BHARATHIAR UNIVERSITY, COIMBATORE – 641 046
M.Phil. /Ph.D. (FT/PT) – ELECTRONICS
PART I – SYLLABUS
(From October 2011 batch onwards)

PAPER I – RESEARCH METHODOLOGY

UNIT I: HIGHER EDUCATION AND LEARNING

Historical perspective – objectives and role of higher education – learning and learning hierarchy – information processing – learning events and outcomes – motivation. **Teaching technology designs:** Meaning, concept and scope – instructional designs: objective based, skill based, competency based, learning style based and model based.

UNIT II: METHODS AND TECHNIQUES OF TEACHING

Large group techniques: lecture – modified lecture – seminar – symposium – panel discussion – team teaching – project approach and workshop**. Small group techniques:** group discussion – simulation – role playing – buzz techniques – brain storming – case discussion – assignment – system approach in education. **Evaluation**: A Conceptual Framework - Methods of Evaluation – Self Evaluation and Student Evaluation in Higher Education - Diagnostic Testing and Remedial Teaching.

UNIT III : RESEARCH METHODOLOGY

Meaning of Research - Objectives of Research - Motivations in Research - Types of Research - Research Approaches - Significance of Research - Research Methods v/s Methodology - Research and Scientific Methods - Research Process - Criteria of Good Research - Funding agencies. **Defining the Research Problem:** Research Problem - Selecting the Problem - Necessity of Techniques in defining the Problem.

UNIT IV: RESEARCH DESIGN

Meaning – Need - Features of Good Design – Concepts – Types - Basic Principles of Experimental Design, Developing a Research Plan. **Sample Design:** Implication – Steps - Criteria for selecting a sample procedure - Characteristics of Good sampling Procedure - Types of Sample Design - Selecting Random Samples - Complex random sampling Design. **Measurement and Scaling Techniques:** Measurement in Research - Measurement Scales - Sources of Errors in measurement - Tests of Second measurement - Technique of developing Measurement Tools - Meaning of Scaling - Scale Classification Bases - Important Scaling Techniques - Scale Construction Techniques.

UNIT V: SCIENTIFIC PAPERS, PRESENTATIONS AND REPORT WRITING

Organizing and writing a rough draft – searching and reviewing scientific literature – publishing in scientific journals – ethical and legal issues – scientific presentations – oral presentation – poster presentation. Preparation of research report - steps involved in writing a good report - concepts of bibliography and references. **Application of Computer for Research Work:** Application of Computer packages - Educational and Research resources on the Internet - Data Analysis and Display using software. **Developing a Research Proposal:** Format of research proposal - Individual research proposal - Institutional proposal.

Reference Books

1. **E.G. Vedanayagam,** "Teaching technology for College Teachers", Sterling Publishers (P) Ltd., 1989.
2. **C. R. Kothari, "**Research Methodology Methods and Techniques", New Age International Pvt. Ltd., Publishers, 2nd revised edition, 2009.
3. **Wayne Goddard and Stuart Melville,** "Research Methodology: An Introduction" Juta Academic Publication, 2nd edition, 2004.
4. **Ranjit Kumar**, "Research Methodology: A Step by Step Guide for Beginners", Sage Publications, 2nd edition, 2005
5. **Martha Davis, "**Scientific Papers and Presentations" San Diego: Academic Press, 1997.

PAPER II – RESEARCH TRENDS IN ELECTRONICS

UNIT I : THIN FLIM TECHNOLOGY

Introduction to thin films: Nucleation, growth, kinetics and thermodynamics of materials. **Film formation**: chemical methods – Physical methods. **Applications**: Thin films for microelectronics, MEMS, optical coatings, photodetectors, smart sensors, TFTs, antiabrasive coatings, solar cells, bioelectronics devices.

UNIT II : DIGITAL SIGNAL AND IMAGE PROCESSING

Methods and techniques for digital signal processing - Review of sampling theorems - Demodulation by Quadrature sampling - Z-transform methods - linear shift-invariant systems - difference equations - Correlation and convolution - Signal flow graphs for digital networks - canonical forms - Design of digital filters - IIR and FIR filters - FFT techniques. Image acquisition - Image representations - Image digitalization - Sampling - Quantization - Histograms - Image Quality - Noise in Images - Basic operations on images - Image Enhancement - Pixel intensity transformations - Histogram equalization and matching - noise removal - Edge sharpening - Image smoothing.

UNIT III: VLSI DESIGN

The Characteristics of Digital Electronic Design and Representation issues - Design abstraction - Hierarchy Views - Connectivity - Spatial Dimensionality - Design Environments - Design flow - Schematic Entry - HDL - Synthesis - Verification - Implementation - Design Handoff - Y-diagram - Simulation - Synthesis - Physical level - RTL level - Floor Planning. **VLSI Devices:** VLSI Devices: CPLD and FPGA - Architecture of Programmable Logic Devices- CPLD - FPGA and SOC.

UNIT IV: EMBEDDED SYSTEMS

Definition and classification – Overview of microprocessor - Microcontroller - DSP – exemplary high performance processors – CISC and RISC architecture – hardware unit in an embedded system - software embedded into a system – exemplary applications – embedded systems on a chip and in VLSI circuit – over view of 8051 family – 8051 instruction set and registers - 8051 assembly programming - addressing modes – assembler directives - Programming with C - Data types – time delay programming – I/O programming – programming of 8051 timer - 8051 serial Communication - 8051 interrupts.

UNIT V: INDUSTRIAL CONTROLLERS

PLC - process event and space sequence description - ladder diagram - programming a PLC - use of microcontrollers - fuzzy logic - Process control systems and automation - case studies of boiler – chiller - clean room – furnace - heat exchanger – pump - steam turbine - bottling plant. **PID:** Process Control loop characteristics - controller modes - ON-OFF control - proportional mode - integral and differential actions - P, PI, PID modes - Analog and digital PID controllers - open/ closed loop tuning of PID - Auto-tuning PID controllers.

Reference Books

1. Milton Ohring and Daniel Gall, "Materials Science of Thin films: Deposition and Structure" Academic Press, 3rd Edition.
2. John G.Proakis, Dimitris G. Manolakis, D.Sharma, "Digital signal processing principles, Algorithms, and Applications", Pearson Education, 2006.
3. S.Jayaraman, S.Esakkirajan, T.Veerakumar, "Digital Image Processing", TMH, 3rd reprint, 2010.
4. Steven M. Rubin, "Computer Aids for VLSI Design", 3rd edition, Addison-Wesley, 2009.
5. Wayne Wolf, "Modern VLSI Design: System-on-Chip Design", 3rd Edition, Prentice Hall, 2002.
6. Muhammad Ali Mazidi, Janice Gillispie Mazidi and Rolin D. McKinlay "The 8051 Microcontroller and Embedded Systems Using Assembly and C", PHI, 2nd edition 2006.
7. Frank D. Petruzella, "Programmable Logic Controllers", Third edition, Tata McGraw Hill 2010.

PAPER III – 1. THIN FILM TECHNOLOGY

UNIT – I: VACUUM SCIENCE AND TECHNOLOGY

Kinetic theory of Gases: Molecular velocities – Pressure – Gas impingement on surfaces- Gas Transport and Pumping: Gas flow regimes – Conductance - Pumping speed- Vacuum Pumps: General Considerations – Rotary mechanical pump – Diffusion pump – Cryopumps – Sputter ion pumps- Vacuum systems: Components and operation – System pumping considerations – Vacuum leaks – Monitoring the vacuum environment.

UNIT – II: PREPARATION OF THIN FILMS

Sputtering: DC Sputtering – RF Sputtering – Reactive sputtering – Magnetron sputtering – Plasma Etching- Physical vapor deposition: Ion plating – Reactive evaporation process – Arc plasma deposition – Ion beam assisted deposition –Ionized cluster beam deposition – Plasma immersion ion implantation- Chemical vapor deposition: Atmospheric pressure CVD – Low pressure CVD – Metal organic CVD – Laser enhanced CVD – Plasma enhanced CVD - electro plating- sol gel coating.

UNIT – III: THICKNESS AND CHARACTERIZATION OF THIN FILMS

Thickness measurement : electrical methods – optical interference methods–multiple beam interferometry – Fizeau – FECO methods – Quartz crystal thickness monitor.
Structural Characteristics: Introduction – Scanning electron microscopy (SEM) – Transmission electron microscopy (TEM) – X ray diffraction (XRD) – Atomic force microscopy (AFM) - Chemical characteristics: Auger electron spectroscopy (AES) – X ray energy dispersive analysis (EDX) – X ray photoelectron spectroscopy (XPS) – Secondary ion mass spectroscopy (SIMS).

UNIT – IV: PROPERTIES OF THIN FILMS

Mechanical Properties: Adhesion- Mechanical methods – Nucleation methods – Nature of adhesion forces - Stress: Stress measuring techniques- Tensile properties: Methods of measurements – Results- Optical properties: UV Vis Spectroscopy - absorption and Transmittance. Electrical Properties: Sources of resistivity in metallic conductors – commonly measured quantities for thin films – Hall effect and Magneto resistance in thin films – Negative temperature coefficients of resistance in films- Influence of heat treatment.

UNIT – V: APPLICATIONS OF THIN FILMS

Design and Fabrication of Thin film resistor – Thin film capacitor – Thin film diode – Thin film transistor — Thin film solar cells -Thin film mask blanks for VLSI – Thin films sensors for gas detectors- Magnetic sensors- storage device- magnetic thin films for MEMS and NEMS application

Reference Books

1. Milton Ohring and Daniel Gall, “Materials Science of Thin films: Deposition and Structure” Academic Press, 3rd Edition.
2. Goswami, “Thin Film Fundamentals” New Age International Ltd., 2003.
3. Krishna Seshan, “Handbook of Thin-film Deposition Processes and Techniques: Principles, Methods Equipment and Applications” William Andrew Inc., 2002
4. Donald L. Smith, “Thin-film deposition: principles and practice”, McGraw-Hill Professional, 1995.
5. L.I.Maissel and R.Glang, “Handbook of Thin films technology”, Mcgraw hill.

PAPER III – 2. NANO SCIENCE AND TECHNOLOGY

UNIT I : INTRODUCTION AND CLASSIFICATION

Classification of nanostructures, nanoscale architecture – Effects of the nanometre length scale – Changes to the system total energy, changes to the system structures, vacancies in nanocrystals, dislocations in nanocrystals – Effect of nanoscale dimensions on various properties – Structural, thermal, chemical, mechanical, magnetic, optical and electronic properties – effect of nanoscale dimensions on biological systems.

UNIT II : NANOMATERIALS PREPARATION METHODS

Fabrication methods – Top down processes – Milling, lithographics, machining process – Bottom-up process – Vapour phase deposition methods, plasma-assisted deposition process, MBE and MOVPE, liquid phase methods, colloidal and solgel methods – Methods for templating the growth of nanomaterials – Ordering of nanosystems, self-assembly and self-organisation – Preparation, safety and storage issues.

UNIT III : CHARACTERISATION TECHNIQUES

General classification of characterisation methods – Analytical and imaging techniques – Microscopy techniques - Electron microscopy, scanning electron microscopy, transmission electron microscopy, STM, field ion microscopy, scanning tunnelling microscopy, atomic force microscopy - X ray diffraction - Absorption spectroscopy - Photo-luminescence - Raman Spectroscopy.

UNIT IV : NANOELECTRONICS AND INTEGRATED SYSTEMS

Basics of nanoelectronics – Single Electron Transistor – Quantum Computation – tools of micro-nanofabrication – nanolithography – quantum electronic devices – MEMS and NEMS – Dynamics of NEMS – limits of integrated electronics.

UNIT V : NANODEVICES AND APPLICATIONS

Nanomagnetic materials – Particulate nanomagnets and geometrical nanomagnets – Magneto resistance – Probing nanomagnetic materials – Nanomagnetism in technology – Carbon nanotubes – fabrication- applications – Organic FET, organic LED's – Organic photovoltaics – Injection lasers, quantum cascade lasers, optical memories, electronic applications, colulomb blockade devices.

Reference Books

1. Kelsall Robert W, Ian Hamley, Mark Geoghegan, "Nanoscale Science and Technology", Wiley Eastern, 2004.
2. Michael Kohler, Wolfgang, Fritzsche, "Nanotechnology: Introduction to Nanostructuring Techniques", 2004.
3. William Goddard, Donald W Brenner, "Handbook of Nano Science Engineering and Technology", CRC Press, 2004.
4. Bharat Bhushan, "Springer Handbook of Nanotechnology", 2004.
5. Charles P Poole, Frank J Owens, "Introduction to Nanotechnology", John Wiley and Sons, 2003.
6. Mark Ratner, Danial Ratner, "Nanotechnology: A Gentle Introduction to the Next Big Idea", Pearson, 2003.
7. Gregory Timp, "Nanotechnology", Springer-Verlag, 1999.
8. Jan Korvink & Andreas Greiner, Semiconductors for Micro and Nanotechnology – an introduction for Engineers, Weinheim Cambridge: Wiley-VCH, 2001.

PAPER III – 3. COMMUNICATION SYSTEMS

UNIT I : DIGITAL COMMUNICATION SYSTEMS

Digital communication principles – FDM - TDM - WDM PCM - delta modulation - transmission coding - code compression – Companding - CODECs, error detection and correction codes - cyclic codes - convolution codes - data security - encryption/decryption algorithms. MODEM - Shift Keying Techniques - Spread Spectrum modulation – FDMA - TDMA - CDMA. Telephone communication - switching networks - analog and digital exchanges - speech digitization and transmission - traffic engineering - numbering and charging plan – facsimile – Mobile communication systems - cellular concepts – UMTS - frequency reuse – roaming – SMS – GSM – GPRS - CDMA – EDGE - GPS.

UNIT II : MICROWAVE COMMUNICATION SYSTEMS

Introduction – Maxwell's equation – Amperes law – Faradays law – Gauss law – Wave equation – Types of wave guides – TE and TM modes – Propagation of TM waves in rectangular wave guide – TM modes in rectangular wave guides. Microwave tubes: - Reflex Klystron – Traveling wave tube (TWT) – Magnetron – Applications MICROWAVE DEVICES: Microwave transistors – Gallium Arsenide (GaAs) metal semi-conductor FET – Varactor Diode – PIN diode – Scotty diode – Tunnel diode – Gunn diode – IMPATT diode – TRAPATT diode – BARITT diode – Maser principle – Applications.

UNIT III : FIBER OPTIC COMMUNICATION SYSTEMS

A basic fiber optic system – Advantages and Disadvantages - Frequencies – Fiber optic Cables – Refraction – Numerical Aperture – Graded index cables – Single mode – Multi mode – Cable Constructions – Cable losses – Connectors – Light Sources – Light Detector – Systems Components — Active and passive optical Networks .

UNIT IV : NETWORK COMMUNICATION SYSTEMS

Messages, characters, bit streams, symbols and waveforms – Digital/analog, serial/parallel, simplex/half duplex/full duplex – Synchronous/asynchronous – Advantages of Networks – Structure of the Communication Network - Point to Point and Multi drop Circuits – Data Flow and Physical Circuits – Network Topologies Goals of Layered Protocols - Network Design Problems - Communication between Layers - Layers of OSI - Concept of LAN, MAN and WAN. **ISDN:** Services – IDN – Channels – User interfaces – ISDN layers – Broad band ISDN

UNIT V : SATELLITE COMMUNICATIONS

Brief history – Equations of the orbit locating the satellite in the orbit – Orbit element – Look angle – Elevation and azimuth calculation – GEO – MEO – LEO – Visibility – Orbital perturbations – Orbital effects in communication system performance. Space craft subsystem – Altitude and orbit control system – Telemetry, Tracking and Command – Power systems – Description of communication system – Transponder – Implementation – Transmission impairments – Space craft antennas – Equipment reliability - Basic transmission theory – System noise temperature – Noise figure – Down link and up link – Limits on link performance.

Reference Books

1. Sam K.Shanmugam, *"Digital and Analog Communication Systems"*, John Wiley Publications, 2005.
2. Kennedy and Davis "Electronic Communication Systems" Tata McGraw Hill, 8th edition, 1999.
3. M.Kulkarni "Microwave And Radar Engineering" Umesh Publications, 2nd edition, 2006.
4. Robert J Schoenbeck "Electronic Communications Modulation And Transmission", PHI, 1999.
5. William Stallings "Wireless Communications And Networks", Pearson Education Asia, 2002.
6. Dr.D.C.Agarwall, "Satellite Communications", Khanna Publications, 3rd edition, 1995.

Paper III – 4. DIGITAL SIGNAL PROCESSING

UNIT I: DISCRETE-TIME SIGNALS

Signal classifications - frequency domain representation - time domain representation - representation of sequences by Fourier transform - properties of Fourier transform. DISCRETE-TIME SYSTEMS**:** Classification - properties - time invariant system - finite impulse Response (FIR) system - infinite impulse response (IIR) system.

UNIT II: SAMPLING OF TIME SIGNALS

Sampling theorem - application - frequency domain representation of sampling - reconstruction of band limited signal from its samples. discrete time processing of continuous time signals - changing the sampling rate using discrete time processing. Z-TRANSFORM**:** Introduction - properties of the region of convergence - properties of the Z-transform - inversion of the Z-transform - applications of Z-transform.

UNIT III: BASICS OF DIGITAL FILTERS

FIR FILTER DESIGN**:** Characteristics of FIR Filters - Properties of FIR Filters - windowing method & frequency sampling method of filter design - finite word length effects in FIR filters - FIR Implementation techniques. IIR FILTER DESIGN**:** Impulse Invariant technique - Bilinear transformation - Frequency transformations - Analog filter approximation (Butterworth) - Finite world length effects in IIR filters - Implementation of IIR filters.

UNIT IV: MULTIRATE DIGITAL SIGNAL PROCESSING

Introduction to multirate digital signal processing - sampling rate conversion - filter structures - multistage decimator and interpolators - digital filter banks. APPLICATION OF DSP**:** Voice processing - introduction to wavelet transforms - Definition of an image - Image representation - introduction to 2-D Fourier Transform.

UNIT V: DIGITAL SIGNAL PROCESSORS

Introduction to Programmable Digital Signal Processors TMS 320C5X - Architecture - Central Arithmetic Logic Unit (CALU) - Parallel Logic Unit (PLU) - Auxiliary Register Arithmetic Unit (ARAU) - Assembly language instructions - Pipelining - Applications. TMS 320C54X : Architecture - Assembly language instructions - Pipelining - Applications. An Overview of TMS 320C6X.

Reference Books

1. John G.Proakis and Dimities. G.Manolakis, "Digital Signal Processing, Algorithm and Applications", 3rd edition, Pearson Education/PHI, 2003.
2. Sanjit K Mitra, "Digital Signal Processing: A Computer-Based Approach", 2nd Edition, McGraw-Hill, 2001.
3. S Salivahanan, A Vallavaraj, C Gnanapriya, "Digital Signal Processing", 2nd Edition, Tata McGraw-Hill, 2011.
4. P.Remesh Babu, "Digital Signal Processing", Fourth Edition, Scitech Publication, 2007.
5. B.Venkataramani, M. Bhaskar, "Digital Signal Processors- Architecture, Programming and Applications", TATA McGraw Hill, 2002.

PAPER III – 5. EMBEDDED SYSTEMS

UNIT I: INTEL 8051 MICROCONTROLLER

Microcontrollers and embedded processors – microcontrollers for embedded systems – over view of 8051 family – Memory organization - 8051 instruction set and registers - 8051 assembly programming – data types – directives - addressing modes - Programming with C - Data types – time delay programming – I/O programming – programming of 8051 timer - 8051 serial Communication - 8051 interrupts.

UNIT II: PIC 16F87X MICROCONTROLLERS

Device overview – architecture – memory organization – status register – option register – INTCON register – PCON register – I/O ports – data EEPROM – instruction set: Byte oriented operations – Bit oriented operations – Literal and Control operations **PERIPHERAL FEATURES:** TIMER0 Module – TIMER1 Module – TIMER2 Module – Capture/Compare/PWM Modules – I^2C transmission and reception – USART – ADC Module - Special features of the CPU : oscillator selection – power on reset – power up timer – oscillator start up timer – brown out reset – interrupts – watchdog timer – SLEEP

UNIT III: ARM MICROCONTROLLER

Architecture of LPC 2378 - Pin Description - On-Chip memory - memory map - GPIO - clock and timing - On chip peripherals - ADC - DAC - DMA controller - UART - Timer /Counter - Real time clock - Watchdog timer - CAN and Ethernet - I^2C mode - USB host/slave.

UNIT IV: REAL TIME OPERATING SYSTEMS

Definitions of process, tasks, and threads – Operating system services – goals – structures- kernel – process management – memory management – device management – file system organization and implementation – I/O sub systems – interrupt routine handling in RTOS – RTOS task scheduling models – handling of task scheduling – latency – deadlines – round robin scheduling – cyclic scheduling – preemptive – critical session – static real time scheduling – IPC and synchronization – use of semaphore – priority inversion – deadlock – IPC using signals – mutex-flag- message queues – mailboxes – pipes- virtual sockets – remote procedure calls

UNIT V: REAL WORLD APPLICATIONS

LCD Interfacing – keyboard interfacing – parallel and serial ADC interfacing – DAC interfacing – sensor interfacing and signal conditioning – RTC interfacing – relays and opto-isolator interfacing – stepper motor interfacing - DC motor interfacing and PWM

Reference Books

1. Muhammad Ali Mazidi, Janice Gillispie Mazidi and Rolin D. McKinlay "The 8051 Microcontroller And Embedded SystemsUsing Assembly And C", PHI, 2nd edition 2006.
2. PIC 16F87X data book, Microchip Technology Inc., 2001
3. Product data sheet of LPC 2378.
4. A. N. Sloss, D. Symes and C. Wright, "ARM System Developers Guide" Elsevier, 2004.
5. Rajkamal, "Embedded Systems Architecture, Programming and Design", TATA McGraw-Hill, First reprint, 2003

PAPER III –6. VLSI DESIGN

UNIT I : CMOS LOGIC

CMOS transistors –Design rules – Combinational logic cells: Pushing Bubbles – Drive strength – Transmission gates – EX-OR cell, Sequential logic cells: FF –clocked Inverter, Data path logic cells: Data path elements

UNIT II : HARDWARE DESCRIPTION LANGUAGES

VERILOG - Introduction- Language elements - Gate-level modeling - data flow – Behavioral - structural modeling – Modeling examples. VHDL: Introduction - Design units, Entity Declaration, Architecture body, Configuration, Declaration, Package Declaration, Package, Body - Basic Language Elements -modeling Styles - Behavioral Modeling - Dataflow Modeling – Structural modeling -Subprograms - Functions - Procedures – Packages.

UNIT III : DIGITAL SYSTEM DESIGN

Introduction to logic circuits - Combinational Logic Design procedure - Physical Design and VHDL, representation of Decoders, Encoders, Multiplexer, Demultiplexer, adder, Subtractor, Multipliers - Sequential logic design procedure - State Diagram andState table - Physical Design and VHDL, representation of flip-Fops, Shift Register, counters - Programmable Logic Technologies - ROM - programmable Logic Arrays - Programmable Array Logic Devices -Programmable logic Devices: Altera, Max7400, GPLD's, Xilinx XC 4000 Structure.

UNIT IV : INTRODUCTION TO ASIC DESIGN

Full custom ASICs - Standard cell Based ASICs - Gate Array Based ASICs -channelless Gate Arrays - Structured Gate Arrays - programmable Logic Devices (PLD) - Field Programmable Gate Arrays (FPGA) Design Flow - Schematic Entry - Hierarchical Design - The Cell Library - Names - Schematic Icons and Symbols - Nets - Schematic Entry For ASICs and PCBs - connections - Vectored Instances and Buses - Edit-in-place - Attributes - Net List Screener - Schematic -Entry tools - Back Annotations.

UNIT V : ASICs CONSTRUCTIONS, FLOOR PLANNING, PLACEMENTS, ROUTING

Physical Design - CAD Tools - System Partitioning Methods - Floor planning Measurement of Delay in Floor planning - Floor planning Tools - Channel Definitions - I/O And Power planning - Clock Planning - Placements, Terms and Definitions - Measurement - Global Routing - Measurement of Interconnect Delay – Methods Routing Between Blocks - Time Driven Methods- Back annotations.

Reference books

1. Michael John Sebastian Smith, “Application specific Integrated Circuits", Addison-Wesley, 2nd reprint, 2000.
2. M. J. S. Smith, "Application Specific Integrated Circuits," Pearson Education Asia Pvt. Ltd, 2003
3. Bhasker.J. ”A Verilog HDL Primer”, BS Publications, 2001
4. Bhasker. J, "VHDL primer", BS Publications, 2001

Paper III –7. PROGRAMMABLE LOGIC CONTROLLER

UNIT I: INTRODUCTION

Programmable Logic Controller (PLC): Principles - operation and Applications. PLC Hardware Concepts: I/O Modules and Specifications - CPU - Memory Design - and recording/Retrieving Data.

UNIT II: LOGIC FUNDAMENTALS

Comprehensive Review of Logic - Hard Wired versus Programmed Logic - Word-Level Logic Instructions. PLC Programming: Processor Memory Organization - Relay Instructions and Ladder Diagrams PLC Languages.

UNIT III: PLC WIRING AND LADDER TYPE PROGRAMS

Control Relays - Motor Starters - and Switches. Transducers and Sensors Connecting Relay - Ladder Diagrams into PLC Ladder Programs. Programming Timers and Counters: Instructions and Incremental Encoder-Counter Applications - Timer Instructions - Counter - Instructions - Combining Functions.

UNIT IV: PROGRAM CONTROL INSTRUCTIONS AND DATA MANIPULATION

I/O Instructions - Addresses - Safety - and Fault Routines - Selectable Timed interrupts - transfer Compare and Set-Point Control - Data Compare and Data manipulation. Math - Sequence and Shift Register Instructions: Device Integration with Lab Applications - Industrial Processes and Data Acquisition systems - Computer Integrated Devices and Data communications.

UNIT V: APPLICATIONS

Simple materials handling applications - Automatic control of warehouse door - Automatic lubricating oil supplier - Conveyor belt motor control - Automatic car - washing machine - Bottle label detection - tea/coffee vending machine control.

References Books

1. Frank D. Petruzella, “Programmable Logic Controllers”, Third edition, Tata McGraw Hill, 2010.
2. R.C. Seals and G.F. Whapshott, “Programmable Logic PLDs and FPGAs”, McGraw-Hill Professional Publishing, 1997.
3. Garry Dunning, “Introduction to Programmable Logic Controllers”, Delmar Thomson Learning, 2001
4. John W. Webb and Ronald A Reiss, “Programmable Logic Controllers”, 5th edition, PHI.
5. John R Hackworth & F D Hackworth, “Programmable Logic Controllers”, Pearson Education, 2004.

PAPER III – 8. AUTOMOTIVE ELECTRONICS

UNIT-I : INTRODUCTION

Introduction – Functional Domain – Standardized components , models and process – Certification issues Application of AUTOSAR **:** Motivation – Main Objectives – Working methods – AUTOSAR architecture –BSW and RTE – Methodology and templates – ECE Configuration – Conformation testing.

UNIT –II : INTELLIGENT VEHICLE TECHNOLOGY

Road transport and its evolution –New technology in vehicle – Dependability issues – Autonomous CAR : ARV –ARN. Embedded communication **:** Automotive communication system – In - CAR embedded networks – Middle layer – Open issues for automotive communication system.

UNIT-III : FLEX RAY PROTOCOL

Introduction- communication – FlexRay Protocol - FlexRay application. Automotive CAN Network: Introduction – Features and limitations – Data consistency issues – Star Topologies for CAN - FTT CAN - Flex CAN architecture – How FlexCAN addresses CAN limitation- Dependability in CAN

UNIT-IV: TESTING AUTOMOTIVE CONTROL SOFTWARE

Introduction – test activities and testing techniques-testing in the development process- test planning – test environment. **Testing and monitoring of Flex ray based Application:** Introduction – objectives-monitoring and testing approaches-software based approaches-Hardware based approaches.

UNIT –V: TIMING ANALYSIS OF CAN BASED COMMUNICATION SYSTEM

Topology –Frames and Frame arbitration - error detection – Bit Stuffing – CAN Schedules-Scheduling model – response time analysis- Holistic analysis- middleware and frame packing

Text book

1. Nicolas Navet, Françoise Simonot-Lion, ”Automotive Embedded System Handbook” CRC Press, 2009.

PAPER III – 9. VIRTUAL INSTRUMENTATION

UNIT I : INTRODUCTION

General functional description of a digital instrument - Block diagram of a Virtual Instrument - Physical quantities and Analog interfaces - Hardware and Software - User interfaces - Advantages of Virtual instruments over conventional instruments - Architecture of a Virtual instrument and its relation to the operating system

UNIT II : SOFTWARE OVERVIEW

LabVIEW - Graphical user interfaces - Controls and Indicators - 'G' programming - Labels and Text - Shape, Size and Color - Owned and free labels - Data type, Format, Precision and representation - Data types - Data flow programming - Editing - Debugging and Running a Virtual instrument - Graphical programming palettes and tools - Front panel objects - Functions and Libraries.

UNIT III : PROGRAMMING STRUCTURE

FOR loops, WHILE loops, CASE structure, formula nodes, Sequence structures - Arrays and Clusters - Array operations - Bundle - Bundle/Unbundle by name, graphs and charts - String and file I/O - High level and Low level file I/O's - Attribute modes Local and Global variables. **OPERATING SYSTEM AND HARDWARE OVERVIEW:** PC architecture, current trends, Operating system requirements, Drivers – Interface Buses – PCI Bus – Interface cards – specification – Analog and Digital interfaces – Power, Speed and timing considerations.

UNIT IV : HARDWARE ASPECTS

Installing hardware, Installing drivers - Configuring the hardware - Addressing the hardware in LabVIEW - Digital and Analog I/O function - Data Acquisition - Buffered I/O - Real time Data Acquisition.

UNIT V : LABVIEW APPLICATIONS

IMAQ - Motion Control: General Applications - Feedback devices, Motor Drives – Instrument Connectivity - GPIB, Serial Communication - General, GPIB Hardware & Software specifications - PX1 / PC1: Controller and Chassis Configuration and Installation.

Reference Books

1. Garry M Johnson, "Labview Graphical Programming", Tata McGraw Hill, New Delhi, 2nd Edition, 1996
2. Robert H.Bishop,"Learning with Lab-View" Prentice Hall, 2003
3. Labview : Basics I & II Manual, National Instruments, 2005.
4. Lisa K Wells, "Labview for Everyone", Prentice Hall of India, New Delhi, 1996
5. Barry Paron, "Sensor, Transducers and Labview", Prentice Hall, New Delhi, 2000

Paper III –10. MEMS AND THEIR APPLICATIONS

UNIT I: OVERVIEW OF MEMS & MICRO SYSTEMS

MEMS & Micro systems - Typical MEMS & Micro system Products - Evaluation of Micro Fabrication - Microsystems and Microelectronics - The Multi disciplinary nature of Micro System design and Manufacture - Micro Systems and Miniaturization - Applications of Micro systems in Automotive Industry — Applications of Microsystems in other Industries.

UNIT II : WORKING PRINCIPLES OF MICRO SYSTEMS

Micro sensors - -Micro actuation : Actuation using Thermal forces - Actuation Using Shape Memory Alloys - Actuation using Piezoelectric Crystals - Actuation using Electrostatic Forces - MEMS with Micro Actuators - Micro Accelerometers – Micro Fluidics.

UNIT III : MATERIALS FOR MEMS AND MICROSYSTEMS

Introduction - Substrates and Wafers - Active Substrate Materials – Silicon as a Substrate Material — Silicon Compounds — Silicon Piezoresistors - Gallium Arsenide - Quarts Piezoelectric Crystals - Polymers - Packaging Materials.

UNIT lV : MICROSYSTEMS FABRICATION PROCESSES

Introduction — Photolithography - Ion Implantation — Diffusion – Oxidation — Chemical Vapour Deposition — Physical Vapour Deposition — Sputtering — Deposition by Epitaxy — Etching - Summary of Micro fabrication. OVERVIEW OF MICROMANUFACTURING Introduction - Bulk Manufacturing - Surface Manufacturing - The LIGA Process - Summary of Micro manufacturing.

UNIT V : MICROSYSTEMS DESIGN

Introduction - Design considerations - Process Design - Photolithography - Thin Filrn Fabrications - Geometry Shaping - Mechanical Design - Mechanical Design using Finite Element method - Design of a Silicon Die for Microprocessor Sensor- Design of Micro f'luidic Network systems — Design case — Computer Aided Design. MICROSYSTEM PACKAGING
Micro System Packaging (Types) - Essential Packaging Technologies (Types).

Reference Book

1. Tai-Ran-Hsu, "MEMS & Micro Systems Design and Manufacture", TMH, 2nd edition, 2003.