with Centre of Excellence)
18EA21 VIRTUAL INSTRUMENTATION SYSTEMS

3 2 0 4

INTRODUCTION: Concept of virtual instrumentation, virtual instrumentation model, design flow with graphical system design, graphical data flow programming - Modular programming, repetition and loops, arrays, clusters, plotting data, structures, strings, state machines – file I/O- creating LabVIEW executables and projects. (12+8)

DATA ACQUISITION: DAQ hardware configuration, DAQ hardware – Sampling and grounding techniques - analog I/O, digital I/O, counter/timer, DAQ software architecture, network data acquisition. Application design using Real Time Targets: PXI, cRIO. (11+7)

INSTRUMENT INTERFACES: Virtual Instrumentation Software Architecture (VISA), instrument drivers, serial and parallel interfaces: RS232, USB, firewire, controller area network (CAN), GPIB, Industrial Ethernet. OLE for Process Control (OPC) (11+7)

ADVANCED FEATURES IN LabVIEW: System identification and control design, signal processing, image acquisition and processing, data logging and supervisory control, LabVIEW Interface for Arduino, case studies on machine vision, motion control, GSD applications. (11+8)

Total: L: 45 T: 30 = 75

REFERENCES:

1. Jovitha Jerome, “Virtual Instrumentation using LabVIEW”, PHI Learning Pvt. Ltd., New Delhi, 2010.
2. Rick Bitter, Taqi Mohiuddin and Matt Nawrocki, “LabVIEW Advanced Programming Techniques”, CRC Press, 2009.
3. Mathivanan, N. “PC-Based Instrumentation”, PHI Learning Pvt. Ltd., New Delhi, 2009.
4. Sanjay Gupta and Joseph John, “Virtual Instrumentation using LabVIEW”, Tata McGraw Hill, 2008.
5. Gary Johnson and Richard Jennings, “LabVIEW Graphical Programming”, McGraw Hill Inc., 2006.

18EA22 / 18EE21 / 18ED22 / 18EM23 INTERNET OF THINGS

3 2 0 4

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 – Consumer IoT vs Industrial Functional Components of a typical IoT System: Sensors, Actuators, Embedded Computation Units, Communication Interfaces, Software Development (9+5)

IoT PROTOCOLS: Physical and Data Linnk Layer Protocols: RFID: NFC, FFC, ZigBEE, Bluetooth Low Energy, Z-Wave, Wi-Fi, Wireless HART - Network Layer Protocols: IPv4, IPv6, TCP & UDP, 6LoWPAN - Application Layer Protocols: COAP, MQTT (13+10)

CLOUD COMPUTING: NIST Visual Model – Essential Characteristics – Components of Cloud Computing - Service Models – Deployment Models – Service Management and Security – Examples – Basics of Fog Computing (12+7)

SECURITY IN IoT: IEEE 802.11 Wireless Networks Attacks: Basic Types, RFID Security – Security Issues in ZigBEE: Bluetooth Security: Threats to Bluetooth Devices and Networks - IoT Applications**:** Health Care, Connected Vehicles, Smart Grid, Smart Home, and Smart City (11+8)

Total: L: 45 T: 30 = 75

REFERENCES:

1. Vijay Madisetti, Arshdeep Bahga, “Internet of Things (A Hands-on Approach)”, Universities Press, 2015.
2. Adrian McEwen and Hakim Cassimally, “Designing the Internet of Things”, John Wiley and Sons Ltd, UK, 2014.
3. Olivier Hersent, David Boswarthick and Omar Elloumi, “The Internet of Things: Key Applications and Protocols”, John Wiley and Sons Ltd., UK 2012.
4. Dieter Uckelmann, Mark Harrison, Florian Michahelles, “Architecting the Internet of Things”, Springer, New York, 2011.
5. Johnny Cache, Joshua Wright and Vincent Liu, “Hacking Exposed Wireless: Wireless Security Secrets and Solutions”, Tata McGraw Hill, New Delhi, 2010.
6. Himanshu Dwivedi, Chris Clark and David Thiel, “Mobile Application Security”, Tata McGraw Hill, New Delhi, 2010.

18EA23 / 18EE22 / 18ED23 / 18EM22 TOTALLY INTEGRATED AUTOMATION

3 2 0 4

INTRODUCTION TO FACTORY & PROCESS AUTOMATION: Evolution of Industrial Versions - Control elements of Industrial Automation - IEC/ ISA Standards for Control Elements – Selection criteria for control elements – Utilisation Category with IEC standards - Construction of Relay Ladder logic with different control elements- Need for PLC - PLC evolution. (6+3)

PROGRAMMABLE LOGIC CONTROLLERS: Architecture of PLC - Types of PLC – PLC modules, PLC Configuration - Scan cycle - Capabilities of PLC- Selection criteria for PLC – PLC Communication - PLC Wiring - Installation of PLC and its Modules. Types of Programming – Bit Instructions - Timers and counters – PLC arithmetic functions PTO / PWM generation - High Speed Counter – Analog Scaling – Encoder Interfacing - Servo drive control – Stepper Motor Control. (12+13)

HMI SYSTEMS: Need for HMI in Industrial Automation, Types of HMI – Configuration of HMI, Screen development and navigation, Configuration of HMI elements / objects and Interfacing with PLC. (6+7)

NETWORKING: PLC Networking - Networking standards & IEEE Standard - Protocols - Field bus - Process bus and Ethernet – EttherCAT (7+0)

SUPERVISORY CONTROL AND DATA ACQUISITION: Architecture – Tools – Tag Configuration - Internal & External graphics, Alarm logging – Tag logging – structured tags – Trends – history – Report generation (14+7)

Total: L: 45 + T: 30=75

REFERENCES:

1. W. Bolton, “Programmable Logic Controllers”, Elsevier Ltd., 2015.
2. Frank D Petruzella, “Programmable Logic Controllers ‖”, McGraw Hill, 2011.
3. John R Hackworth and Fredrick D Hackworth Jr., “Programmable Logic Controllers: Programming Methods and Applications ‖”, Pearson Education, 2006.

PROFESSIONAL ELECTIVES

18EA24 ALGORITHMS FOR VLSI DESIGN AUTOMATION

3 0 0 3

INTRODUCTION TO DESIGN METHODOLOGIES: VLSI Design problem - The Design Domains-Design methods and Technologies. (3)

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 - Placement Algorithms- Constructive Placement, Iterative Improvement - Partitioning - Kernighan - Lin Partitioning algorithm - Floor Planning - Representation - Shape functions and floor plan sizing. (11)

ROUTING: Local routing problems - Area routing - Channel routing - Channel Routing Models, The Vertical Constraint Graph, Horizontal Constraints and the Left-edge Algorithm, Channel Routing Algorithms - Global routing - Standard-cell, Building-block Layout and Channel Order, Algorithms for Global Routing. (11)

SIMULATION: Gate level modeling and simulation - Compiler driven simulation - Event driven simulation - Switch-level modeling and simulation. (6)

HIGH LEVEL SYNTHESIS: Hardware models - Allocation - Assignment - Scheduling - Assignment Problem - High level transformation. (6)

Total L: 45

REFERENCES:

1. Abramovici M, Brever A and Friendman D, "Digital Systems Testing and Testable Design", Jaico Publishing House, 2014.
2. Naveed Sherwani, "Algorithms for VLSI Physical Design Automation", Springer-Verlag, 2013.
3. Sabih H.Gerez, "Algorithms for VLSI Design Automation", John Wiley & Sons, 2011.
4. Sadiq M Sait and Habib Youssef, "VLSI Physical Design Automation", IEEE Press, New York, 2010.
5. WayneWolf, "Modern VLSI Design: Systems on Chip Design", Pearson Education Inc., Indian Reprint, 2007.

18EA25 VLSI TESTING AND TESTABILITY

3 0 0 3

FAULT MODELS AND FAULT SIMULATION: 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. (11)

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. (12)

DELAY TEST & ANALOG SIGNAL TEST: Delay test problem – Path delay test – Transition faults – Delay test methodologies. 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 (11)

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. (11)

Total L: 45

REFERENCES:

1. Abramovici M., Brever A. and Friedman D., "Digital Systems Testing and Testable Design", Jaico Publishing House, 2013.
2. Xiaoqing Wen, Cheng Wen Wu and Laung Terng Wang, "VLSI Test Principles and Architectures: Design for Testability", Morgan Kaufmann, 2011.
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18EA26 MIXED SIGNAL VLSI DESIGN

3 0 0 3

SIGMA DELTA CONVERTERS: Over Sampled Converters - Over Sampling With Out Noise & With Noise - Implementation Imperfections - First Order Modulator - Decimation Filters - Higher Order Modulators – Sigma Delta DAC & ADCs (11)

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. (11)

PHASE LOCKED LOOPS AND MIXED SIGNAL LAYOUT: Basic Architecture of PLL, Charge Pump PLL, Non-ideal effects in PLLs, Applications.
CMOS design rules – Layout of CMOS – Capacitors – Resistors – Mixed layout issues: Floor planning, power supply and ground, fully differential matching, Guard rings and shielding. (12)

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. (11)

Total L : 45

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2. David A Johns and Ken Martin, "Analog Integrated Circuit Design", John Wiley and Sons, 2002, 2nd Edition, 2011.
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4. Jacob Baker, Harry W Li, and David E Boyce "CMOS, Circuit Design Layout and Simulation", Wiley-IEEE Press, 2nd Edition August, 2010.
5. Rudy van de Plassche "Integrated Analog-to-Digital and Digital-to-Analog Converters", Springer, 2007.
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18EA27 HARDWARE DESIGN VERIFICATION TECHNIQUES

3 0 0 3

VERIFICATION TECHNIQUES: Introduction – Testing Versus Verification – Design and Verification reuse. Techniques based on simulation – Analytical and Formal approaches – Function verification – Timing verification – Formal verification – Basic of equivalence checking and model checking. (10)

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

VERITIFCATION PLAN: Levels of verification – Verification Strategies – Test cases – Test benches. (13)

STIMULUS AND RESPONSE: Reference signals – Simple stimulus – Simple output – Complex Stimulus and response – Transaction Level Interface. (11)

ARCHITECTING TEST BENCHES: Test Hardness – VHDL Test Hardness – Design Configuration – Self Checking Test benches – Directed stimulus – Random stimulus – VHDL configuration management. (11)

Total L: 45

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5. Thomas Kropf “Introduction to Formal Hardware Verification”, Springer Verlag, 1999.

18EA28 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. (4)

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. (8)

DESIGN METHODOLOGY FOR MEMORY AND ANALOG CORES: Embedded memories – Simulation modes – Specification of analog circuits – A to D converter – D to A converter – Phase-locked loops – High speed I/O (11)

DESIGN VALIDATION: Core level validation – Test benches- SoC design validation – Co-simulation – Hardware/software co-verification. (11)

SOC TESTING: SoC Test issues – Testing of digital logic cores – Cores with boundary scan – Test methodology for design reuse – Testing of microprocessor cores – Built in self test method – Testing of embedded memories. Case Studies. (11)

Total L: 45

REFERENCES:

1. Rajanish K Kamat, Santosh A Shinde, Vinod G Shelake, “Unleesh the System-on-Chip using FPGAs and Handle C, Spinger 2009.
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. Rochit Rajsuman, “System-on-a-chip: Design and Test”, Artech House, London, 2000.

18EA29 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. (11)

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. (11)

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. (7)

LOGIC SYNTHESIS, SIMULATION AND TESTING: VHDL and logic synthesis - types of simulation - boundary scan test - fault simulation automatic test pattern generation. (6)

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. (10)

Total L: 45

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1. Smith M.J.S., "Application - Specific Integrated Circuits", Addison - Wesley Longman Inc., 2013.
2. Chu P., “FPGA Prototyping by VHDL Examples”, Wiley, 2008.
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5. Andrew Brown, "VLSI Circuits and Systems in Silicon", McGraw Hill, 1991.
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18EA30 OPERATING SYSTEMS

3 0 0 3

INTRODUCTION: Operating system structure – Function – Evolutions of Operating Systems - Serial processing, Batch Processing, Multiprocessing, Time-sharing operating systems - Distributed OS - Multiprocessor OS – Real-time OS – Introduction to system calls. (4)

PROCESS MANAGEMENT: Introduction to processes –Threads - Scheduling objectives - Scheduling Criteria - Types of scheduling algorithms – Performance comparison – Inter-process communications - Synchronization – Semaphores – Deadlock - Prevention, Recovery, Detection – Avoidance. (9)

MEMORY MANAGEMENT: Single contiguous allocation – Partitioned allocation – Paging – Virtual memory concepts – Swapping – Demand paging – Page replacement algorithms – Segmentation – Segmentation with paging. (11)
DEVICE AND FILE MANAGEMENT: Principles of I/O hardware – I/O software – Disks – Disk Scheduling Algorithms – File Systems – Files-Directories- File system implementation – Allocation methods – Security – Protection mechanisms. (11)

CASE STUDIES:
LINUX – History – Design Principles – Kernel modules – Process Management – Scheduling – Memory Management – File Systems – Input and Output – Inter-process Communication – Network Structure – Security. (5)

WINDOWS 7 – History – Design Principles – System Components – Terminal Services and Fast User Switching –File System – Networking – Programmer Interface. (5)

Total L: 45

REFERENCES:

1. Andrew S. Tanenbaum, “Modern OS”, Pearson Education Pvt. Ltd., New Delhi, 3rd Edition, 2015.
2. Dhamdhere D. M., “Operating Systems- A Concept Based Approach”, Tata McGraw Hill, 3rd Edition, 2014.
3. Silberschatz A., Galvin P and Gagne G., “Operating System Concepts”, John Wiley and Sons, Singapore, 2013.
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18EA31 LINEAR SYSTEMS

3 0 0 3

MATHEMATICAL DESCRIPTION OF SYSTEM: Causality, Lumpedness, Linearity, Linearization, Concept of state, state variables and state model, State space representation using physical, phase and canonical variables, Comparison of input-output description and state variable description, MIMO systems, Discretization of a continuous time model. (11)

SOLUTION OF STATE EQUATIONS: State transition matrix-Significance, Properties, Computation, solution of continuous time state equation, impulse response matrix, Solution of discrete time state equation, Solution of linear time variant systems, Transfer function from state space model, similarity transformation, decomposition of transfer functions - direct, cascade and parallel decomposition techniques. (12)

CONCEPT OF CONTROLLABILITY AND OBSERVABILITY: Kalman`s and Gilbert`s test, State feedback controller design using Ackermann’s formula, Design of full order observer using Ackermann’s formula, Duality, Observer based controller design, Reduced order observer design, Controllability and observability of Discrete LTI systems, Controllability and observability of linear time variant systems, Effect of pole-zero cancellation. (11)

STABILITY: Stability in the sense of Lyapunov, asymptotic stability of linear time invariant continuous and discrete systems, Solution of Lyapunov equation, internal stability, stability of linear time variant system. (12)

Total: L: 45

REFERENCES:

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18EA32 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 – Vi editior - Commands – Overview of shell and GUI. (11)

LINUX KERNAL ARCHITECTURE: Layer diagram of OS - Hardware Abstraction Layer (HAL) – Memory manager – scheduler – file system – I/O subsystem – Networking subsystem – IPC – user space. (11)

LINUX FILE SYSTEM: Layers of Linux file system – structure of inode – process file system – The Ext2 File system – System programming concepts – API & ABIs – C library and compiler. (11)

DEVICE DRIVER: System start up (Booting) Methods - 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 - kernel modules – Linking and unlinking of modules – On Demand modules linking. (12)

Total L: 45

REFERENCES:

1. Robert Love, “LINUX System Programming”, Shroff Publishers & Distributors Pvt. Ltd., 2007.

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18EA33 / 18EE29 WIRELESS SENSOR NETWORKS

3 0 0 3

CHARACTERISTICS OF WSN: Characteristic requirements for WSN, Challenges for WSNs, WSN vs Adhoc Networks, Sensor node architecture, Commercially available sensor nodes, Physical layer and transceiver design considerations in WSNs, Energy usage profile, Choice of modulation scheme, Dynamic modulation scaling, Antenna considerations. (11)
MEDIUM ACCESS AND ROUTING: Fundamentals of MAC protocols, Low duty cycle protocols and wakeup concepts, Contention based protocols, Schedule-based protocols: SMAC - BMAC - Traffic-adaptive medium access protocol (TRAMA), The IEEE 802.15.4 MAC protocol. Routing And Data Gathering Protocols, Routing Challenges and Design Issues in Wireless Sensor Networks, Flooding and gossiping, Data centric Routing, Energy aware routing, Hierarchical Routing, Real Time routing Protocols. (12)
LOCALIZATION AND MANIPULATION: Localization and positioning, Coverage and connectivity, Single-hop and multihop localization, Self configuring localization systems, Sensor management. Data Storage and Manipulation, Data centric and content based routing, Storage and retrieval in network, Compression technologies for WSN, Data Aggregation Techniques. (11)

OPERATING SYSTEMS AND APPLICATIONS: Operating Systems for Wireless Sensor Networks, Design Issues, Examples of Operating Systems: TinyOS – Mate – MagnetOS – MANTIS. WSN Applications, Home Control, Building Automation, Medical Applications, - Reconfigurable Sensor Networks, Civil and Environmental Engineering Applications Nanoscopic Sensor Applications, Case Study: IEEE 802.15.4 LR-WPANs Standard - Target detection and tracking - Contour/edge detection - Field sampling. (11)

Total L: 45

REFERENCES:
1. Kazem Sohraby, Daniel Minoli and Taieb Znati, “Wireless Sensor Networks Technology, Protocols, and Applications“, John Wiley & Sons, 2015.
2. Holger Karl and Andreas Willig, “Protocols and Architectures for Wireless Sensor Networks”, John Wiley & Sons, Ltd, 2015.
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18EA34 ELECTRONIC PRODUCT DESIGN

3 0 0 3

ELECTRONIC SYSTEM DESIGN: Top down design - product concept - innovation - creativity - validation – communication - product requirements - system architecture development - trade-off analysis - cost modelling - circuit design - physical and mechanical design - Tolerance and reliability - Quality control - quality assurance - quality functional deployment - assignment matrices – checklist - quality in the design process - concurrent design - risk analysis - quality in production (11)
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. (11)

ELECTROMAGNETIC COMPATIBILITY & MECHANICAL DESIGN: Electromagnetic fields and human health – EMC Control : Characterizing the threat – Laws and Regulators – EMC Design : Grounding and shielding – Emission Suppression – Susceptibility hardening - EMC Testing - EMI shielding

THERMAL MANAGEMENT: High level thermal analysis, thermal issues in notebook computers - mechanical integration - DFMA analysis. (11)

PORTABLE ELECTRONICS : Digital and Analog processing: microprocessor, logic devices, microcontrollers, DSP, analog devices, sensors, wireless communication, system memory and mass storage - Displays: Display technologies - Flexible OLED Displays - LED-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. (12)

Total L: 45

REFERENCES:
1. Tim Williams, “EMC for Product Designers”, 5th Edition, Copyright@2017 Elsevier Ltd.
2. Bert Haskell, “Portable Electronics Product Design and Development: For Cellular Phones, PDAs, Digital Cameras, Personal Electronics and More”, McGraw Hill, 2010.
3. Tony Ward and James Angus, “Electronic Product Design”, Chapman and Hall publications, 1996.

18EA35 / 18EE33 DIGITAL IMAGE PROCESSING

3 0 0 3

IMAGE FORMATION AND ENHANCEMENT: Human visual system – Sampling and Quantization – Color fundamentals – Spatial domain processing – Simple image operations – Point wise intensity transformations - Histogram processing - Linear and non-linear noise smoothening – Sharpening - Derivatives – Laplacian – Combing spatial enhancement methods. (11)

FREQUENCY TRANSFORMS AND APPLICATIONS: Frequency domain processing – 2-D transforms: DFT, DCT, and DWT– Properties – Frequency domain filtering techniques–Sub band coding of image compression – Coding techniques: Huffman, Run length and Block transform – JPEG – Performance metrics. (11)

IMAGE RESTORATION AND RECONSTRUCTION: Image degradation – Noise models – Image observation models- Spatial filtering: mean filters, order statistics filters, adaptive filters - Inverse filtering - Wiener filtering – Constrained least squares filtering. Image Reconstruction from projections – Radon transform and it's Application. (11)

SEGMENTATION AND FEATURE EXTRACTION: Edge detection: Gradient operators - edge linking and boundary detection: Global processing via Hough transforms, Graph theoretic techniques – Thresholding techniques – K-means Clustering – Feature extraction: Boundary feature descriptors – Region feature descriptors – Principal components – SIFT. Object Recognition applications. (12)

Total L: 45

REFERENCES:

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3. Jain A.K., "Fundamentals of Digital Image Processing", Prentice Hall of India, 2010.

18EA36 DIGITAL VIDEO PROCESSING

3 0 0 3

VIDEO FILTERING: Digital video standards: Resolution, frame rate, and interface – Quality assessment - Video format conversion: Down conversion, De-Interlacing - Frame rate conversion - Multi-frame noise filtering - Multi-frame restoration - Super resolution. (11)

MOTION ESTIMATION AND COMPENSATION: 2D and 3D motion - Block matching methods - Optical flow estimation - Differential methods: Lucas-Kanade method, Horn-Schunk method - Transform domain phase correlation method - Subpixel and region based motion compensation techniques. (11)

COMPRESSION AND STANDARDS: Basics of 2D image compression – JPEG – 3D DCT Transform coding – 3D subband coding using wavelets – Motion compensated transform coding – Scalable video coding – Coding standards: MPEG1, MPEG2, MPEG4-AVC/ITU-T H.264. (11)

SEGMENTATION AND TRACKING: Image Segmentation: Thresholding, Clustering and Active - contour models - Change detection - Background modeling and subtraction - Motion segmentation - Motion tracking: Kanade-Lucas-Tomasi tracking - Mean shift tracking - Tracking performance metrics. (12)

Total L: 45

REFERENCES:

1. Murat Tekalp, "Digital Video Processing", 2nd Edition, Pearson Education, 2015.
2. John W Woods, "Multidimensional Signal, Image and Video Processing and Coding", 2nd Edition, Academic Press, USA, 2012.
3. Bovik A., "The Essential Guide to Video Processing", Academic Press, USA, 2009.

18EA37 WAVELETS AND APPLICATIONS

3 0 0 3

WAVELETS: Vector spaces – Relationship between functions, Sequences, Vectors – Properties – Fourier transform and non-stationary signals – Limitations – Review of sampling theorem.

Haar Wavelet: Analysis of Haar wavelet in function of scale and time – Haar multire solution Analysis: Analysis part and Synthesis part – Frequency domain analysis of Haar filter bank.

Daubechies Family: Calculation of scaling function – Daub-4 and Daub–6 design details. (12)

CONTINUOUS WAVELET TRANSFORM: The uncertainty principle – Time-bandwidth product – Time-Frequency tiling – STFT and wavelets – CWT-Comparison of STFT and CWT – Interpretation of spectrogram plot – Reconstruction and Admissibility – Discreitization of scale. (11)

DISCRETE WAVELET TRANSFORM: Dyadic MRA – Theorem – Inverse DWT computation – Bi-orthogonal and orthogonal filter banks – Construction of Orthogonal filterbank – Variants of MRA: Splines and Wavelet packets.

Other Wavelet Families: Mortlet, Mexican Hat, and Gabor – Multi-dimensional wavelets: 2-D Haar wavelet transform. (12)

APPLICATIONS: Review and demonstration of different wavelet applications: Compression – Denoising – Analysis of biomedical signals and power signals. (10)

Total L: 45

REFERENCES:

1. Vikram M Gadre and Aditya S Abhyankar, "Multiresolution and Multirate Signal Processing", McGraw Hill Education, 2017.
2. Soman K.P. and Ramachandran K.I., "Insight into Wavelets - From Theory to Practice", Prentice Hall of India, 2010.
3. Mallat S., "A Wavelet Tour of Signal Processing: The Sparse Way", 3rd Edition, Academic Press, 2009.
4. Rao R.M. and Bopardikar A.S., "Wavelet Transforms: Introduction to Theory and Applications", Addison Wesley, Reprint, 2003.
5. Gilbert Strang and Truong Nguyen, "Wavelets and Filter Banks", Wellesley-Cambridge Press, 1997.

18EA38 BIOSIGNAL PROCESSING

3 0 0 3

BIO SIGNALS: Nature of Biomedical signals, Types: Action Potential, Electroneurogram (ENG), Electromyogram (EMG), Electrocardiogram (ECG), Electroencephalogram (EEG), Electrogastrogram (EGG), Phonocardiogram (PCG), Photoplethysmography (PPG). (11)

FILTERING FOR REMOVAL OF ARTIFACTS: Stationary versus non-stationary processes, Noise in event-related potentials, High-frequency noise in the ECG, Motion artifact in the ECG, Power-line interference in ECG signals, Maternal interference in fetal ECG, Time domain filters, Frequency domain filters, Optimal filtering: The wiener Filter, Adaptive filters for removal of Interference, Application: Removal of Artifacts in the ECG. (12)

MODELING STOCHASTIC SIGNALS: Random Processes, Mean and Autocorrelation function of a Random Processes, Stationarity and Ergodicity, General Linear Processes, Yule-Walker Equations, Autoregressive (AR) Processes, Moving Average (MA) Processes, Autoregressive- Moving Average(ARMA) Processes, Harmonic Processes. (12)

SIGNAL COMPRESSION: Direct Digital compression Techniques, Transformation Compression Techniques, Other Compression Techniques and Comparison. (10)

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Total L: 45

REFERENCES:

1. Rangaraj M. Rangayyan, "Biomedical Signal Analysis, A Case Study Approach", IEEE Press, 2014.
2. D.C. Reddy, "Biomedical Signal Processing, Principles and Techniques", Tata McGraw Hill, New Delhi, 2012.
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6. Willis J Tompkins, "Bio Medical Digital Signal Processing": C Language Example and Lab, Prentice Hall INC, New Delhi, 2004.

18EA39 / 18ED33 / 18EE35 / 18EM32 OPTIMIZATION TECHNIQUES

3 0 0 3

LINEAR PROGRAMMING: Statement of Optimization problems, Graphical method, Simplex method, Revised simplex method, Two phase simplex method, Duality in linear programming, Sensitivity analysis. (12)

NON-LINEAR PROGRAMMING (UNCONSTRAINED OPTIMIZATION): Direct search methods - Univariate method, Pattern search method, Simplex method, Descent methods - Steepest Descent method, Conjugate gradient method, Quasi Newton method. (11)

NON-LINEAR PROGRAMMING (CONSTRAINED OPTIMIZATION): Direct methods - The Complex method, Zoutendijk's Method of Feasible Directions, Rosen's Gradient Projection Method, Indirect method - Transformation Techniques, Basic Approach of the Penalty Function Method, Interior Penalty Function Method, Exterior Penalty Function Method. (11)

DYNAMIC PROGRAMMING: Multistage decision process, Suboptimization and Principle of Optimality, Computational procedure, Final value problem to initial value problem, Linear Programming as a Case of Dynamic Programming, Continuous dynamic programming (11)

Total L: 45

REFERENCES:

1. Sharma J K, "Operations Research: Theory and Applications", Macmillan Company, New Delhi, 2013.
2. Hamdy A Taha, "Operations Research: An Introduction", Pearson Education, New Delhi, 2012.
3. Gupta C B, "Optimization Techniques in Operations Research", I K International, New Delhi, 2012.

18EA40 / 18EE28 INTERNETWORKING AND APPLICATIONS

3 0 0 3

INTERNETWORKING: Overview of Internetworking, Underlying networking technologies, Concept and Architectural model, Protocol layering – LAN Fundamentals – Wired LANS : ETHERNET Protocol – Wireless LANS : 1EEE 802.11, Bluetooth, WiMax - Connecting Devices : Repeaters, Hub, Switches, Routers, Unicast Routing - Multicast Routing (12)

NETWORK PROTOCOLS AND APPLICATIONS: Protocols**:** Network layer introduction - Network layer protocols : IPv4 Datagram Format, IPv4 Addresses, Forwarding IP packets, ICMPv4 – DHCP, Transport layer protocols - Transmission Control Protocol (TCP) – User Datagram Protocols (UDP) - Applications : Simple Mail Transfer Protocol (SMTP) – Multipurpose Internet Mail Extension (MIME) – World Wide Web and HTTP – Remote login : Telnet, Electronic Mail - Next Generation IP. (11)

NETWORK MANAGEMENET AND SECURITY: Areas of Network Management – SNMP – SMI – MIB - ASN.1, Introduction to network security – Confidentiality – Message Integrity - Message Authentication - Digital Signature – Digital Certification – HTTPS-Entry Authentication - Key management – Internet Security – Firewalls. (11)

MOBILE NETWORKS & MULTIMEDIA COMMUNICATIONS: Mobile phone technologies: different generations, Mobile Internet Protocol, Synchronization and replication protocols, WAP Architecture: Introduction, Components, Infrastructure, Security issues, WAP gateways.

Multimedia Networking Applications, Streaming stored video, Voice over IP, Protocols for real-time conversational applications, network support for multimedia. (11)

Total L : 45

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1. Behrouz A Forouzan and Firouz Mosharraf, "Computer Network – a Top Down Approach", Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2012.
2. Jochen Burkhardt, Horst Henn, Stefan Hepper, Klaus Rindtoroff, Thomas Schaeck, "Pervasive Computing – Technology and Architecture of Mobile Internet Applications", Pearson, 2012.
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18EA41 / 18EE38 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. Hopfield network – Discrete Hopfield networks – Associative memories – Recurrent auto association memory – Bi-directional associative memory – Boltzman machine. (12)

UNSUPERVISED LEARNING NETWORKS: Hamming networks – Self-organising feature maps – Adaptive resonance theory network – Instar model – Outstar model – Counter propagation network – Radial basis function networks (10)

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. 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 (11)

GENETIC ALGORITHMS AND SOFT COMPUTING APPLICATIONS: Introduction – Genetic operators – Selection, cross-over and mutation – Fitness function – A simple genetic algorithm – Applications, .Application of Neural Networks: Pattern Recognition - Image compression – Communication - Control systems, Applications of Fuzzy Logic: Fuzzy Pattern Recognition - Fuzzy Image compression - Fuzzy Logic controllers. (12)

Total L: 45

REFERENCES:

1. Sivanandam S N, Sumathi S. and Deepa S. N., “Introduction to Neural Networks using Matlab 6.0”, Tata McGraw Hill Publications,
   New Delhi, 20th Reprint, 2014.
2. Sivanandam S N, and Deepa S. N., “Principles of Soft Computing”, Wiley India (P) Ltd., New Delhi, 2nd Edition, June 2011.
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18EA42 / 18EE39 / 18ED36 / 18EM33 MACHINE LEARNING AND APPLICATIONS

3 0 0 3

PROBABILITY DISTRIBUTIONS: Basic Definitions, Types of learning, Probability Theory, Probability Reasoning, Model Selection, Curse of Dimensionality, Decision Theory, Information Theory, Binary Variables, Multinomial Variables, Gaussian Distribution, Exponential Family, Nonparametric Methods, Belief Networks. (12)

LINEAR MODELS FOR REGRESSION AND CLASSIFICATION: Linear Basis Function Models, Bias-Variance Decomposition, Bayesian Linear Regression, Bayesian Model Comparison, Evidence Approximation, Limitations of Fixed Basis Functions, Discriminant Functions, Probabilistic Generative and Discriminative Models, Laplace Approximation, Bayesian Logistic Regression. (11)

NEURAL NETWORKS: Introduction, Reforcement Learning, Feed-forward Network functions, Error Back propagation, Hessian Matrix, Mixture Density Networks, Bayesian Neural Networks, Convolution Neural Network, Dual Representations, Constructing Kernels, Gaussian Processes, Maximum Margin Classifiers, Relevance Vector Machines. (11)

APPLICATIONS OF MACHINE LEARNING ALGORITHMS: Content Based Image Retrieval, Machine Learning Approach for face Recognition, Computer Aided Diagnosis, Computer Vision, Speech Recognition, Text Mining, Thinking Machines, Smart Machines, Business Applications of Deep Learning, Software Reliability Prediction, Medical Imaging. (11)

Total L: 45

REFERENCES:

1. Pradeep Kumar and Arvind Tiwari., “Ubiquitous Machine Learning and Its Applications”, IGI Global, 2017.
2. David Barber., “Bayesian Reasoning and Machine Learning”, Cambridge University Press, New Delhi, 2014.
3. Christopher M Bishop., “Pattern Recognition and Machine Learning”, Springer, New Delhi, 2013.

18EA43 INDUSTRIAL DRIVES FOR AUTOMATION

3 0 0 3

DYNAMICS OF ELECTRIC DRIVES: Fundamental torque equation - multi-quadrant operation- nature and classification of load torques- modes of operation. **Induction Motor Drives**: Construction - Principle – performance characteristics – stator voltage control, frequency control, v/f control, rotor resistance control. (10)

VECTOR CONTROL OF INDUCTION MOTOR DRIVES: Introduction to Park’s and Clarke’s transformation - Principle of vector control - Direct vector control-indirect vector control - stator flux oriented vector control - rotor flux oriented vector control – sensorless control - Direct torque control. (12)

SPECIAL DRIVES: PMSM – principle - PMSM flux density distribution - Controller – SynRM - principle - magnetic flux density and operating point - BLDC - principle, controller – Stepper motor – types, drive circuit. (12)

CONFIGURATIONS OF I/O CONTROL: AC drive Hardware Blocks – Control Blocks – Automatic Motor Adaptation – Parameterization of Drives (Local and Remote). Digital input and output - Analog input and Output control - word access - motion control - sequential logic control(SLC) - parameterization of different communication protocol: RS 485 – MODBUS – PROFIBUS. (11)

Total L: 45

REFERENCES:

1. Gopal K Dubey, "Fundamentals of Electric Drives", Narosa Publishing House, New Delhi, 2005.

2. John Park, Steve Mackey and Edwin Wright, "Data Communications for Instrumentation and Control", Elsevier, 2003.
3. Ned Mohan, “Advanced Electric Drives: Analysis, Control and Modeling using Simulink”, John Wiley and Sons Ltd., 2001.
4. Bimal K Bose, "Power Electronics and Variable Frequency Drives - Technology and Application", IEEE Press, New York 1997
5. Peter Vas, "Vector Control of AC Machines", Oxford University Press, 1990.
6. T. J. E. Miller, “Brushless Permanent-Magnet and Reluctance Motor Drives”, Clarendon Press Oxford, 1989.

ONE CREDIT COURSE

18EK06 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)

Total L: 15

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.

18EK07 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)

Total L: 15

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. Stephen L. Montgomery,”MISRA C: Guidelines for the use of the C Language in Critical Systems”, Motor Industry Research Association,2013.
3. Robert C. Seacord, “The CERT C Secure Coding Standard”, Addison-Wesley Professional, 1st edition, 2008.
4. Justyna Zander, Ina Schieferdecker,Pieter J. Mosterman, “Model-based Testing for Embedded Systems”, CRC Press, Taylor and Francis Group, 2012.

18EK13 SYSTEMS ENGINEERING FOR AUTOMOTIVE APPLICATIONS

1 0 0 1

INTRODUCTION: Systems, Systems Engineering and System on Systems Design Models flow: Waterfall, Spiral and INCOSEVEE model Product development flow Values of Systems Engineering (4)

ROLES OF SYSTEM ENGINEER: Understanding the Systems Engineering goal, Significance of documentation, Knowing about DSM (Design structure matrix), Interdisciplinary role of Systems Engineering, Behavioral aspects of Systems Engineering (3)

PROCESS: Requirements process, Baseline creation

INNOVATION IN SYSTEM ENGINEERING: Creativity characteristics, About TRIZ, Ideality, Contradictions and approach to resolve Innovation in Technical systems: Architectural Innovation (3)

DESIGN PROCESS: Definitions, Axioms, Design Matrices, Types and examples, Constraints (3)

SYSTEM RELIABILITY: Approach to achieve system reliability, significance of Reuse (1)

EXAMPLE SYSTEM DESIGN: Designing an Automotive ECU (1)

Total L: 15

REFERENCES:

1. "INCOSE Systems Engineering Handbook: A Guide for System Life Cycle Processes and Activities", Wiley, 2015.
2. Alexander Kossiakoff, William N. Sweet, Samuel J. Seymour, Steven M. Biemer, "Systems Engineering Principles and Practice", 2nd Edition, Wiley, 2011.
3. Benjamin S. Blanchard, John E. Blyler, "System Engineering Management", 5th Edition, Wiley, 2016.

18EK14 ELECTRIC VEHICLES

1 0 0 1

INTRODUCTION TO ELECTRIC VEHICLES: Social and environmental importance of electric vehicles. Conventional Vehicles: Basics of vehicle performance, vehicle power source characterization, transmission characteristics, and mathematical models to describe vehicle performance. (3)

History of Hybrid Electric Vehicles - Energy consumption Concept of Hybrid Electric Drive – Architecture: Series Hybrid Electric Drive, Parallel hybrid electric drive. Fuel Cell basic principle and operation, Types of Fuel Cells, PEMFC and its operation, Modelling of PEMFC, Super Capacitors. (3)

ELECTRIC PROPULSION UNIT: Electric components, Configuration and control of drives: DC Motor - Induction Motor - Permanent Magnet Motor - Switch Reluctance Motor. Drive system efficiency - Energy storage for EV and HEV - Energy storage requirements, Battery parameters, Modelling of Battery. (5)

Power Electronic Converter for Battery Charging - Charging methods for battery - Design of Z-converter for battery charging. Case Study: Design of a Battery Electric Vehicle (BEV). (4)

Total L: 15

REFERENCES:

1. Sheldon S. Williamson, "Energy Management Strategies for Electric and Plug-in Hybrid Electric Vehicles", Springer, 2013.
2. Chris Mi, M. Abul Masrur, David Wenzhong Gao, "Hybrid Electric Vehicles Principles and Applications with Practical Perspectives", Wiley Publication, 2011.
3. Iqbal Husain, "Electric and Hybrid Vehicles: Design Fundamentals", CRC Press, 2010.
4. M. Ehsani, Y. Gao, S. Gay and Ali Emadi, "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design", CRC Press, 2009.
5. James Larminie, John Lowry, "Electric Vehicle Technology Explained", Wiley, 2003.
6. C.C. Chan and K.T. Chau, "Modern Electric Vehicle Technology", OXFORD University Press, 2001.

18EK15 PHASOR MEASUREMENT UNITS AND APPLICATIONS

1 0 0 1

INTRODUCTION: Phasor Measurement Units (PMUs), Global Positioning System (GPS), Functional requirements of PMUs and Phasor Data Concentrators (PDCs), Phasor estimation of nominal frequency inputs. (2)

TRANSIENT RESPONSE: Transient response of Instrument Transformers, Transient response of Filters, Transient response during Electromagnetic and Power Swings, Impact of Transient Response of Phasor Measurements. (2)

APPLICATIONS OF PHASOR MEASUREMENT UNITs: Phasor Measurements Unit based Adaptive Protection of Transmission Lines, Out-of-Step protection, Adaptive System Restoration, Phasor Measurement units in Large Scale Integration of Wind and Solar Energy systems, Introduction to Wide Area Monitoring, Protection and Control (WAMPAC). Deployment of large scale PMUs in Utilities, Globally and in Indian Power sector. (8)

STANDARDS: Synchrophasor Standards - IEEE C37.118.1-2011, IEEE C37.118a-2014, IEC 61850 & IEEE C37.118, Evaluation / Validation of PMU-Total Vector Error (TVE) both Steady State and Dynamic/Transient conditions. IEEE C37.118.2-2011. (3)

Total L: 15

REFERENCES:

1. Phadke A.G., Thorp J.S., "Synchronized Phasor Measurements and Their Applications", Springer Publications, Second Edition, 2017.
2. IEEE C37.118.1a-2014, IEEE Standard for Syncrophasor Measurements for Power Systems.
3. IEEE C37.242, 2013 - Guide for Synchronization, Calibration, Testing, and Installation of Phasor Measurement Units (PMU) for Power System Protection and Control.
4. IEEE C37.244, 2013 - Guide for Phasor Data Concentrator (PDC) Requirements for Power System Protection, Control, and Monitoring.

5. Phadke A.G., Thorp J.S, “Computer Relaying for Power Systems”, John Wiley and Sons Ltd., Research Studies Press Limited, 2nd Edition, 2009.
6. IEC 61850-90-5, Communication networks and systems for power utility automation – Part 90-5: Use of IEC 61850 to transmit Synchrophasor information according to IEEE C37.118.

18EK16 GRAPHICAL PROGRAMMING FOR REAL-TIME APPLICATIONS

1 0 0 1

INTRODUCTION TO REAL-TIME CONCEPTS: Concept of Real-Time Systems - Characteristics of Real-Time Systems – Need for Real-Time Operating Systems (2)

LabVIEW REAL-TIME HARDWARE: ARCHITECTURE: Overview of Hardware Setup and Installation -Configuration of Network Settings of Real-Time Target and Host Computer - Configuration of Real-Time Target in Measurement and Automation Explorer - Configuring Real-Time targets through the LabVIEW Project. (3)

PROGRAMMING LabVIEW REAL-TIME MODULE: Accessing I/O using driver APIs or Scan Engine – Multithreading – Sleep Mode -Timing loops in LabVIEW Real-Time. (4)

COMMUNICATION: Inter-process Communication**:** Sharing Data locally on Real-Time Target - Sharing Data between Deterministic and Non-Deterministic Processes - Sharing data between non-deterministic processes - Communication between Real-Time Target and Host Computer – Implementation of Network Communication (4)

DEBUGGING AND DEPLOYMENT: Standard Debugging Techniques – Analysis of Memory Consumption – Creating Build Specification – Communication with Deployed Applications. (2)

Total L: 15

REFERENCES:

1. Course Manual Titled, “LabVIEW Real-time Application Development”, Published by National Instruments, 2016.
2. Rick Bitter, Taqi Mohiuddin, Matt Nawrocki, “LabVIEW: Advanced Programming Techniques”, Second Edition, 2006.
3. Garry W. Johnson,”LabVIEW Graphical Programming”, Tata McGraw Hill, 2001.

18EK17 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

REFERENCES :

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

18EK18 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

REFERENCES:

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.
3. Bhaskar J,”A Verilog Primer”, Prentice Hall of India Learning, 2012.

18EK19 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. KK Jain , RB Sharma, “Automobile Engineering”, Tata McGraw Hill Publications, 2011.
2. Ronald K.J., “Automotive Electronics Handbook”, McGraw Hill Publications, USA, 2009.
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. Tom Denton, “Automobile Electrical and Electronics Systems”, Routledge Taylor & Francis Group, London & New York, 2002.

AUDIT COURSES

18EA81 ENGLISH FOR RESEARCH PAPER WRITING

vide Automotive Engineering 18AE81

18EA82 RESEARCH METHODOLOGY AND IPR

vide Automotive Engineering 18AE82