BHARATHIAR UNIVERSITY

Coimbatore – 641046

DEPARTMENT OF
ELECTRONICS AND INSTRUMENTATION

M.Sc. Electronics & Instrumentation Syllabus

(For the Candidates admitted during the academic year **2012-2013 onwards**)

BHARATHIAR UNIVERSITY: COIMBATORE – 641 046

SCHOOL OF PHYSICAL SCIENCES

DEPARTMENT OF ELECTRONICS & INSTRUMENTATION (DEI)

M.Sc., ELECTRONICS AND INSTRUMENTATION

ELIGIBILITY CONDITIONS FOR STUDENTS

(For the Candidates admitted during the academic year **2012-2013 onwards**)

THE ELIGIBILITY CONDITIONS FOR ADMISSION TO M.Sc ELECTRONICS & INSTRUMENTATION SHALL BE AS FOLLOWS:

1. A PASS IN B.Sc. ELECTRONICS / INDUSTRIAL ELECTRONICS/ ELECTRONIC SCIENCE / ELECTRONICS AND COMMUNICATION SYSTEMS/ B.Sc. HONS/ B.Sc. ELECTRICAL EQUIPMENT MAINTENANCE, INSTRUMENTATION / B.E.S.
2. A PASS IN TRIPLE MAJOR (MATHS, PHYSICS & ELECTRONICS) OR (MATHS, ELECTRONICS & COMPUTER SCIENCE).
3. A PASS IN B.Sc. ELECTRONICS WITH COMPUTER HARDWARE, TECHNOLOGY OF APPLIED SCIENCE, B.SC COMPUTER TECHNOLOGY, B.E WITH ECE, EEE, EIE, AND A.M.I.E IN RESPECTIVE BRANCHES IS ALSO ELIGIBLE FOR JOINING THE ABOVE SAID COURSES.

ALL THE ABOVE CHANGES SHALL TAKE EFFECT FOR THE STUDENTS ADMITTED DURING THE ACADEMIC YEAR 2011-2012 AND ONWARDS.

ELIGIBILITY CONDITIONS FOR APPOINTMENT OF ASSISTANT PROFESSORS

THE ELIGIBILTY CONDITIONS FOR APPOINMENT OF ASSISTANT PROFESSORS IN ELECTRONICS BE NET / SLET WITH

- M.Sc. ELECTRONICS AND INSTRUMENTATION/ INSTRUMENTATION AS PER UGC GUIDELINE
- Ph.D/ME/ M.TECH IN INSTRUMENTATION/CONTROL SYSTEM AS PER UGC/AICTE GUIDELINE.

DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION

M.Sc. Electronics and Instrumentation

Scheme of Examination

Sem	Code No.	Subject	Class Hours	University Examination			
				Internal (%)	External (%)	Total	Credit
I		Sensors and Transducers	4	25	75	100	4
		Signals and Systems	4	25	75	100	4
		Embedded Systems and RTOS	4	25	75	100	4
		Bio-Medical Instrumentation	4	25	75	100	4
		Embedded System Laboratory	3	25	50	75	3
		Medical Electronics Laboratory	3	25	50	75	3
		Elective – I	4	25	75	100	4
		Supportive – I	2	12	38	50	2
II		Control Systems	4	25	75	100	4
		Fiber optics and Laser Instrumentation	4	25	75	100	4
		Programmable Logic Controllers and its Applications	4	25	75	100	4
		Analytical Instrumentation	4	25	75	100	4
		PLC, SCADA & Instrumentation Laboratory	3	25	50	75	3
		Intelligent Instrumentation Laboratory	3	25	50	75	3
		Elective II	4	25	75	100	4
		Supportive – II	2	12	38	50	2
III		Process Control	4	25	75	100	4
		Digital Signal Processing	4	25	75	100	4
		Digital System Desig0n and Testing	4	25	75	100	4
		VLSI System Design	4	25	75	100	4
		Digital Signal Processing Laboratory	3	25	50	75	3
		VLSI and FPGA Laboratory	3	25	50	75	3
		Elective- III	4	25	75	100	4
		Supportive – III	2	12	38	50	2
IV		Project Work	---	---	---	100	4
		Viva – Voce	---	---	---	25	1
		In-plant Training & Industrial Visit Report	---	---	---	25	1
Total Marks: 2250			**Credits: 90**				

M.Sc., ELECTRONICS AND INSTRUMENTATION

List of Electives:

Elective I (Semester I)

1. Electrical Measurements and Instruments
2. Measurements Techniques and its Applications.
3. Industrial Instrumentation

Elective II (Semester II)

1. Data Communication Networks
2. Industrial Data Networks
3. Computer Aided Instrumentation

Elective III (Semester III)

1. Nano Electronics and systems
2. System on a chip
3. Robotics and Automation

Supportive Papers offered at Electronics & Instrumentation Department for other students.

Paper I : Digital Electronics and Microprocessor.

Paper II : Biomedical Instrumentation.

Paper III : Analytical Instrumentation.

Semester I - 1. SENSORS AND TRANSDUCERS

UNIT I

SCIENCE OF MEASUREMENTS AND INSTRUMENTATION OF TRANSDUCERS: Units and standards-Calibration methods-Static calibration-classification of errors –Error analysis-Statistical methods-Odds and uncertainty-Classification of transducers-Selection of transducers.

UNIT II

CHARACTERISTICS OF TRANSDUCERS: Static characteristics Accuracy, precision, resolution, sensitivity, Linearity, threshold resolution, hysteresis and dead space, Dynamic characteristics-Mathematical model of transducer-Zero, II order transducers and I. response to impulse, step, ramp and sinusoidal inputs.

UNIT III

RESISTANCE TRANSDUCERS: Principle of operation, construction details, characteristics and application of resistance potentiometer, strain gauge, resistance thermometer, thermister, hot-wire anemometer, pizeoresistive sensor and humidity sensor.

UNIT IV

INDUCTANCE AND CAPACITANCE TRANSDUCERS: Induction potentiometer-Variable reluctance transducers-EI picks up-LVDT-Capacitive transducer and types-Capacitor microphone-Frequency response

UNIT V

OTHER TRANSDUCERS: Piezoelectric transducer, magnetostrictive -IC sensor-Digital transducers-Smart sensor-Fibre transducer.

TEXT BOOKS

1. A.K.Sawhney”A course in Electrical & Electronic Measurement and Instrumentation’ Dhanpat Raj and Co (P) Ltd.2004
2. D.V.S Murthy, ‘Transducer and Instrumentation’ Prentice Hall of India,1995

REFERENCE BOOKS

1. E.O.Doebelin, Measurement Systems-Applications and Design Tata McGraw Hill, New Work, 1990
2. D.Patranabis,”Sensors and Transducers” Prentice Hall of India, 1999.
3. John P.Bentley” Principles of Measurement Systems” III Edition, Pearson Education, 2000.
4. Hermann K.P.Neubert,” Instrument Transducers” Oxford University Press, 2000.
5. D.V.S.Murthy”Transducers and Instrumentation” Prentice Hall of India, 2001.
6. S.Ranganathan”Transducer Engineering” Allied Publishers Pvt.Ltd.2003.
7. AlSulko and J.D.Fault”Industrial Instrumentation” Vikas Publications, Delhi, 1996

Semester I - 2.SIGNALS AND SYSTEMS

UNIT I:

INTRODUCTION: Continuous Time (CT) and Discrete Time (DT) signals – classification of CT and DT signals – Basic CT and DT signals – Signal Operations – Representation of signals by impulses

UNI II:

CONTINUES TIME & DISCRETE TIME SYSTEMS: Properties – Linear Time Invariant (LTI) system – Linear Shift Invariant (LSI) systems - Properties – Continuous and discrete convolution – CT systems representation by differential equations – DT systems representation by difference equations.

UNIT III:

FOURIER SERIES REPRESENTATION OF PERIODIC SIGNALS: Fourier series analysis of periodic signals – properties of Continuous Time Fourier series (CTFS)– Convergence of CTFS - Representation of periodic signals by Continuous time Fourier transform (CTFT) – properties of CTFT– Convergence of CTFT – Frequency response of systems characterized by differential equations.

UNIT IV:

FOURIER ANALYSIS OF DT SIGNALS AND SYSTEMS: Fourier series representation of DT periodic signals (DTFS) – Properties of DTFS -representation of aperiodic signals by DTFT – properties of the DTFT – Frequency response of systems characterized by differential equations.

UNIT V:

SAMPLING AND LAPLACE TRANSFORM: Sampling: Introduction – sampling theorem – reconstruction of a signal from its samples using interpolation – Aliasing – DT processing of a CT signal – sampling of DT signals Laplace Transform: Introduction – Laplace transform – region of convergence for LT – Inverse Laplace Transform – properties of Laplace transform.

TEXT BOOK

1. Alen V Oppenheim Alen S. Wilsky and Hamid Nawab S “Signals and Systems”, second Edition, PHI, New Delhi, 1997

REFERENCE BOOKS

1. Michael J Roberts, “ Signals and Systems Analysis using transform methods and MATLAB”, Tata McGraw-
Hill, 2003
2. Haykin.S and Barry Van Veen, “Signals and Systems”, John willy and Sons Inc., 2002
3. Samir S Soliman and Srinath MD, “Continuous and discrete signals and systems” Second Edition, PHI, 2003
4. Lathi B.P., “Linear Systems and Signals”. Oxford University Press Inc., 2003

Semester I -3. EMBEDDED SYSTEM AND RTOS

UNIT-I

INTRODUCTION TO EMBEDDED SYSTEMS: Embedded systems-processor embedded into a system-Embedded Hardware units and devices in system- Embedded software in a system – examples of embedded systems – embedded system on-chip (Soc) and use of VLSI circuit design technology

UNIT-II

DEVICES AND COMMUNICATION BUSES FOR DEVICES NETWORK: IO types and examples- serial communication devices- parallel device ports- sophisticated interfacing features in device ports- wireless devices – timer and counting devices – watchdog timer – real time clock – networked embedded systems – serial bus communication protocols – parallel bus device protocols-parallel communication network using ISA, PCI, PCI-X and advanced buses – Internet enabled systems–network protocols – wireless and mobile system protocols.

UNIT-III

PROGRAMMING CONCEPTS AND EMBEDDED PROGRAMMING IN , C++ AND JAVA : Software programming in assembly language (ALP) and in high-level language 'C' – C program elements: header and source files and preprocessor directives – macros and functions – data types, data structures, modifiers, statements, loops and pointers – object-oriented programming – embedded programming in C++, embedded programming in Java.

UNIT-IV

REAL-TIME OPERATING SYSTEMS: OS services – process management – timer functions – event functions – memory management – device, file and IO subsystems management – interrupt routines in RTOS environment and handling of interrupt source calls – real-time operating systems – basic design using an RTOS – RTOS task scheduling models, interrupt latency and response of the tasks as performance metrics – OS security issues.

UNIT-V

DESIGN EXAMPLES, CASE STUDIES OF PROGRAM MODELING AND PROGRAMMING WITH RTOS: Case Study of Embedded System Design and Coding for an Automatic Chocolate Vending Machine (Acvm) Using Mucos RTOS – Case Study of Digital Camera Hardware and Software Architecture – Case Study Of Coding For Sending Application Layer Byte Streams On A TCP/IP Network Using RTOS Vxworks.

TEXT BOOKS

1.Rajkamal,"Embedded System-Architecture, Programming, Design'Tata Mc Graw Hill 2006.
2.Daniel W.Lewis'Fundamentals of Embedded Software' Prentice Hall of India, 2004.

REFERENCE BOOKS

1. David E Simon," An Embedded Software Primer" person Education Asia, 2006.
2. Frank Vahid, Embedded System Design – A Unified hardware & Software Introduction John Wiley, 2002.
3. SriramV.Iyer,Pankaj Gupte,Embedded Real Time Systems Programming'Tata Mc Graw Hill, 2004.
4. Steve Heath,' Embedded System Design'II edition, Elsevier, 2003.Architecture
5. Arnold Berger," Embedded System Design: An Introduction to processes, Tools, and Techniques", CMP Books, 2001.

Semester I - 4. BIOMEDICAL INSTRUMENTATION

UNIT-I

MEDICAL INATRUMENTATION BASICS: generalized system constraints - classification of biomedical instruments - bio statistics - generalized static and dynamic characteristics - regulation of medical device.

SENSOR TRANSDUCERS AND AMPLIFIERS: Resistive - capacitive - inductive piezoelectric - thermocouple thermister - fiber - optic sensor - radiation sensor - smart sensors - electro chemical sensor - electric fibro sensor - blood –glucose sensor - operational amplifier - inverting - non inverting -differential - instrumentation amplifier - pre amplifier - isolation amplifier - active filters.

UNIT-II

BIOELECTRIC SIGNALS AND ELECTRODES : origin of bioelectrical activity - volume conductor fields ECG ,EEG,EMG, MEG, Electrode –electrolyte interface - polarizable electrode - electrode model - recording electrodes - micro electrode.

UNIT-III

MEASURMENT SYSTEM: Patient monitoring system - measurement of blood pressure - heart rate - pulse rate - temperature - heat sound - blood flow volume - respiratory systems measurement - cardiac output measurement - blood ph po2 measurement- oximeters - audio meters spectrophoto meters.

UNIT-IV

MEDICAL IMAGING SYSTEM: Information content of an image - radiography - computed radio graphy - computed tomography - magnetic resonance imaging - nuclear medicine - single photon emission computed tomography positron emission tomography - ultrasonagraphy.

UNIT-V

THERAPUTIC AND PROSTHETIC DEVICES: cardiac pacemaker - defibrillators - hemodialysis - lithotripsy - ventilator incubators drug delivery device - artificial heart valve - heart lung machine - application of laser.

TEXT BOOKS

1. John G.webster , editor ," medical instrumentation application and design ", john Wiley & sons ,inc noida .3rd edition 2001
2. R.S. Khandpur," hand book of biomedical instrumentation ", Tata mc graw hill New Delhi, 2nd edition, 2003
3. Shakli Chatterjee., Aubert Miller., " Biomedical Instrumentation", Congage Learning, 2010

REFERENCE BOOK

Josep J. Carr and john M.brown," introduction to biomedical equipment technology ", Pearson education, 2003

Semester I -EMBEDDED SYSTEMS LABORATORY
(Any 12 Experiments)

`

8051 BASED EMBEDDED SYSTEMS (Any 5 Experiments)

1. Arithmetic and Logic programs
2. Seven segment display interfacing.
3. ADC interface.
4. Stepper motor interface.
5. Serial port interfacing using RS232C.
6. LCD interface.

PIC 16F87X BASED EMBEDDED SYSTEMS & RTOS (Any 5 Experiments)

1. Single digit timer using seven segment displays.
2. DAC interface.
3. ADC INTERFACE.
4. LCD interface.
5. Stepper motor control.
6. Serial communication using RS232C.

ARM BASED EMBEDDED SYSTEMS (Any 2 Experiments)

1. 8 Bit Digital output (LED interfacing).
2. 4X4 matrix Keypad interfacing
3. 128X64 pixels Graphics LCD interface
4. ADC interface

Semester I - MEDICAL ELECTRONICS LABORATORY

(Any 12 Experiments)

1. Operation and function of all the controls of hospital X-Ray machine
2. Measurement of skin contact impedance and technique to reduce it.
3. Observe its wave shape on CRO the output of pulse sensors
4. Use of sphygmomanometer for measurement of blood pressure
5. Concept of ECG system and placement of electrodes
6. Measurement of leakage currents with the help of safety tester
7. PH measurement of given biological sample
8. Concept of EMG system and placement of electrode
9. Measurement of respiration rate using thermister
10. Concept of EEG system and placement of electrode
11. Measurement of differential temperature -Thermometer,
12. Study and testing of ECG Equipment, (Signal analysis and vector cardio graph, abnormality)
13. Study and waveform analysis -Electronic Stethoscope,
14. Study (Arterial) Blood gas Analyzer (non -Invasive),
15. Study and testing of Endoscopes (non -Invasive),
16. Design of low noise pre-amplifier for ECG

Semester II -1. CONTROL SYSTEMS

UNIT I

CONTROL SYSTEM COMPONENTS: Basic elements in control systems – open and closed loop systems, electrical analog of mechanical and thermal systems – Transfer functions –Error detectors-potentiometers and synchronous a.c and d.c servomotors-stepper motors-Tacho generators-Proportional-integral and derivative controllers.

UNIT II

TEST SIGNALS: Response of second order systems - time-domain specifications-Generalised error series - Frequency domain specifications - polar plots - Bode plots.

UNIT III

STABILITY ANALYSIS: Routh-Hurwitz criterion-Nyquist criterion- Stability of systems with transportation lag-Gain margin and phase margin.

UNIT IV

ROOT LOCUS METHOD: Definitions-Root locus diagram-Rules of constructions of root loci - Effect of pole zero additions on the root loci- Root contours.

UNIT V

COMPENSATOR DESIGN: Constant M and N loci - Nichols Chart. Compensator design using Bode plots PID controller design.

TEXT BOOKS

1. Nagrath, I.J., and Gopal, M., 'Control systems Engineering', Wiley EasternLtd.,1992.
Shanmuga Priya publishers, 1998.

REFERENCE BOOKS

1. Katsuhiko Ogata , ‘ Modern control Engineering ‘ , Fourth Edition , Pearson Education , First Indian Reprint 2002.
2.Richard C.Dorf and Robert H.Bishop . ‘Modern control systems ‘, Addison - Wesley, Eigth Edition.

Semester II - 2. FIBRE OPTICS AND LASER INSTRUMENTATION

UNIT I

OPTICAL FIBRES AND THEIR PROPERTIES: Principles of light propagation through a fibre-Different types of fibres and their properties, fibre characteristics-Absorption losses-Scattering losses-Dispersion-Connectors& splicer. Optical fibers and cables:Prepartion of optical fibers-Liquid-phase(melting) techniques-Vapour -phase deposition techniquies-Fluoride glass fibers-optical fibers-Optical fiber cables-Stability of the transmission characteristics-Cable design.

UNIT II

OPTICAL SOURCES: Optical Sources 1:the Laser: Basic concepts-Optical emission from semiconductors-semiconductor injection Laser- some injection Laser Structures-single frequency injection Laser- injection Laser characteristics- injection Laser to fiber coupling-non semiconductor Laser-narrow line width and wavelength tunable Lasers. Optical Source 2: the light emitting diode: LED power and efficiency-LED structures-LED characteristics.

UNIT III

OPTICAL DETECTORS: Device types-Optical detection principles- Absorption-Quantum efficiency Responsivity-Long Wavelength cutoff-Semiconductor Photodiodes Without internal gain- Photodiodes With internal gain-Mid-infrared photodiodes-phototransistors-photoconductive. Direct detection receiver performance considerations:Noise-Recevier noise -Receiver Structures –FET Preamplifiers-High performance Receivers.

UNIT IV

FIBRE SENSOR: Introduction: Fiber optic sensors Intensity modulated sensors, Micro bend Strain Intensity Modulated sensors, Liquid level hybrid sensor, Internal Effect Intensity Modulated sensor, Phase sensor, Diffraction Grating sensor, sensor using mode fibre,Interferometric Sensor: Interferometric Pressure Sensor, Interferometric temperature Sensor, Distributed Fiber Optic sensors, Polarisation problem in Interferometric Sensor using single mode fibre- Medical application of fibre sensor: Fabry-perot fibre optics sensor. Military and Aerospace application, Vibration and displacement measurement sensors, Rotary Position Sensor, Linear Position measuring Sensor, Liquid Level Sensor, Acceleration Measuring Sensor, Multiplexing and Distributed Sensing.

UNIT V

HOLOGRAM AND ITS APPLICATION: Holographic Optic Element (HOE**)** - HOE Fabrication Materials - Vibration and Motion Analysis by Holographic Techniques - Hologram Interferometry - Superposition of Ramp Motion and Sinusoidal Vibration - Stroboscopic Holography - Holographic Measuring Systems and Evaluation of Holographic Interferograms - Holography-application of Holography - Real-time Holographic Interferometry with a $LiNbO_3$: Fe Crystal - Quantum Holography.

TEXT BOOKS

1. J.M.Senior,' Optical Fibre Communication-Principles and Practice' Prentice Hall of India, 1985.
2. J.Wilson and J.F.B.Hawkes,'Introduction to Opto Electronics'Prentice Hall of India, 2001.

REFERENCE BOOKS

1. Donald J.Sterling Jr.'Technicians Guide to Fibre Optics'3rd Edition, Vikas Publishing House, 2000.
2. M.Arumugam,'Optical Fibre Communication and Sensors'Anuradha Agencies, 2002.
3. John F.Read,'Industrial Applications of Lasers'Academic Press, 1978.
4. Monte Ross,'Laser Applications, Mc Graw Hill, 1968
5. G.Keiser,'Optical Fibre Communication'Mc Graw Hill, 1995.
6. Mr.Gupta,'Fibre Optics Communication,'Prentice Hall of India, 2004.

Semester II- 3. PROGRAMMABLE LOGIC CONTROLLERS AND ITS APPLICATIONS

UNIT-1

BASIC PLC PROGRAMMING: General PLC programming procedures - Programming on/off inputs and outputs: Relation of digital gate logic to contact/ coil logic - Creating ladder diagrams from process control descriptions.

UNIT-II

BASIC PLC FUNCITON AND INTERMEDIATE FUNCTION: PLC Register Basics - Timer Functions - Counter Functions - Arithmetic Functions - Number comparison functions - Numbering systems and PLC number conversion functions.

UNIT-III

DATA HANDLING FUNCITONS AND PLC FUNCTIONS WORKING WITH BITS: The PLC SKIP and MASTER CONTROL RELAY functions - JUMP Functions - Data Move Systems - Other PLC Data Handling Functions - Digital Bit Functions and Applications - Sequencer functions - Controlling Robot with a PLC - Matrix functions.

UNIT-IV

SUPERVISIORY CONTROL AND DATA ACQUISITION: SCADA – overview – Developer and runtime packages – architecture – Tools – Tag Internal and External Graphics, Alarm Logging – Tag Logging – Structured tags – Trends – History – Report Generation - Proprietary and open protocols – OLE/OPC – DDE ;- Client /server configuration- – Interfacing of SCADA with PLC, drive and other field devices- Case studies of process plants using SCADA.

UNIT-V

DISTRIBUTED CONTROL SYSTEMS: Difference between SCADA System and DCS– architecture – local control unit – programming language – communication facilities – operator interface – engineering interfaces - Case studies of process plants using DCS.

TEXT BOOKS

1. John W. Webb &Ronald A., Reis, “Programmable Logic Controllers Principles and Applications“, Fifth Edition, Prentice Hall Publication, New Delhi, 2002.
2. Gary Dunning, “Introduction To Programmable Logic Controllers”, Third Edition.

REFERENCE BOOKS

1. W.Bolton, “Programmable Logic Controllers”, Fifth Edition, Elsevier Publication.
2. John R. Hackworth, Frederick D. Hackworth, “Programmable Logic Controllers Programming Methods and Applications”, Pearson Publication.
3. Frank D. Petruzella, “Programmable Logic Controllers”, Third Edition, Tata McGraw Hill Education Private Limited, 2010.
4. Michael P.Lukas, “Distributed Control Systems”, Van Nostrand Reinfold Company,1995

Semester II - 4. ANALYTICAL INSTRUMENTATION

UNIT I

COLORIMETRY AND SPECTROPHOTOMETRY: Special methods of analysis- Beer-Lambert law-colorimeters-UV-ViS spectrophotometers-Single and double beam instruments-Sources and detectors-IR Spectrophotometers-Types-Attenuated total reflectance flame photometers- Atomic absorption spectrophotometers-sources and detectors-FTIR spectrophotometers-Flame emission photometers.

UNIT II

CHROMOTOGRAPHY: Different techniques-Gas chromatography-Detectors-Liquid chromatographs-Applications-High pressure liquid chromatographs-Applications.

UNIT III

INDUSTRIAL GAS ANALYZERS AND POLLUTION MONITORING INSTRUMENTS: Types of gas analyzers-Oxygen, NO2 and H2S types, IR analyzers, thermal conductivity analyzers, analysis based on ionization of gases. Air pollution due to carbon monoxide, hydrocarbons, nitrogen oxides, sulphur dioxide estimation-dust and smoke measurements.

UNIT IV

pH METERS AND DISSOLVE COMPONENT ANALYZERS: Principle of pH measurement, glass electrodes, hydrogen electrodes, reference electrodes, selective ion electrodes, ammonia electrodes, biosensors, dissolved oxygen analyzer-sodium analyzer-silicon analyzer.

UNIT V

RADIO CHEMICAL AND MAGNETIC RESONANCE TECHNIQUES: Nuclear radiations-Detectors-GM Counter-Proportional counter-Solid state detector-Gamma cameras-X-ray spectroscopy-Detectors-Diffract meters-Absorption meters-Detectors NMR-Basic principles-NMR spectrometer-Applications. Mass spectrometers-Different types-Applications.

TEXT BOOKS

1. R.S. Khandpur, ”Handbook of Analytical Instruments” Tata Mc Graw Hill publishing Co.Ltd.2003.
2. H.H.Willard, L.L.Merrit, J.A.Dean, F.A.Settle, ”Instrumental methods of analysis” CBS publishing & distribution, 1995.

REFERENCE BOOKS

1. Robert D.Braun, ”Introduction to Instrumental Analysis” Mc Graw Hill, Singapore, 1987.
2. G.W. Ewing, ”Instrumental Methods of Analysis” Mc Graw Hill 1992.
3. DA Skoog and D.M.West, ”Principles of Instrumental Analysis” Harper and Row publishers, 1974.

Semester II -PLC, SCADA & INSTRUMENTATION LABORATORY
(Any 12 Experiments)

1. Displacement measurement using LVDT
2. Instrumentation amplifier
3. Signal conditioning circuit for any resistive pressure, transducer.
4. P.I.D Controller.
5. Signal conditioning circuit for optical encoder.
6. Developing the Ladder diagram for the truth table of Logic Gates.
7. Develop and test the control circuit for Automatic Star-Delta Starter using ladder programming.
8. Develop and test the control circuit for Automatic rotor resistor starter using ladder programming.
9. Develop and test the control circuit for dynamic braking of DC motor using ladder programming.
10. Develop and test the control circuit for Lift operation using ladder programming**.**
11. Develop and test the control circuit for Conveyor using ladder programming.
12. Develop the control circuit automatic tank filling using ladder programming with SCADA.
13. Monitoring and control of PLC through HMI
14. Monitoring of industrial drive through SCADA system.
15. Interfacing of PLC with SCADA system.
16. Machine monitoring and control through Ethernet.

Semester II -INTELLIGENT INSTRUMENTATION LABORATORY
(Any 12 Experiments)

INTELLIGENT INSTRUMENTATION LAB: (USING Lab VIEW)

1. Creating a simple VI to place a Digital Control.
2. VI to make a Degree C to Degree F Converter.
3. Converting VI in to Sub VI
4. Create a random number generator
5. Create a Boolean Switch Action
6. Wright a programme to count Modulus 32 and display the values in decimal, octal decimal and Binary.
7. Create a Temperature simulator to set up over and under – Temperature LEDs to light up whenever the deviations is $> 5^0C$
8. Built a VI using while loop that displays random numbers in to three wave form charts. (Strip, scope & Sweep)
9. Built a VI that displays to random chart in to single chart
10. To check given number is positive or negative.
11. Built a four function calculator
12. Built VI that continues the monitor every 250 ms
13. Built VI to produce sine, square, triangle and saw tooth wave forms.
14. Built a 8 bit binary counter to display the results graphically.
15. Wright a simple programme to generate a voltage at analog output is zero using knobs to select voltage.
16. Built VI to compute and display Y=mx+b

Semester III - 1. PROCESS CONTROL

UNIT I

FINAL CONTROL ELEMENTS: Final control operation: Signal conversion, actuators, control element- signal conversions: analog electrical signals, digital electrical signals, neumatic signals- power electronics, switching devices, controlling devices – actuators: electrical actuators, pneumatic actuators – control elements: mechanical, electrical, fluid walls

UNIT II

DISCRETE STATE PROCESS CONTROL: Definition of Discrete state process control – characteristics of the system: Discrete state variables, process specification, event sequence description – Process characteristics: Process equation, Process load, Process Lag, Self – regulation – Control system parameters: Error, variable range, Control parameter range, Control Lag, Dead time, Cycling, Controller modes- Discontinuous Controller Modes: Two-position Mode, Multiposition Mode, Floating control Mode – Continuous control Modes: Proportional control Mode, Integral control Mode, Derivative –control Mode- Composite Control Mode: Proportional –Integral Control, Proportional –Derivative Control Mode, Three Mode controller (PID)

UNIT III

ANALOG AND LOGIC CONTROLLERS: General features of analog controllers: Physical layout, front panel, side panel – Electronic controllers: Error detector, Single mode, composite controller mode – Pneumatic Controllers: General features, Mode Implementation – Relay controllers: Background, Ladder diagrams- Programme Logic Controllers: Relay sequences, Programmable Logic Controller Design, PLC operation, Programming, Functions of PLC software

UNIT IV

COMPUTER BASED CONTROL: Digital applications: Single and multivariable alarms, Two position control – Computer based controllers: Hardware configuration, Smart sensors, multiloop controllers- Software requirements- algorithms to implement the control equations: errors, proportional mode, integral mode, derivative mode,PID Control mode – Data Loggers – Supervisory control – Process control system networks, field bus operations, General characteristics of buses

UNIT V

CONTROL LOOP CHARACTERISTICS: Control System configurations: Single variable, Cascade Control – Multivariable control system: analog control, supervisory and direct digital control – Control system quality: definition of quality, measure of quality – Stability: Transfer function frequency dependence, stability criteria- Process Loop Tuning: Open Loop Transient Response Method, Ziegler-Nichols Method, Frequency Response Method

TEXT BOOK

1. Curtis D. Johnson, Process control instrumentation Technology, Eight editions, Prentice Hall of India, 2006

REFERENCE BOOK

1. Bela G. Liptak “Process Control” butterworth – Heinemann

Semester III - 2. DIGITAL SIGNAL PROCESSING

UNIT I

THE Z-TRANSFORM: Definition of the z-Transform – z-Transform and ROC of Finite and Infinite Duration Sequences –ROC of Two-sided Sequence – Stability and ROC – Properties of Region of Convergence – Properties of the z-Transform – The system Function – Poles and Zeros of a System Function – Stability Criterion – Relationship between the Fourier Transform and the z-Transform – Relationship between s-plane and z-plane – Inverse z-Transform – Solution of Difference Equations using One Sided z-Transform – Deconvolution using z-Transform.

UNIT II

DISCRETE FOURIER TRANSFORM & COMPUTATION: The Discrete Fourier Transform – Relation of The DFT to Other Transforms – Properties of the Discrete Fourier transform – Comparison between Circular Convolution and Linear Convolution – Methods to Evaluate Circular Convolution of Two Sequences – Linear Convolution From Circular Convolution – Filtering Long Duration Sequences – Parameter Selection to Calculate DFT. Introduction of DFT – Efficient Computation of DFT – Properties of DFT – FFT algorithms – Radix – FFT algorithm – Decimation in Time – Decimation in Frequency algorithms – Use of FFT- algorithms in Linear Filtering and correlation.

UNIT III

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

UNIT IV

FINITE WORD LENGTH EFFECTS: Introduction - Number of representation - Types of Number representation - Floating Point Numbers - Block Floating Point Numbers - Quantization noise - Input Quantization Error - Product Quantization Error - Coefficient Error - Zero input Limit Cycle Oscillations - Overflow Limit cycle Oscillation - Signal Scaling - Quantization in Floating Point Realization of IIR Digital Filters - Finite Word Length Effect in FIR Digital Filters - Quantization Effect in the Computation of the DFT - Quantization Error in FFT Algorithms.

UNIT V

DIGITAL SIGNAL PROCESSORS: Introduction to DSP architecture – Von Neumann Architecture – Harvard architecture- Dedicated MAC unit – Multiple ALUS, Advanced addressing modes, pipelining, Overview of instruction set of TMS320CSX and C54XX

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.

REFERENCE BOOKS

1. Alan V.Oppenheim, Ronald W.Schafer and John R.Buck,"Discrete-Time Signal Processing" Pearson Education, New Delhi, 2003.

2. B.Venkataramani, M.Baskar,"Digital Signal Processors, Architecture, Programming and Applications"Tata Mc Graw Hill, New Delhi, 2003.

3. S.Salivahanan, A.Vallavaraj, C.Gnanapriya, Digital Signal Processing"Tata McGraw Hill, New Delhi, 2003.

4. Texas TMS 320C54X user manual (website)

5. J.R.Jhonson, Introduction to Digital Signal Processing Prentice Hall of India, 1989.

Semester III - 3. DIGITAL SYSTEM DESIGN AND TESTING

UNIT-I

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

UNIT-II

FIELD PROGRAMMABLE GATE ARRAYS: Types of FPGA – Xilinx XC3000 series – Logic Cell Array (LCA) – Configurable Logic Blocks (CLB) – Input/ Output Blocks (IOB) – Programmable Interconnection Points (PIP) – Xilinx XC4000 series – Introduction to Xilinx SPARTAN, VIRTEX FPGA – Design examples

UNIT-III

INTRODUCTION TO VHDL: Design process flow – Software tools – Hardware Description Languages – VHDL: Data Objects – Data types – Operators – Entities and Architecture – Components and Configurations – Concurrent signal assignment - Conditional signal assignments – Selected signal assignment – Concurrent statements – Sequential statements – Transport and Inertial delays – Delta delays – Behavior, Data flow and Structural modeling – Attributes – Generics – Package and Libraries – Multivalued logic and signal resolution – IEEE 1164 std logic – Subprograms: Functions and Procedures – Operator overloading – Test Benches – Design examples.

UNIT-IV

FAULT MODELING: Defects, errors, faults, Levels of Fault models – Types – Fault Detection and Redundancy 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 for testing memories.

UNIT-V

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

TEXT BOOKS

1. Palmer, J.E. Perlman. D.E., “Introduction to Digital Systems”, Tata McGraw Hill, New Delhi, 1996.
2. Nelson. V.P., Nagale. H.T., Carroll. B.D., and Irwin. J.D., “Digital Logic Circuit Analysis and Design”, PrenticeHall International, Inc., New Jersey, 1995.

REFERENCE BOOKS

1. Robert K Dueck, “ Digital Design with CPLD applications and VHDL”, Thomson Asia, 2002.
2. J. Bhasker, “ A VHDL Primer”, Addison Wesley, 1999
3. Charles H Roth, “Digital Systems Design Using VHDL, “Thomson Asia, 2004.
4. “ Programmable Logic Devices Databook and Design Guide”, National semiconductors, 1989
5. Michael L Bushnell Vishwani D Agrawal, “Essentials of Electronic Testing for digital memory and mixed signal VLSI circuits”, Kluwar academic Publications, USA 2001
6. Pradhan. D.K. “Fault – Tolerant computing – Theory and Techniques” Vol I&II Prentice Hall, 1986

Semester III - 4. VLSI SYSTEM DESIGN

UNIT - I

VLSI DESIGN METHODOLOGY: VLSI design process – Architectural design – Logical Design – Physical design – Layout Styles – Full custom – Semicustom approaches.

BASIC ELECTRICAL PROPERTIES OF MOS AND CMOS CIRCUITS: MOS transistor - Threshold Voltage – Threshold Voltage equations- MOS device 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.

UNIT - II

VLSI FABRICATION TECHNIWQUES; An overview of wafer fabrication – wafer processing – oxidation patterning – diffusion – ion implantation – deposition – silicon gate NMOS process – CMOS process N-Well and P-Well process – Twin tub – Silicon on insulator – CMOS process enhancements – Interconnect – Circuit elements – latch up prevention techniques.

UNIT - III

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.

UNIT - IV

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 – Clocked CMOS Logic – recharged Domino CMOS Logic – Structured design – simple combinational logic design examples – Parity generator – Multiplexers – Clocked Sequential circuit – Two phase clocking – Charge Storage – Dynamic Shift register Semi static register – JK flip flop circuit.

UNIT - V

SUBSYSTEM DESIGN PROCESS: General arrangement of a 4 bit arithmetic processor – Design of 4-bit shifter – Design of ALU sub system – implementing ALU function with an adder – Carry look ahead adders – multipliers – serial parallel multipliers – pipelined- multiplier array – Modified Booth's algorithm – increment / decrement – Two Phase non-overlapping clock generator.

TEXT BOOKS

1. Kamran Eshraghian, Douglas A Puknel and Sholeh Eshraghian, "Essentials of VLSI Circuits and Systems," prentice Hall of India, New Delhi, 2005.
2. Neil H.E West and Kamran Eshranghian, "Principles of CMOS VLSI Design: A system perspective ", Addison-Wesley, 2nd Edition, 2004.

REFERENCE BOOKS

1. Sung-Mo Kang and Yusuf Leblebici," CMOS Digital integrated circuits", Tata McGraw Hill 3rd Edition, New Delhi, 2008.
2. Jan M Rabaey, Chandrasekaran A and Nikolic B, "Digital Integrated Circuits," Pearson Education, 3rd edition, 2004.
3. Amar Mukharjee, "Introduction to NMOS and CMOS VLSI System," Prentice Hall, USA, 1986.
4. Wayne wolf," Modern VLSI Design : System on chip design", Pearson Education Inc., 3rd Edition, Indian Reprint, 2007.

Semester III-DIGITAL SIGNAL PROCESSING LAB

(Any 12 Experiments)

USING TMS320C5X/TMS320C54XX/TMS320C67XX (Any 6 Experiments)

1. Study of addressing Modes of DSP using simple examples.
2. Arithmetic operations.
3. DFT computations.
4. FFT Computations.
5. Convolution of two discrete signals.
6. Waveform generation.
7. FIR Filter design
8. IIR filter design

SIMULATION USING MATLAB (Any 6 Experiments)

1. Generation of signals.
2. Impulse, Step, Exponential & Ramp functions.
3. Design of FIR filter.
4. Design of IIR filter.
5. Image Segmentation.
6. Color Image to Gray and Binary Image.
7. Convolution of two Sequences.
8. Concept of Aliasing

Semester III-VLSI AND FPGA LABORATORY
(Any 12 Experiments)

Design and simulation of Combinational Logic Circuit using VHDL/Verilog

1. Test benches in VHDL/Verilog
2. Adder
3. Logic gates verification
4. Multiplexer and Demultiplexer
5. Encoder and Decoder
6. Multiplier

Design and simulation of Sequential Logic Circuit using VHDL/Verilog

1. Flip Flops
2. Counter
3. Shift registers
4. Frequency Divider
5. Modeling of sequential digital system

FPGA Implementation

1. Implementation of ALU
2. 4- bit Adder
3. 8- bit ALU
4. Real Time Clock
5. Implementation of MAC unit

Elective (Semester I)-1. ELECTRICAL MEASUREMENTS AND INSTRUMENTS

UNIT I

MEASUREMENT OF VOLTAGE AND CURRENT: Galvanometers - Ballistic, D'Arsonval galvanometer-Theory, calibration, application, Principle, construction, operation and comparison of moving coil, moving iron meters, dynamometer, induction type & thermal type meter, rectifier type- Extension of range and calibration of voltmeter and ammeter-errors and compensation

UNIT II

MEASUREMENT OF POWER AND ENERGY: Electrodynamometer type wattmeter-Theory & its errors-Methods of correction-LPF wattmeter-Phantom loading-Induction type KWH meter-Calibration of wattmeter, energy meter

UNIT III

POTENTIOMETERS & INSTRUMENT TRANSFORMERS: DC potentiometer-Basic circuit-standardization-Laboratory type (Crompton's)-AC otentiometer-Drysdate (polar type) type-Gall-Tinstey (coordinate) type-Limitations& applications-C. T and V.T construction theory, operation, phasor diagram, characteristics, testing, error elimination-Applications.

UNIT IV

RESISTANCE MEASUREMENT: Measurement of low, medium & high resistance-Ammeter, voltmeter method-Wheatstone bridge-Kelvin double bridge- Ductor ohmmeter-Series and shunt type ohmmeter-High resistance measurement-Megger-Direct deflection methods-Price's guard-wire method-Loss of charge method-Earth resistance measurement.

UNIT V

IMPEDENCE MEASUREMENT: A.C bridges-Measurement of inductance, capacitance-Q of coil-Maxwell Bridge-Wien's Bridge-Hey's bridge-Anderson bridge-Campbell bridge to measure mutual inductance-Errors in A.C.bridge methods and their compensation-Detectors –Excited field-A.C.galvanometer-Vibration galvanometer-Introduction to cable fault and eddy current measurement

TEXT BOOKS

1. E.W.Golding & F.C.Widdis,'Electrical Measurements & Measuring Instruments' A.H.Wheeler & Co.1994
2. A.K.Sawhney, 'Electrical & Electronic Measurements and Instrumentation" Dhanpath Raj & Co (P) Ltd. 2004

REFERENCE BOOKS

1. J.B.Gupta" A Course in Electronic and Electrical Measurements and Instrumentation" S.K. Kataria &Sons, Delhi 2003
2. S.K.Singh,"Industrial Instrumentation and control' Tata Mc Graw Hill, 2003.
3. H.S.Kalsi,'Electronic Instrumentation' Tata Mc Graw Hill, 1995.
4. Martia U.Reissland, 'Electrical Measurement' New Age International (P) Ltd.2001.

Elective (Semester I)-2. MEASUREMENT TECHNIQUES AND ITS APPLICATIONS

UNIT I

REVIEW OF MEASUREMENT SYSTEM: Functional elements of a measuring system - Input – output configuration of instrumentation system - Method of correction for interfering and modifying inputs.

UNIT II

MEASUREMENT OF VIBRATION: Nature of vibration - Quantities involved in vibration measurements - Seismic transducer - Types of accelerometers – potentiometric type accelero-meter, LVDT accelerometer, Piezo electric accelerometer.

UNIT III

HIGH FREQUENCY MEASUREMENT: Resonance methods - Measurement of inductance and capacitance - Measurement of effective resistance by resistance variation method and reactance variation method – T networks – parallel T networks and bridge T networks - Radio frequency measurement – sensitivity and selectivity measurement of radio receiver.

UNIT IV

OPTO ELECTRONIC MEASUREMENT: Photo sensitive devices – light emitting diodes, photo diodes, photo conductors - Photo voltaic cell, photo thyristors, photo transistors - Light modulating techniques – light suppression, light attenuation, photometric and radiometric fittings.

UNIT V

ULTRASONIC MEASUREMENT: Ultrasonic method of flow measurement, and measurement of thickness, measurement of displacement etc - Ultrasonic digitizer.

TEXT BOOK

1. Measurement systems, Application and Design – E.O Doeblin, McGraw Hill International Edition

REFERENCE BOOK

1. A Course in Electrical and electronics Measurement and Instrumentation by A K Sawhney; Dhanpat Rai and Co Pvt. Ltd., New Delhi

Elective (Semester I) -3. INDUSTRIAL INSTRUMENTATION

UNIT-I

MEASUREMENT OF FORCE, TORQUE AND VELOCITY: Electric balance – Different types of load cells – Magnets – Elastic load cells - Strain gauge load cell – Different methods of torque measurement – Strain gauge, relative regular twist – Speed measurement – Revolution counter – Capacitive tacho-drag cup type tacho – D.C and A.C tacho generators – Stroboscope.

UNIT –II

MEASUREMENT OF ACCELERATION, VIBRATION, DENSITY AND VISCOSITY: Accelerometers – LVDT, piezoelectric, strain gauge and variable reluctance type accelerometers – Mechanical type vibration instruments – Seismic instrument as an accelerometer and vibrometer – Calibration of vibration pick-ups – Units of density, specific gravity and viscosity used in industries – Baume scale, API scale – Pressure head type densitometer – Float type densitometer – Ultrasonic densitometer – Bridge type gas densitometer – Viscosity terms – Saybolt viscometer – Rotameter type.

UNIT-III

PRESSURE MEASUREMENT: Units of pressure - Manometers – Different types – Elastic type pressure gauges – Bourdon type bellows – Diaphragms – Electrical methods – Elastic elements with LVDT and strain gauges – Capacitive type pressure gauge – Piezo resistive pressure sensor – Resonator pressure sensor – Measurement of vacuum – McLeod gauge – Thermal conductivity gauges – Ionization gauge, cold cathode and hot cathode types – Testing and calibration of pressure gauges – Dead weight tester.

UNIT-IV

TEMPERATURE MEASUREMENT: Definitions and standards – Primary and secondary fixed points – Calibration of thermometer, different types of filled in system thermometer – Sources of errors in filled in systems and their compensation – Bimetallic thermometers – Electrical methods of temperature measurement – Signal conditioning of industrial RTDs and their characteristics – Three lead and four lead RTDs.

UNIT-V

THERMOCOUPLES AND PYROMETERS: Thermocouples – Laws of thermocouple – Fabrication of industrial thermocouples – Signal conditioning of thermocouples output – Thermal block reference functions – Commercial circuits for cold junction compensation – Response of thermocouple – Special techniques for measuring high temperature using thermocouples – Radiation methods of temperature measurement – Radiation fundamentals – Total radiation & selective radiation pyrometers – Optical pyrometer – Two colour radiation pyrometers.

TEXT BOOKS

1. E.O. Doebelin, ‘Measurement Systems – Application and Design’, Tata McGraw Hill publishing company, 2003.
2. R.K. Jain, ‘Mechanical and Industrial Measurements’, Khanna Publishers, New Delhi,1999.

REFERENCE BOOKS

1. D. Patranabis, ‘Principles of Industrial Instrumentation’, Tata McGraw Hill Publishing Company Ltd, 1996.
2. A.K. Sawhney and P. Sawhney, ‘A Course on Mechanical Measurements, Instrumentation and Control’, Dhanpath Rai and Co, 2004.
3. B.C. Nakra & K.K.Chaudary, ‘Instrumentation Measurement & Analysis’, Tata McGraw Hill Publishing Ltd, 2004.
4. S.K. Singh, ‘Industrial Instrumentation and Control’, Tata McGraw Hill, 2003.
5. D.P. Eckman’, Industrial Instrumentation’, Wiley Eastern Ltd.,

Elective (Semester II)-1. DATA COMMUNICATION NETWORKS

UNIT - I

PHYSICAL LAYER AND THE MEDIA: Review of signals – Data Rate Limits – Performance Issues – Bandwidth, Throughput, Latency, Bandwidth-Delay Product, and Jitter. Digital Transmission and Analog Transmission: Line coding techniques, PCM and Delta Modulation techniques – ASK, FSK, PSK, and QAM Techniques – bandwidth Utilization: Multiplexing and Spreading – Data Transmission using Telephone Networks – Dial-up MODEMS, Digital Subscriber Line (DSL)

UNIT - II

DATA LINK LAYER: Error Detection and Correction techniques – Data Link Control: Framing, Flow and Error Control – HDLC and PPP protocols. Multiple Access Techniques – CSMA, CAMA/CD, CSMA/CA – Channelization – TDMA, FDMA, and CDMA

UNIT - III

LAN: Wired LANs – IEEE 802 standards – Ethernet – IEEE 802.3 MAC Frame – Token Ring LAN – IEEE 802.5 MAC Frame – Wireless LANs – IEEE 802.11 standard – Bluetooth Technology – Interconnection of LANs.

UNIT - IV

WAN: Wired WANs – Circuit- Switched Networks, Datagram Networks, Virtual Circuit-Switched Networks, Structure of Circuit and Packet Switches – Wireless WANs – Introduction to Cellular Telephone and Satellite networks.

UNIT - V

INTERNETWORKING: Internetworking – tunneling – IP Addressing Scheme – Structure of IP Datagram – IP Routing – TCP as Transport Layer Protocol – Structure of TCP Segment – TCP connection: Establishment and Closing – SMTP Protocol for E-mail Application.

TEXT BOOK

1. Behrouz A. Forouzan, “Data Communications and Networking”, 4th Edition, Tata McGraw-Hill, Delhi, 2006

REFERENCE BOOKS

1. Larry L. Peterson and Bruce S. Davie, “Computer Networking: A Systems Approach” Edition, Elsevier Publications, Delhi, 2007
2. Stanford H. Rowe and Marsha L. Schuh, “Computer Networking”, Pearson Education, Delhi, 2005
3. James Kurose and Keith Ross, “Computer Networking: Top Down Approach featuring the Internet”, Pearson Education, Delhi, 2002

Elective (Semester II) -2. INDUSTRIAL DATA NETWORKS

UNIT-I

INTRODUCTION: Modern Instrumentation and Control Systems – Introduction to Networks – Advantages and Disadvantages. OSI Model-Foundations of OSI model. Protocol – Standards. Grounding, Shielding & Noise. Basic of Digital Modulation techniques. EIA-232-overview - EIA-485-overview – current loop & EIA converters.

UNIT-II

INDUSTRIAL ETHERNET: Introduction-IEEE standards – Ethernet MAC layer – IEEE 802.2 and Ethernet SNAP – OSI and IEEE 802.3 standard. Ethernet transceivers, Ethernet types, switches & switching hubs, 10 Mbps Ethernet, 100 Mbps Ethernet, Gigabit Ethernet. TCP/IP overview-Internet layer protocols – Host-to-Host layer.

UNIT-III

MODBUS: Introduction-Protocol Structure- Function Codes: Read Coil or Digital O/P Status – Read Digital I/P Status-Read Holding Registers- Force Single Coil- Preset Signal Register-Read Exception Status – Loop-back Test – Force Multiple Coils or Digital O/Ps – Force Multiple Registers – Modbus Common Problems and Faults - Physical Layer Topology – Device Taps – Data link Layer: Frame Format – Medium Access – Fragmentation

UNIT-IV

DEVICENET: Overview – layers. Profibus-overview-protocol stack. HART protocol – overview-layers. Foundation field bus-layers – Error Detection and Diagnostics. Local interconnect networks, Redundancy Overview – Actuator- sensor Interface- CAN bus – overview-layers. Device Net and SDS(Smart Distributed Systems)-Physical Layer and Wiring Rules- The Data link Layer- The Application Layer.

UNIT-V

RADIO AND WIRELESS COMMUNICATION: Introduction – components of a radio link. Radio spectrum and frequency allocation. Radio modems. Intermodulation and prevention. Implementation a radio link.

TEXT BOOKS

1. John Park, Steve Mackey and Edwin Wright, “Data Communications for Instrumentation and Control”, Elsevier, 2003
2. Steve Mackay, Edwin Wright and Deon Reynders, “Practical Industrial data networks: Design, Installation and troubleshooting”, Elsevier international projects ltd., 2004

REFERENCE BOOKS

1. William Buchanan, “Computer Buses-Design and Application”, CRC Press, 2000
2. Theodore S Rappaport, “Wireless Communications: Prentice and Practice”, Prentice Hall PTR, second edition, 2002.
3. Perry Marshall and John Rinaldi, ”Industrial Ethernet”, The Instrumentation, Systems and Automation Society, 2005
4. Richard Zurawski ,”Industrial Communications Technology Handbook”, CRC Press, 2005

Elective (Semester II)- 3. COMPUTER AIDED INSTRUMENTATION

UNIT - I

DATA ACQUISITION SYSTEMS AND DIGITAL SIGNAL TRANSMISSION: General Configuration – single and multichannel DAS – A/D and D/A converters – Digital data Acquisition Systems – Sample and Hold Circuit – Anti-aliasing filter –Introduction to noise and ground/ shielding – Introduction to protocols and standards - Data Transmission systems – Pulse code formats – Analog and Digital modulation Techniques

UNIT - II

TELEMETRY AND INDUSTRIAL ETHERNET: Telemetry systems – RF network analyzer – Higher frequency signal sources – Introduction to wireless communication - Introduction-IEEE standards – Ethernet MAC layer – IEEE 802.2 and Ethernet SNAP – OSI and IEEE 802.3 standard. Ethernet transceivers, Ethernet types, switches & switching hubs, 10 Mbps Ethernet, 100 Mbps Ethernet, Gigabit Ethernet. TCP/IP overview-Internet layer protocols – Host-to-Host layer.

UNIT - III

COMMON INSTRUMENT INTERFACES: Current loop, RS 232c/RS485, GPIB, interface buses: USB, PCMCIA, VXI, SCXI and PXI: Networking Basics for industrial automation instrumentation Bus – HART, RS 422, IEC/ISA Field Bus, ZigBee and Bluetooth - Open System interconnection (OSI) model – MOD BUS: Introduction-Protocol Structure- Function Codes: Read Coil or Digital O/P Status – Read Digital I/P Status-Read Holding Registers- Force Single Coil- Preset Signal Register-Read Exception Status – Loop-back Test – Force Multiple Coils or Digital O/Ps – Force Multiple Registers – Modbus Common Problems and Faults - Physical Layer Topology – Device Taps – Data link Layer: Frame Format – Medium Access – Fragmentation

UNIT - IV

DEVICENET: Overview – layers. Profibus-overview-protocol stack. HART protocol – overview-layers. Foundation field bus-layers – Error Detection and Diagnostics. Local interconnect networks, Redundancy Overview – Actuator- sensor Interface- CAN bus – overview-layers. Device Net and SDS(Smart Distributed Systems)-Physical Layer and Wiring Rules- The Data link Layer- The Application Layer.

UNIT – V

PC IN REAL TIME ENVIRONMENT AND PROGRAMMING: Introduction-PC system and facilities – PC BUS and signals – Interrupts – Interfacing PC to outside world – PC in real time environment - Real-Time applications of PC – PC based distributed control systems – Real time programming: Introduction – Multi-Tasking – Task Management – Inter-Task communication – Real-Time operating systems versus Real-time programming languages – Real-time programming languages-A survey – iRMX real-time operating system.

TEXT BOOKS

1. John Park, Steve Mackey and Edwin Wright, “Data Communications for Instrumentation and Control”, Elsevier, 2003
2. Steve Mackay, Edwin Wright and Deon Reynders, “Practical Industrial data networks: Design, Installation and troubleshooting”, Elsevier international projects ltd., 2004
3. Krishna Kant, “Computer Based Industrial Control”, Prentice Hall India Ltd., 2004.

REFERENCE BOOKS

1. Bouwens, A.J., “Digital instrumentation”, McGraw Hill, Reprint 2007.
2. S. Gupta and J.P Gupta, “PC Interfacing for Data Acquisition and Process Control”, 2nd Edition 2002.
3. Doeblin, “Measurement and system, Application and Design”, McGraw-Hill, 5th Edition 2003.
4. John lenk, D., “Handbook of **M**icro computer based Instrumentation and control’, Prentice Hall, 1984.
5. M.M.S.,Anand, Electronic Instruments and Instrumentation Technology, Prentice Hall, 2004.

Elective (Semester III)-1. NANO ELECTRONICS AND SYSTEMS

UNIT I

SURVEY OF MODERN ELECTRONICS: Diode as Basic Element of Electronics,Field Effect of Transistors, Heterostructure transistors,Resonant-Tunneling diodes and transistors Need for New Concepts in Electronics,From Microelctronics towards Biomolecule Electronics.

UNIT II

BASIC CONCEPTS OF ELECTROMAGNETIC WAVES AND QUANTUM MECHANICS: Electromagnetic Waves and Maxwell's Equations, Duality of Electron,Schrodinge Equation,Eigenvalue Problem and Electron in Quantum Well,Electrons in Multiple Quantum Wells.Superlattices Artificial Atoms:Quantum Dots,Molecules,Energy Level Splitting,Chemical Bonds,Optical Transitions and Lasers.

UNIT III

ROLE OF PATTERN FORMATION IN NANOELECTRONICS: High Resolution Lithography, Dip-Pin Lithography,N EMS,Nano-Electromechanical Systems,Self-Assembly structures – Chemically Directed Self-Assembly,Surface- Layer Proteins in monolithography.

UNIT IV

TRADITIONAL LOW-DIMENSIONAL SYSTEMS: Quantum Well.cascade Lasers and other Quantum-Well Devices,Quantum Wires,Quantum Dots and Quantum Dot molecules,Quantum Dot Based cellulaaar Automata, Coloumb Effects,Single Electron Devices Nanoscale sensors and Actuators.

UNIT V

NEWLY EMERGED NANOSTRUCTURES: Challenges and Potential Applications of Inorganic Heterostructures,Quantum Dots Embedded in organic Matrix,organic light emitting diodes,Quantum Wire Interconnects,DNA and Peptides,Fullerness and carbon nanotubules,Molecular Electronics Materials and Biomolecules,Future Integrated circuits:Quantum computing.

TEXT BOOKS

1. C.P. Poole and F.J.Owens, " Introduction to nanotechnology",John Wiley & Sons,2003
2. M.A. Ratner and D.Ratner, "Nanotechnology; a gentle introduction to the next big idea" , Prentice Hall,2002.

REFERENCE BOOKS

1. Nanometer structures:theory,modeling and simulation" Editor:Akhlesh Lakhtakia, ASME Press
2. S.E.Lyshevski,"Nano-and micro-electrochemical systems fundamentals of nano and microengineering, 2004.

Elective (Semester III) -2. SYSTEM ON A CHIP

UNIT - I

INTRODUCTION: System tradeoffs and evolution of ASIC Technology – System on chip concepts and methodology – SoC design issues – SoC challenges and components.

UNIT - II

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

UNIT - III

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

UNIT - IV

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

UNIT - V

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

TEXT BOOKS

1. Rochit Rajsunah, “System-on-a-chip: Design and Test”, Artech House, London, 2000
2. Prakash Raslinkar, Peter Paterson & Leena Singh, “System-on-a-chip verification: Methodology and Techniques”, Kluwer Academic Publishers, 2003

REFERENCE BOOK

1. Lavng-Testing Wang, Charles E Strout and NurAtouba “System-on-a-chip Test Architectures: Nanometer Design for Testability”, Morgan Kaufmann, 2007

Elective (Semester III)- 3. ROBOTICS AND AUTOMATION

UNIT -I

FUNDAMENTAL CONCEPTS OF ROBOTICS: History, Present Status and future trends in Robotics and Automation - Laws of Robotics –Robot definitions – Robotics systems and anatomy – Specifications of Robots – resolution, repeatability and Accuracy of manipulator, Robotics application.

UNIT -II

ROBOT DRIVES AND POWER TRANSMISSION SYSTEMS: Robot drive mechanism, hydraulic – electric – servomotor – stepper motor - pneumatic drives, Mechanical Transmission method – GEAR transmission, Belt drives, Cables, Roller chains, link – rod systems – rotary –to-rotary motion conversion, rotary-to-linear motion conversion, Rack and pinion drives, lead drives, ball bearing screws, End effectors- Types.

UNIT -III

SENSORS: Principle of operation, types and selection of Position and velocity sensors, Potentiometer, encoders, receivers, LVDT, Tachogenerators, proximity sensors, Proximity Sensors, limit switches, tactile sensors – touch sensors – force and torque sensors.

UNIT -IV

VISION SYSTEMS AND ROBOTICS: Robot vision systems, illumination technique, image capture- solid state cameras- image representation – Gray scale and colour images, images sampling and quantization – image processing and analysis – image data acquisition – Segmentation – feature extraction – object recognition – image capturing and communication – JPEG ,MPEGs and H 62x standards , packet video, error concealment – image Texture analysis.

UNIT -V

TRANSFORMATIONS AND KINEMATICS: Matrix representation – homogeneous transformation matrices – The forward and inverse kinematics of robots – D-H representation of forward kinematic equation of robots.

TEXT BOOKS

1. Richard D Klafter, Thomas A Chmielewski, Michael negin, “Robotics Engineering – An Integrated Approach”, Eastern Economy Edition, Prentice Hall of India P Ltd, @2008.
2. Fu K,s., GonZalez R.c., Lee C.S.G, “Robotics: control, Sensing, Vision and intelligence “, McGraw Hill Book Company, 1987.

REFERENCE BOOKS

1. Mikelic. P.Groover et. Al., “Industrial robotics: Technology, programming and Application” McGraw Hill, New York, 2008.

Supportive paper – I-1. DIGITAL ELECTRONICS AND MICROPROCESSOR

UNIT-I

LOGIC GATES: Different Logic gates such as AND, OR, NOT, NAND, NOR, EXOR, Symbol and Truth Table, De Morgan's Theorems: Statement, verification and applications, Half-adder. Full adder, Half Subtractor and full subtractor, Shift register

UNIT-II

NUMBER SYSTEMS: Introduction to Decimal, Binary, Octal, Hexadecimal Number Systems, BCD Codes, Inter conversions of Decimal, Binary, and BCD Numbers, Parity, Excess-3.

UNIT-III

MICROPROCESSOR: Architecture and Programming of 8085 - functional Block diagrams, bus systems, Instruction set, and addressing modes- timing diagram and assembly level programme- Interfacing RAM and ROM sections.

TEXT BOOKS

1. Ramesh Gaonkar, 'Microprocessor Architecture, Programming and applications', with the 8085/8080A, 3rd Edition, Penram International Publishing house.
2. Donald P. Leach, Albert Paul Malvino, 'Digital Principles and Applications' 5th edition, Tata-McGraw Hill Company

REFERENCE BOOK

1. Salivahanan, 'Electronic Devices and Circuits' 2nd edition, Tata-McGraw Hill Company.

Supportive Paper - II - 2. BIOMEDICAL INSTRUMENTATION

UNIT-I

MEDICAL INSTRUMENTATION BASICS: Cells and their structure – Transport of ions through the cell membrane – Resting and action potentials –Characteristics of Resting potential - Bio-electric potentials – Design of Medical Instruments – Components of the Bio-Medical Instrument System.

UNIT-II

BIOPOTENTIAL RECORDERS: Electrocardiography (ECG) - Electroencephalography (EEG) – Electromyography (EMG) - Electroretinography (ERG) – Electrooculography (EOG)

UNIT-III

SPECIALISED MEDICAL EQUIPMENT: Angiography – Endoscopes – Different types of endoscopes - Computer tomography – Application of Computer tomography - Ultrasonic imaging systems – Magnetic resonance imaging

TEXT BOOK

1. Arumugam M.,'Bio Medical Instrumentation', Anuradha agencies Pub.

REFERENCE BOOK

1. R.S. khandpur," Hand book of Biomedical instrumentation ", Tata mc graw hill New Delhi, 2nd edition, 2003

Supportive Paper – III - 3. ANALYTICAL INSTRUMENTATION

UNIT I

COLORIMETRY AND SPECTROPHOTOMETRY: Electromagnetic radiation-Electromagnetic spectrum-Interaction of radiation with matter-Beer Lambert law-Absorption instruments-UV-ViS spectrophotometers- Single beam null type (Beckman model), Spectronic 21 Spectrophotometer- IR Spectrophotometers-Block diagram of double beam IR Spectrophotometer- Atomic absorption spectrophotometers-FTIR spectrophotometers-Flame photometers-Principle- Essential Parts- Block Diagram- Emission System.

UNIT II

CHROMOTOGRAPHY: Gas chromatography-Block diagram-Basic parts-Sample injection system-chromatography columns-Thermal conductivity detector - Liquid chromatographs-Types of liquid chromatography- High pressure liquid chromatographs

UNIT III

pH METERS AND DISSOLVE COMPONENT ANALYZERS: Principle of pH measurement, glass electrodes, hydrogen electrodes, reference electrodes, selective ion electrodes, ammonia electrodes, biosensors, dissolved oxygen analyzer-sodium analyzer-silicon analyzer.

TEXT BOOK

1. R.S. Khandpur,”Handbook of Analytical Instruments” Tata Mc Graw Hill publishing Co

REFERENCE BOOKS

1. Robert D.Braun, ”Introduction to Instrumental Analysis” Mc Graw Hill, Singapore, 1987.
2. G.W. Ewing, ”Instrumental Methods of Analysis” Mc Graw Hill 1992.
3. DA Skoog and D.M.West, ”Principles of Instrumental Analysis” Harper and Row publishers, 1974