

BHARATHIAR UNIVERSITY, COIMBATORE-641046

ELECTRONICS AND INSTRUMENTATION

**M.Phil./Ph.D.(FT/PT)– PART I - SYLLABUS
(From October 2011 batch onwards)**

PAPER I : Research Methodology

PAPER II : Research Trends in Electronics and Instrumentation

PAPER III : Special Papers:

1. Computer Based Instrumentation
2. Bio Medical Instrumentation
3. Embedded System Design
4. VLSI System Design
5. MEMS and their application
6. Advanced Digital Signal Processing
7. RTOS and Vx Works
8. Molecular Physics
9. Thin Film Characterization and Applications
10. Industrial Automation

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/ ELECTRONICS & INSTRUMENTATION

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. COMPUTER BASED INSTRUMENTATION**UNIT I: 8051 CORE MICROCONTROLLER**

8051 Core Microcontroller: Introduction-Memory Organization Logical Separation of Program memory and Data memory-Program Memory-Data Memory-Instruction Set-CPU Timing-Interrupt structure.

UNIT II: PIC MICROCONTROLLER

PIC 16F877 Microcontroller: Introduction –Architecture-Pin Out Diagram –Memory Organization-ALU-Status Register-Option Register –INTCON Register-Program Counter – Watch Dog Timer –Sleep Ports Interrupt-Timer-Instruction set.

UNIT III: PC HARDWARE

Special Features Of 286, 386, 486,Pentium Series Processor-Motherboard types and Classification-Memory Mapping –I/O address-RAM Types-I/O Cards-Basic Concepts Of FDD and HDD-I/O Slot-Com port-LPT Port-Interrupt-BIOS-TSR Programs.

UNIT IV: INTERFACING CONCEPT

Input Output Interfacing-Practical Interface Considerations-Logical level –Serial drive –Capacities –Driving heavy Loads –Driving AC Loads-Serial Format-Asynchronous/Synchronous Serial Data Communication-MODEM –Parallel/Serial Interface. Interfacing Keyboard –Interfacing Alphanumeric Display-Interfacing ADC-interfacing DAC-Interfacing LCD Module-Interfacing Stepper Motor-Temperature Monitoring –design of 8255 card for PC-Optical Motor Shaft Encoder.

UNIT V: COMPUTER –BASED CONTROLLER

Introduction- Computer-Based Controller-Hardware Configuration, Software Requirements-Other Computer applications –Data Logging, Supervisory Control –Control system Networks-Development, General Characteristics, field Bus Types.

REFERENCE BOOKS

1. Intel Manual Embedded Microcontroller
2. Ayala K.J.-The 8051 Microcontroller Architecture Programming and Applications -3rd Edition-Penram International.
3. Muhammad Ali Mazidi, Janice Gillispie Mazidi and Rolin D.McKinlay, The 8085 Microcontroller and Embedded systems, using Assembly and C,2nd Edition Prentice Hall, 2008
4. PIC 16F877 DATA Sheet
5. PIC Micro Mid Range MCU Family Reference Manual.
6. Stephan J.Bigelow-Trouble Shooting, Maintaining & Repairing PC's-Tata McGraw Hill, 2nd Edition.
7. B.Govindarajalu-IBM PC and Clones Hardware Troubleshooting and Maintenance-TataMcGraw Hill.
8. Peter Norton –Inside IBM PC and PS/2-4the edition, Prentice Hall of India.

9. Ronald J.Tocci, Leots P.Laskowski-Microprocessor and microcomputer Hardware and Software-Prentic Hall of India.
10. Douhgles V.Hall-Microprocessor and Interfacing Programming and Hardware-TataMcGrawHill.
11. Ramesh S.Goankar--Microprocessor and Interfacing Programming and Application with 8085/8080A –3rd-Edition- Wiley Eastern Limited.

2. BIO-MEDICAL INSTRUMENTATION

UNIT I: PHSYIOLOGY AND TRANSDUCERS

Cell and its structure-Action and resting-Potential propagation of action potential-Sodium pump-Nervous system-CNS-PNS –Nerve cell-Synapse-Cardio pulmonary system-Physiology of heart and lungs Circulation and respiration-Transducers-Different types-Piezo-electric, ultrasonic, resistive, capacitive, inductive transducers-Selection criteria

UNIT II:ELECTRO-PHYSIOLOGICAL MEASUREMENTS

Basic components of biomedical system-Electrodes-Micro, needle and surface electrodes-amplifiers-Preamplifiers, differential amplifiers, chopper amplifiers-isolation amplifier.ECG-EEG-EMG-ERG-Lead systems and recording methods-Typical waveforms.

UNIT III:NON-ELECTRICAL PARAMETER MEASUREMENTS

Measurement of blood pressure-Cardiac output-Cardiac rate-Heart sound-Respiratory rate-Gas volume-Flow rate of CO₂,O₂ in exhaust air-pH of blood, ESR, GSR measurements-Plethysmography

UNIT IV:MEDICAL INSTRUMENTATION

X-ray machine-Radio graphic and fluoroscopic techniques-Computer tomography-MRI –Ultrasonography-Endoscopy-Thermography-Different types of biotelemetry systems and patient monitoring-Electrical safety.

UNIT V:ASSISTING AND THERAPEUTIC EQUIPMENTS

Pace makers-Defibrillators-Ventilators-Nerve and muscle stimulators-Diathermy-Heart-Lung machine-Audio meters-Dializers.

TEXT BOOKS

1. Lesilie Cromwell, Fred J.Weibell,Erich A.Pfeiffer, "Bio-Medical Instrumentation and Measurements" II edition, Pearson Education,2002/PHI
2. R.S.Khandpur, "Handbook of Bio-Medical Instrumentation" Tata Mc Graw Hill Publishing Co.Ltd.2003.

REFERENCE BOOKS

1. M.Arumugam,Bio-Medical Instrumentation, ”Anuradha Agencies,2—3.
2. L.A.Geddes and L.E.Baker, ”Principles of Applied Bio-Medical Instrumentation” John Wiley & Sons 1975.

3. EMBEDDED SYSTEM DESIGN**UNIT I: INTRODUCTION TO EMBEDDED SYSTEMS**

Introduction – Features – microprocessors – ALU - Von Neumann and Harvard Architecture – CISC and RISC - Instruction pipelining, Microcontroller: characteristics and Features, Controller overview and architecture – PIC 16F 84 – Philips80C552 – Motorola 68HC05/08, Examples of Embedded Systems: Telegraph and Bar coded scanner.

UNIT-II: EMBEDDED BOARD BUSES, I/O AND MEMORY SYSTEMS

Board I/O - Managing Data: Serial vs. Parallel I/O -Interfacing the I/O Components-I/O and Performance - Board Buses - Bus Arbitration and Timing. Integrating the Bus with Other Board Components Bus Performance. MEMORY SYSTEMS: Introduction- Memory Spaces-Cache Overview-External Memory-Direct Memory Access.

UNIT-III: EMBEDDED SYSTEMS DESIGN: HARDWARE AND SOFTWARE INTERACTION

Introduction - From Simple Compiler to Software Design for MPSoC - MPSoC Programming Steps - Hardware/Software Abstraction Levels-The Concept of Mixed Architecture/Application Model-Examples of Heterogeneous MPSoC Architectures-Examples of Multimedia Applications. The MPSoC Architecture - Programming Models for MPSoC-Software Stack for MPSoC-Hardware Components-Software Layers.

UNIT-IV: SOFTWARE DEVELOPMENT TOOLS AND DEBUGGING TECHNIQUES

Development Tool: Cross Compiler—Cross Compiler –Cross Assemblers –Linker /locator PROM Programmers – ROM Emulator –In Circuit Emulators—Debugging Techniques: Software Techniques on Development –Host—Simulators—The Assert Macro – Laboratory Tools.

UNIT-V: REAL TIME OPERATING SYSTEMS (RTOS) AND APPLICATIONS

Real time specifications – real time kernels – inter-task communications and synchronizations – real time memory management. Real time system as complex systems – real time databases – real time image processing – real time UNIX – building real time applications with real time programming languages.

REFERENCE BOOKS

1. Jack Ganssle-Embedded System Hardware
2. Rajkamal – Embedded Systems Architecture, Programming and Design, TMH, 2008
3. Tim wilmshurst—An Introduction to Design of Small Scale Embedded systems—Pal Grave Publications.
4. John B. Peatman Design with P/C Microcontrollers—Pearson Education.
5. Johnathan. w. valvano –Embedded Microcomputer Systems, real time interfacing-Brooks/Cole, 2000.
6. David E. Simon –An Embedded Software Primer Pearson Education, 1999.

4. VLSI SYSTEM DESIGN

UNIT I: DIGITAL SYSTEMS AND VLSI

why design integrated circuits? – integrated circuits manufacturing – CMOS Technology – Integrated Circuit Design Techniques. Transistors and Layout : Introduction – Fabrication processes – transistors – wires and vias – design rules – layout design and tools.

UNIT II: LOGIC GATES

Introduction – combinational logic functions – static complementary gates – switch logic – low power gates – delay through resistive interconnect-delay through inductive interconnect.

UNIT III: COMBINATIONAL LOGIC NETWORKS

Introduction – standard cell – based layout – simulation – combinational network delay – logic and interconnect design – power optimization – switch logic networks – combinational logic testing.

UNIT IV: SEQUENTIAL MACHINES

Introduction – latches and flip-flops – sequential systems and clocking disciplines – sequential system design – power optimization – design validation – sequential testing

UNIT V: SUBSYSTEM DESIGN

Introduction – subsystem design principles – combinational shifters– address – high density memory – field – programmable gate arrays – programmable logic arrays – floorplanning methods – off-chip connections.

REFERENCE BOOKS :

- N.H.E. Weste et al, CMOS VLSI design, (3/e), Pearson, 2005
 J. Smith, Application Specific Integrated Circuits, Addison Wesley, 1997.
 Uyemura, Introduction to VLSI Circuits and Systems, Wiley, 2002.

5. MEMS AND THEIR APPLICATION

UNIT I: OVERVIEW OF MEMS & MICRO SYSTEM

MEMS & Micro systems - typical MEMS & Micro system products – Evaluation of Micro fabrication – Microsystems and Microelectronics –The Multidisciplinary nature of Micro Systems 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 MICROSYSTEMS

Micro sensors – Micro 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 – Quartz – Piezoelectric Crystals- Polymers- Packaging Materials.

UNIT IV: 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 Film Fabrications – Geometry Shaping – Mechanical Design – Mechanical design using Finite Element Method Design of a Silicon Die for Micro pressure sensor – Design of Micro fluidic Network systems – Design case – Computer Aided Design.

MICROSYSTEM PACKAGING

Micro Systems Packaging (Types) – Essential Packaging Technologies (Types)

REFERENCE BOOKS :

Tai Ran Hus – MEMS & Micro systems Design and Manufacture – Tata McGraw Hill.

6. ADVANCED DIGITAL SIGNAL PROCESSING

UNIT I: INTRODUCTION

Classification of systems: Continuous, discrete, linear, casual stable, dynamic, recursive, time variance, classification of signals: continuous and discrete, energy and power, mathematical representation of signals: spectral density, sampling technique, quantization, quantization error, Nyquist rate, aliasing effect

UNIT II: DISCRETE FOURIER TRANSFORM

Frequency Domain Sampling-Properties of DFT-Linear Filter Method Based of the DFT-Fast Fourier Transform Algorithm (FFT): Efficient Computation of DFT-Structure and Design of FIR System-Structure and Design of IIR Systems Realization of Digital Linear System.

UNIT III: DIGITAL FILTERS DESIGN

Amplitude and phase response of fir filters – linear phase filters – windowing techniques for design of linear phase FIR filters – rectangular, Hamming, Kaiser windows – Frequency sampling techniques – IIR Filters – magnitude response – Phase response – group delay – Design of Low Pass Butterworth filters(low pass)- Bilinear transform – Prewarping, impulse invariant transformation.

UNIT IV: DSP ALGORITHMS

The Goertzel algorithm, the chirp – z transform algorithm the Levinson – Durbin algorithms, the Schur algorithm, and other algorithms, computations of the DFT, concept of tunable digital filters.

UNIT V: SIGNAL PROCESSING APPLICATIONS

Introduction Definition, basic concepts, Types- voiced and unvoiced; Production of speech-Biological Model, Signal Processing Model; Application areas and trends; Steps of human-human communication; Speech reception and Comprehension by the listener; Digital model of speech perception;

Steps in Digital Image Processing, Components of an Image Processing system, Applications. Human Eye and Image Formation; Sampling and Quantization, Basic Relationship among pixels- neighbour, connectivity, regions, boundaries, distance measures.

TEXT BOOKS

1. J.G.Proakis and D.G.Manollakis,"Digital Signal Processing Principles. Algorithms and Applications" Pearson education, New Delhi 2003/PHI.
2. S.K.Mitra, Digital Signal Processing – A Computer Based Approach Tata Mc Graw Hill, New Delhi, 2001.
3. Digital Processing of Speech- Rabiner and Schafer, Pearson Education
4. Digital Image Processing using MATLAB- R. C. Gonzalez , R. E. Woods and S. L. Eddins, Pearson

7. RTOS AND Vx: WORKS

UNIT I: REAL TIME OS-OVERVIEW

Introduction to Operating System – Functions of Operating System – Types of Operating Systems – Memory Management – Static and Dynamic partitions using MFT and MVT algorithms – Swapping, paging, segmentation – paged segmentations

UNIT II: FILE MANAGEMENT SYSTEM OF OS

File systems – File structure – Disk structure – File allocation – contiguous and non contiguous allocation – free space management – disk scheduling algorithms – Process management Process - Threads – tasks – PCB –TSB – Process, status, short term – medium term – long term schedulers – CPU scheduling – algorithms – introduction to intel process communication using shared memory – pipes – message ques – semaphore – signal interrupt sockets – introduction to RTOS – real time systems – Hard real time systems – soft real time systems – micro knernel and Monolithic kernel architecture – features of RTOS- overview of some RTOS – LIKE Vx works,QNX,RT Linux,Window Ce,Symbian, Psos.

UNIT III: Vx WORKS, MEMORY MANAGEMENT

Vx works and Tornado, Features of IDE – Host Target Architecture – Project Management – Thread Scheduling algorithm – Inter task communication using shared memory – Pipes – Message Queres – Semaphores – Mutual exclusion

UNIT IV: FILE FORMATS OF Vx WORKS

Hardware and software interrupt handling – RAM Disk – File systems – Using DOS file systems on RAM disks – I/O systems – Memory Management – WDT – Message logging – Overview of networking on Vx Works – Managing host table – Managing IP

UNIT V: SOCKET PROGRAMMING

Address – Sockets – Accessing remote files using FTP, TFTP, RSH and NSF – configuring Vx Works as FTP server and FTP client – TFTP server and client – NFS server and NFS client – NFS Client Rlogin – Using Crosswind for Debugging – Using Wind View as a Runtime Analyzer – Using Browser and Winds, Using Integrated Simulator – Building Vx Works image – Creating a Boot image – Download and Booting Vx Works on the Target system

REFERENCE BOOKS:

1. LIU – Real time systems – Pearson Education
2. Lante – Real time system design and analysis – PHI
3. Vx Works – www.tornado.com

8. Molecular Physics

UNIT - I: Molecular Symmetry

Symmetry operation – symmetry elements – Different type of symmetry operations – symmetry point groups – Linear and non linear molecules – Representations of groups - Irreducible Representations and character – and character tables .

UNIT - II: Symmetry Aspects of molecular Orbital theory

General principles – the LACO approximation – the Huckel approximation – Bonding character of orbitals - symmetry factoring of secular equations – Transformation properties of Atomic orbitals – Hybridization schemes of and orbitals Hybrid orbitals as linear combinations of Atomic orbitals – Molecular orbital theory for Ab_n – types molecules .

UNIT - III: Central field approximation

Hartree Fock equation – The method of self consistent field – Hydrogen ion – Hydrogen molecule – covalent bond – Heitler – London theory – Approximate self – consistent molecular orbital theory I, II, III, and IV, Calculation of Equilibrium bond lengths by the CNDO Method .

UNIT - IV: Molecular vibrations

The symmetry of Normal vibrations – Determining the symmetry types of the Normal mode – Internal coordinates – symmetry coordinates - Normal coordinates – potential and kinetic energies interms of symmetry coordinates – removal of redundant coordinates – application of group theory of Raman and I.R .activity .

UNIT - V: Potential Functions

The General Quadratic potential function – The approximation of central forces, valence forces - Modification of the simple force functions - Isotopic effect – An harmonic terms in the potential energy – Quantum mechanical Resonance – characteristic values and characteristic vectors – symmertrization of the secular determinant – solution of the simulanous equations – Matrix Iteration methods – Perturbation methods .

Books for study and References :

1. Chemical applications of group theory – Wiley Inter science F .A . Cotton .
2. infra red Raman spectroscopy – Herzberg.
3. Quantum chemistry A .K .Chandra
4. Molecular vibrations – E .B .Wilson , Decies and cross
5. Group theory application to molecular vibrations – PG Puranik
6. Approximate self – consistent molecular orbital theory II calculations with complete neglect of Differential over lap J . A . people and G .A .Segal J . Che . Phy . vol. 43 . (1965) .
7. Approximate self – consistent molecular orbital theory II Calculations with complete Neglect of Differential over lap J .A . people and G .A . segal J . che. Phy . Vol. 43 No .10
8. Approximate self – consistent molecular orbital theory III CNDD Results for AB,2 and AB,3 Systems .
9. Approximate self – consistent molecular orbital theory 4 Calculations on Molecules including the Elements sodium through chlorine D .P . Santry and G . A . segal J . chem. . phys . vol. 47 – 158 – 174 (1967) .
10. Calculation of Equilibrium bond lengths by the CNDO method G . A . Segal J . chem. . Phys . vol. 47 . 1876 – 1877 (1967) .

9. Thin Film Characterization and Applications

UNIT - I: Preparation of Thin Films

Spray pyrolytic process – characteristic feature of the spray pyrolytic process – ion plating – Vacuum evaporation – Evaporation theory – The construction and use of vapour sources – sputtering Methods of sputtering – Reactive sputtering – RF sputtering - DC planar magnetron sputtering .

UNIT-II: (Thickness measurement and Nucleation and Growth in Thin Film)

Thickness measurement : electrical methods – optical interference methods – multiple beam interferometry – Fizeau – FECO methods – Quartz crystal thickness monitor .

Theories of thin film nucleation – Four stages of film growth incorporation of defects during growth .

UNIT-III: Electrical properties of metallic thin films

Sources of resistivity in metallic conductors – sheet resistance - Temperature coefficient of resistance (TCR) – influence of thickness on resistivity – Hall effect and magneto resistance – Annealing – Agglomeration and oxidation .

UNIT - IV: Transport properties of semiconducting and insulating Films

Semiconducting films ; Theoretical considerations - Experimental results – Photoconduction – Field effect thin films – transistors, Insulation films Dielectric properties – dielectric losses – Ohmic contacts – Metal – Insulator and Metal – metal contacts – DC and AC conduction mechanism .

UNIT - V: Optical properties of thin films and thin films solar cells

Thin films optics –Theory – Optical constants of thin films – Experimental techniques – Multilayer optical system – interference filters – Antireflection coating ,Thin films solar cells : Role, Progress , and production of thin solar cells – Photovoltaic parameter, Thin film silicon (Poly crystalline) solar cells : current status of bulk silicon solar cells – Fabrication technology – Photo voltaic performance : Emerging solar cells : GaAs and CuInSe .

Books for study

- 1 . Hand book of Thin films Technology : L I Maissel and R Clang .
- 2 . Thin film Phenomena : K L Chopra .
- 3 . physics of thin films, vol. 12 , Ed George Hass and others .
- 4 . Thin films solar cells – K L Chopra and S R Das .
- 5 . Thin films processes – J L vilsan

Books of Reference

- 1 . vacuum deposition of thin films – L Holland .
- 2 . The use of thin films in physical investigation – J C Anderson .
- 3 . Thin films technology – Berry, Koil and Harris

10. Industrial Automation

UNIT-1 INTRODUCTION TO AUTOMATION OF PLC AND SCADA

PLC-Block diagram, programming languages, ladder diagram, functional block diagram, application, interfacing of plc with scada. SCADA: Data acquisition system, evaluation of scada, communication technologies, monitoring and supervisory functions.

UNIT-II SCADA ARCHITECTURE AND SYSTEM COMPONENTS

Various SCADA Architecture, advantage and disadvantage of each system, single unified standard architecture IEC 61850 SCADA/HMI System. Remote terminal unit, intelligent electronics devices, communication network and scada server.

UNIT-III PLC, SCADA COMMUNICATION AND OPERATION

Various Industrial Communication Technologies-Wired and Wireless Methods and fiber optics, open standard communication protocols. Automatic substation control, scada configuration, energy management system, system operating states, system security, state estimation.

UNIT-IV ROBOTICS APPLICATIONS IN INDUSTRIES

Robot Application in Manufacturing: Material Transfer - Material handling, loading and unloading-

Processing - spot and continuous arc welding & spray painting - Assembly and Inspection.

UNIT-V PLC AND SCADA APPLICATIONS

Applications of PLC Simple materials handling applications Automatic control of warehouse door, Automatic lubricating oil supplier Conveyor belt motor control, Automatic car washing machine Bottle label detection Process control application. SCADA: Utility applications, transmission and distribution sector operation, monitoring analysis and improvement. Industries oil gas and water case studies, implementation.

TEXT BOOKS

1. Stuart a boyer: SCADA supervisory control and data acquisition
2. Gordon clark, deem reynders, practical modem scada protocols.
3. Charles H. Roth, Jr " Fundamentals of Logic Design ", Fourth Edition, Jaico Publishing house, 1999,
4. Frank D. Petruzella " Programmable Logic Controllers ", McGraw- Hill book, company, 1989
5. Siemens "PLC Handbook "
6. B.G. Liptak 'Handbook of Instrumentation- Process Control'
7. Jose A. Romagnoli, Ahmet Palazoglu, 'Introduction to process Control' (CRC Taylor and rancis group)
8. Industrial Robotics / Groover M P /Pearson Edu.

Reference books:

1. Sunil s.rao, switchgear and protections, khanna publication
2. William I. Fletcher "An Engineering Approach to Digital Design ", Prentice, Hall of India Ltd., New Delhi, 1999.
