BHARATHIAR UNIVERSITY: COIMBATORE – 641 046

M.Sc., ELECTRONICS AND INSTRUMENTATION

(For the Candidates admitted during the academic year **2010-2011 onwards**)

THE ELIGIBILITY CONDITIONS FOR ADMISSION TO M.Sc ELECTRONIC & INSTRUMENTAION SHALL BE AS FOLLOWS:

1. A PASS IN B.Sc. ELECTRONICS / INDUSTRIAL ELECTRONICS/ ELECTRONIC SCIENCE / ELECTRONICS AND COMMUNICATION SYSTEMS/ PHYSICS / APPLIED SCIENCE / COMPUTER SCIENCE/BCA/ 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.SC INFORMATION TECHNOLOGY, B.E WITH ECE, EEE, EIE, CSE, IT AND A.M.I.E IN RESPECTIVE BRANCHES IS ALSO ELIGIBLE FOR JOINING THE ABOVE SAID COURSES.

Scheme of Examination

Sem	Subject	Ins	University Examination			
			Int.	Ext.	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
	Elective - I	4	25	75	100	4
	Supportive – I	2	12	38	50	2
	Systems Lab	6	-	-	-	-
	Embedded System Lab	6	-	-	-	-
II	Control Systems	4	25	75	100	4
	Computer Aided Instrumentation	4	25	75	100	4
	Programmable Logic Controllers	4	25	75	100	4
	Analytical Instrumentation	4	25	75	100	4
	Instrumentation and Control Systems Lab	4	25	75	100	4
	Embedded Systems Lab	4	40	60	100	4
	Elective II	4	40	60	100	4
	Supportive – II	2	12	38	50	2
III	Digital Signal Processing	4	25	75	100	4
	Digital System Design and Testing	4	25	75	100	4
	VLSI System Design	4	25	75	100	4
	Digital Signal Processing Lab	4	25	75	100	4
	VLSI and Intelligent Instrumentation Lab	4	40	60	100	4
	Elective – III	4	25	75	100	4
	Supportive – III	2	12	38	50	2
IV	Process Control	4	25	75	100	4
	Bio – Medical Instrumentation	4	25	75	100	4
	Medical Electronics Lab	4	40	75	100	4
	Project Work & Viva – voce	4	40	60	100*	4
					2250	90

*Internal and External examiners shall jointly evaluates the report for 80 marks and conduct the Viva – voce examination for 20 marks.

Duration of Practical Examination 4 hours

Elective I (Semester I)

1. Electronic Test Instruments
2. Electrical Measurements and Instruments
3. Measurements Techniques and its Applications.

Elective II (Semester II)

1. Data Communication Networks
2. Industrial Networking and Standards
3. Fiber Optics and Laser Instrumentation

Elective III (Semester III)

1. Nano Electronics and Systems
2. System on a Chip
3. Robotics

Supportive Papers offered to the students of other departments

Paper I: Biomedical Instrumentation
Paper II: Electronic Test Instruments
Paper III: Microprocessor and its Applications.

SENSORS AND TRANSDUCERS **Semester I**

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, hysterisis 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

VARIABLE 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

VARIABLE INDUCTANCE AND VARIABLE 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

SIGNALS AND SYSTEMS **Semester I**

UNIT I
INTRODUCTION

A Signal – Signal Modeling – Continuous-time, Discrete-time and Digital signals – Elementary Continuous Time Signals – Representation of Discrete-time Signals – Elementary Discrete-time Signals – Basic Operations on Signals – Classification of Signals.

A System – Classification of Systems – System Modeling.

UNIT II
CONTINUOUS TIME & DISCRETE TIME SYSTEMS

Introduction(CT) – Solution of Differential Equations – Representation of a Continuous Time Signal – Convolution Integral – Properties of Convolution – Impulse Response of Interconnected Systems – Causality – Stability – Step Response – Graphical Procedure to Perform Convolution – Correlation.

Introduction(DT) – Solution of Difference Equations – Natural Response – Forced Response – Total Response – Impulse Response – Representation of Discrete-time Signals in Terms of Impulses – Impulse Response and Convolution Sum – Properties of Convolution Sum – Convolution of Two Sequence – Causality –Stability – BIBO Stability – Step Response – Correlation of Two Sequence – Inverse System and Deconvolution.

UNIT III
FOURIER SERIES REPRESENTATION OF PERIODIC SIGNALS

Introduction – Evaluation of Fourier Coefficients – Symmetry Conditions – Cosine Representation – Exponential Fourier Series – Existence of Fourier Series – Properties of Continuous-time Fourier Series – Power Representation Using the Fourier Series – Fourier Spectrum – Gibb's Phenomenon.

Introduction – Existence of Fourier Transform – Fourier Transform of Some Standard Signals – Properties of Fourier Transform – Fourier Transform of a Periodic Signals – Modulation – System Analysis with Fourier Transform.

UNIT IV
FOURIER ANALYSIS OF DT SIGNALS AND SYSTEMS

Introduction – Discrete Frequency Spectrum and Frequency Range – Discrete-time Fourier Transform – The Frequency Response of Discrete-time Systems – Transfer Function – The Discrete Fourier Transform – Zero padding – Fast Fourier Transform – IDFT using FFT Algorithm.

UNIT V
LAPLACE TRANSFORM & SAMPLING

Introduction – Convergence of the Laplace Transform – s-Plane – The Unilateral Laplace Transform – Properties of Unilateral Laplace Transform – Inversion of Unilateral Laplace Transform – Inversion of Bilateral Laplace Transform – Solution of Differential Equations Using Laplace Transform.

Introduction – Sampling Theorem – Anti Aliasing – Signal Reconstruction – Sampling of Bandpass Signals

TEXT BOOK

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

REFERENCES:

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

EMBEDDED SYSTEM AND RTOS **Semester I**

UNIT I

INTRUDUCTION TO EMBEDDED SYSTEMS: Embedded systems - Application of Embedded Systems - processors in the system - Other Hardware units - software embedded to a system - Exemplar embedded system - Embedded system – on - chip (SOC) and in VLSI circuit.

UNIT II

DEVICES AND BUSES FOR DEVICE NETWORK: I/O Device - timer and counting devices - serial communication using I^2C, CAN and USB. Parallel communication using PCI, PCIX and advanced parallel High Speed Buses.

UNIT III

DEVICE DRIVERS FOR DEVICE AND INTERRUPTS SERVING MECHANISM: Device drives-parallel port devices drive in a system, serial port Device Drivers in a system, Drivers for internal programmable timing Devices – Interrupt servicing Mechanism – Context and the periods for context switching, Deadline and Interrupt Latency.

UNIT IV

EMBEDDED SOFTWARE DELOPMENT USING IDE: Introduction to Integrated development environment (IDE) – programming concepts and embedded programming in Assembly and C – creating a New project – Adding Files to a project – Building a project – Debugging and simulating the application – Getting Embedded software into the Target system.

UNIT V

REAL TIME OPERATING SYSTEM (RTOS)

Introduction to basic concepts of RTOS,Basics of real time& embedded system operating systems,RTOS-Interrupt handling, task scheduling; embedded system design issues in system development process-Action plan, use of target system,emulator,use of software tools.

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.
6. Wayne Wolf, "Computers as components" Morgan Kaufmann Publishers, 2005.
7. Douglas V Hall, "Microprocessors and Interfacing: Programming and Hardware", Tata McGraw –
Hill, Second Edition, 2001.

CONTROL SYSTEMS **Semester II**

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.

REFERENCES:

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.

COMPUTER AIDED INSTRUMENTATION **Semester II**

UNIT - I

DATA ACQUISITION SYSTEMS: 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 Distributed Automation and Supervisory Control and Data Acquisition.

UNIT - II

DIGITAL SIGNAL TRANSMISSION: Data Transmission systems – Pulse code formats – Analog and Digital modulation Techniques – Telemetry systems – RF network analyzer – Higher frequency signal sources – Introduction to wireless communication.

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 – IEEE 488, HART, RS 232, RS 422, RS 485, IEEE 488, HS488, IEC/ISA Field Bus, ZigBee and Bluetooth.

UNIT - IV

CURRENT TRENDS IN DIGITAL INSTRUMENTATION: Introduction to special function add on cards – resistance card – input and output cards – Digital equipment construction with modular designing: interfacing to microprocessor, microcontrollers and computers – Computer aided software engineering tools (CASE), Use of case tools in design and development of automated measuring systems.

UNIT - V

APPLICATION EXAMPLES IN MEASUREMENT AND CONTROL: PC based Data Acquisition systems – Industrial process measurements like flow, temperature, pressure and level. PC based instruments development system.

REFERENCES:

1. Krishna Kant, "Computer Based Industrial Control", Prentice Hall India Ltd., 2004.
2. Bouwens, A.J., "Digital instrumentation", McGraw Hill, Reprint 2007.
3. S. Gupta and J.P Gupta, "PC Interfacing for Data Acquisition and Process Control", 2nd Edition 2002.
4. Doeblin, "Measurement and system, Application and Design", McGraw-Hill, 5th Edition 2003.

5. John lenk, D., "Handbook of **M**icro computer based Instrumentation and control', Prentice Hall, 1984.
6. M.M.S.,Anand, Electronic Instruments and Instrumentation Technology, Prentice Hall, 2004.

PROGRAMMABLE LOGIC CONTROLLERS **Semester II**

INTRODUCTION: Factory and Process Automation, PLC – Networking standards – Vertical Integration of Industrial Automation – field and Ethernet.

UNIT - I

HMI SYSTEMS: Necessity and Role in Industrial Automation, Text Display – operator panels – Touch panels Panel PC's – Integrated Displays (PLC & HMI)

UNIT - II

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, VB and C Scripts for SCADA application.

UNIT - III

COMMUNICATION PROTOCOLS IF SCADA: Proprietary and open protocols – OLE/OPC – DDE ;- Client /server configuration – Messaging – Recipes – User administration – Interfacing of SCADA with PLC, drive and other field devices.

UNIT - IV

DISTRIBUTED CONTROL SYSTEMS: Difference between SCADA System and DCS – architecture – local control unit – programming language – communication facilities – operator interface – engineering interfaces.

UNIT - V

APPLICATIONS OF SCADA AND DCS: Case studies of process plants using SCADA and DCS – Advanced features / options in SCADA and DCS – Role of PLC in DCS & SCADA – Comparison – interfacing field devices(Transducers, drives etc) in DCS/SCADA.

TEXT BOOKS

1. John W.Webb &Ronald A., Reis, "Programmable Logic Controllers ", Prentice Hall Publication, New Delhi, 2002.
2. Michael P.Lukas, "Distributed Control Systems", Van Nostrand Reinfold Company,1995

REFERENCES:

1. WiNCC Software Manual, Siemens, 2003.
2. RS VIEW 32 Software Manual, Allen Bradley, 2005.
3. CIMPLICITY SCADA Packages Manual, Fanuc India Ltd, 2004.

ANALYTICAL INSTRUMENTATION **Semester II**

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-Diffractometers-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,"Prinicples of Instrumental Analysis" Harper and Row publishers, 1974.

INSTRUMENTATION AND CONTROL SYSTEM LABORATORY

(Any 12 Experiments) **Semester II**

1. Displacement measurement using LVDT
2. Design of V-F converter and V- F converter
3. Characteristics of differential pressure transmitter with zero elevation and zero suppression
4. Analog Multiplexer and Demultiplexers
5. Instrumentation amplifier
6. Strain gauges.
7. Thermocouple Compensation.
8. Thermister Linearization transmitter design.
9. Pressure Calibration.
10. Signal conditioning circuit for any resistive pressure, transducer.
11. P.I.D Controller.
12. Signal conditioning circuit for optical encoder.
13. Implementation of star- delta starter using RLL for S7-200 PLC
14. Development of a monitoring program for induction motor in RLL/STL for S7-300
15. PWM/PTO based drive control using PLC
16. Analog sensor interface using PLC
17. Monitoring and control of PLC through HMI
18. Monitoring of industrial drive through winCC SCADA system
19. Interfacing of S7-300 with winCC SCADA system
20. Machine monitoring and control through Ethernet

EMBEDDED SYSTEMS LABORATORY **Semester II**

8051 BASED EMBEDDED SYSTEMS (Any 10 Experiments)

1. Arithmetic and Logic programs
2. Square wave generation using ports
3. Matrix Key Board interfacing
4. LED Interfacing
5. Seven segment display interfacing
6. Solid state relay interfacing using interrupts
7. Traffic light control system
8. ADC interface
9. DAC interface
10. Stepper motor interface
11. Timer/Counter operation
12. Serial port interfacing using RS232C
13. Digital clock
14. LCD interface
15. Object counter
16. Water level controller
17. Flow measurement
18. Temperature measurement

PIC 16F87X BASED EMBEDDED SYSTEMS & RTOS (ANY 10 EXPERIMENTS)

1. Arithmetic and Logical programs
2. Square wave generation using ports
3. Matrix Key Board & LED interfacing
4. Single digit timer using seven segment displays
5. DC motor driving via H Bridge
6. DAC interface
7. ADC INTERFACE
8. LCD interface
9. Stepper motor control
10. PWM generation
11. Compare and capture operation program
12. Serial communication using RS232C
13. PIC to PIC communication using I2 C bus

PROGRAMMING WITH RTOS

14. Semaphore & flag related functions
15. Queue & Mailbox related functions
16. Memory related functions
17. Embedded system for an adaptive cruise control system in a car
18. Embedded system for a smart card

1. DIGITAL SIGNAL PROCESSING Semester III

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

DSP arithmetic: fixed point arithmetic and floating point arithmetic – representation,addition, and multiplication– ADC quantization noise – finite word length effects in IIR filters: influence of filter structure, coefficient quantization error, coefficient word length requirements for stability and desired frequency response – addition overflow errors and their effects – scaling in canonic section, direct structure, cascade, and parallel realization – output overflow detection and prevention – product round off errors and their effects– round off noise in cascade and parallel realization and their effects in modern DSP systems- round off noise reduction schemes – limit cycle due to product round off errors – finite word length effects 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 C54X

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.

2. DIGITAL SYSTEM DESIGN AND TESTING Semester III

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 BOOK:

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.

REFERENCES:

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

3. VLSI SYSTEM DESIGN Semester III

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 – Twintub – 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 BOOK:

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.

REFERENCES:

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.

DIGITAL SIGNAL PROCESSING LAB **Semester III**

USING TMS320C5X/TMS320C54XX/TMS320C67XX (Any 12 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. Correlation of two discrete signals
7. Waveform generation
8. Solving differential equations
9. Solving z-transform
10. Voice storing & Retrieval
11. FIR Filter design
12. IIR filter design

SIMULATION USING MATLAB (Minimum of 4 experiments)

13. Generation of signals
14. Amplitude Modulation & FFT response
15. Impulse, Step, Exponential & Ramp functions
16. Frequency sampling method
17. Design of FIR filter
18. Design of IIR filter

VLSI AND INTELLIGENT INSTRUMENTATION LAB **Semester III**
(Any 12 Experiments)

VLSI LAB

I-Design and simulation of Combinational Logic Circuit using VHDL

1. Adder
2. Multiplexer and Demultiplexer
3. Encoder and Decoder
4. Multiplier

II-Design and simulation of Sequential Logic Circuit using VHDL

1. Flip Flops
2. Counter
3. Shift registers
4. Frequency Divider

III-FPGA Implementation

1. 4 bit Adder
2. Real Time Clock

INTELLIGENT INSTRUMENTATION LAB:

1. Creating a simple VI to place a Digital Control
2. Navigation and Editing
3. VI to make a Degree C to Degree F Converter
4. Converting VI in to Sub VI
5. Create a random number generator
6. Create a Boolean Switch Action
7. Wright a programme to count Modulus 32 and display the values in decimal, octal decimal and Binary.
8. Create a Temperature simulator to set up over and under – Temperature LEDs to light up when ever the deviations is $> 5^0C$
9. Built a VI using while loop that displays random numbers in to three wave form charts. (Strip, scope & Sweep)
10. Built a VI that displays to random chart in to single chart
11. To check given number is positive or negative.
12. Built a four function calculator
13. Built VI to compute and display $y_2 = mx+b$.
14. Built VI that continues the monitor every 250 ms
15. Built VI to produce sine, square, triangle and saw tooth wave forms.
16. Built a 8 bit binary counter to display the results graphically.
17. Wright a simple programme to generate a voltage at analog out put is zero using knob to select voltage

1. PROCESS CONTROL **Semester IV**

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 edition, Prentice Hall of India, 2006

REFERENCES:

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

2.BIOMEDICAL INSTRUMENTATION Semester IV

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.

ELECRICAL SAFETY: Physiological effect of electricity - important susceptibility parameters - distribution of electric power - macro shock hazards micro shock hazards - electrical safety code and standards - basic approaches to protection against shock - equipment design - electrical safety analyzer- testing.

TEXT BOOK:

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

REFERENCES:

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

MEDICAL ELECTRONICS LAB **Semester IV**

Any 12 Experiments

1. Operation and function of all the controls of hospital X-Ray machine
2. Operation and function of all the controls of dental X-Ray machine
3. Identification of different block/sub system of circuits in X-Ray machine
4. Measurement of skin contact impedance and technique to reduce it.
5. Observe its wave shape on CRO the output of blood pressure transducers body temperature transducers and pulse sensors
6. Use of sphygmomanometer for measurement of blood pressure
7. Concept of ECG system and placement of electrodes
8. Measurement of leakage currents with the help of safety tester
9. PH measurement of given biological sample
10. Concept of EMG system and placement of electrode
11. Measurement of respiration rate using thermistor
12. Concept of EEG system and placement of electrode
13. Identification of different types of PH electrode
14. pO_2 Measurement of given sample
15. Measurement using Audiometer

1. ELECTRONIC TEST INSTRUMENTS Elective (Semester I)

UNIT I ANALOG METERS

D.C,A.C voltmeters, ammeters, multimeter,power meter,Q-meter,true RMS meter, vector impedance meter, vector voltmeter, component measuring instrument.

UNIT II SIGNAL SOURCES

Sine wave generator-Frequency synthesized sine wave generator-Sweep frequency generator, pulse and square wave generator-Function generator-Wave analyzer-Applications-Harmonic distortion analyzer-Spectrum analyzer-Applications-Audio Frequency generator-Noise generator.

UNIT III OSCILLOSCOPES

General purpose oscilloscope-Screens for CRT graticules-Vertical & horizontal deflection systems- Time base operation, triggers – sweep control, z axis input - Delay line-Multiple trace-Dual beam & dual trace-Probes-Oscilloscope techniques-special oscilloscopes-Storage oscilloscope-sampling oscilloscope-digital CRO.

UNIT IV DIGITAL INSTRUMENTS

Digital method for measuring frequency, period, phase difference, pulse width, time interval, total count-Digital voltmeter-Types-Automatic polarity indication, automatic ranging, and auto zeroing-DMM-Microprocessor based DMM-DPM-swept – spectrum analyzer-network analyzer-discharge analyzer- logic probes-logic analyzer.

UNIT V DISPLAY AND RECORDING DEVICES

Bar graph display-Segmental and dot matrix display-X-Y recorders, magnetic tape recorders-Digital recording-Data loggers-Interference and screening-Electrostatic and electromagnetic interference & earth loops.

TEXT BOOKS

1.Albert D. Herlfrick & William D. Cooper, "Modern electronic Instrumentation & Measurement Techniques" Prentice Hall of India,2002.
2.A.J.Bouwens,'Digital Instrumentation" Tata Mc Graw Hill, 1997.
3.RobertA.Witte,'Electronic Test Instruments,Theory and applications'
Prentice Hall, 1993.

REFERENCE BOOKS

1.B.M.Oliver and J.M.Cage,"Electronic Measurements & Instrumentation" Mc Graw Hill International Edition, 1975.
2.Joseph, J.Carr,"Elements of Electronic Instrumentation & Measurements" III edition, Pearson Education,2003.
3.C.S.Rangan, G.R.sarma, V.S.V.Mani,"Instrumentation Devices & systems" Tata Mc Graw Hill, 2002
4.D.A.Bell, "Electronic Instrumentation and Measurements" Prentice Hall of India,2002.
5.Rajendra Prasad,"Electronic Measurements and Instrumentation", Khanna Publishers, Delhi,2003.
6.B.R.Gupta,"Electronics and Instrumentation"S.Chand Co. (P)Ltd., Delhi,2003.

2. ELECTRICAL MEASUREMENTS AND INSTRUMENTS Elective (Semester I)

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.

3. MEASUREMENT TECHNIQUES AND ITS APPLICATIONS Elective (Semester I)

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 – potentio-metric 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 BOOKS

1. Measurement systems, Application and Design – E.O Doeblin, McGraw Hill International Editions
2. A Course in Electrical and electronics Measurement and Instrumentation by AK Sawhney; Dhanpat Rai and Co Pvt. Ltd., New Delhi

1. DATA COMMUNICATION NETWORKS Elective (Semester II)

INTRODUCTION: Definition of Networks – Classifications of Networks – LAN, MAN, WAN, internet – Network Topology – Protocols and Standards – Network Models – OSI, TCP/IP Models of networking – Internet

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

LANS: 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

WANS: 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

REFERENCES:

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

2. INDUSTRIAL NETWORKING AND STANDARDS Elective (Semester II)

UNIT-I

INTRODUCTION: Modern Instrumentation and Control Systems-Open Systems Interconnection Model-Introduction to Protocols and standards-Introduction to Noise and Ground/Shielding

UNIT-II

EIA-232 AND EI-485: EIA-232 Interface Standard- Major Elements of EIA-232 – Half-Duplex Operation of EIA-232 Interface-EIA-485 Interface Standard- EIA-485 versus EIA-422- EIA-485 Noise Problems

UNIT-III

DATA HIGHWAY PLUS/DH485: Overview- Physical Layer- **HART:** Overview: Introduction-Protocol-Physical Layer Data link Layer.

UNIT-IV

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

UNIT-V

DEVICENET: Physical Layer Topology – Device Taps – Data link Layer: Frame Format – Medium Access – Fragmentation

UNIT-VI

OPEN INDUSTRIAL FIELD BUS AND DEVICE NET SYSTEMS: Overview – Actuator- sensor Interface- Introduction to CAN Bus, Device Net and SDS(Smart Distributed Systems)-Introduction to Profibus – Foundation Field bus: Physical Layer and Wiring Rules-The Data link Layer- The Application Layer – Error Detection and Diagnostics.

UNIT-VII

ETHERNETS: Industrial Ethernet Overview- Ethernet Hardware Basics – Ethernet Protocol and Addressing – Introduction to 10Mbps, 100Mbps and Gigabit Ethernet

TEXT BOOK

1. John Park, Steve Mackey and Edwin Wright, "Data Communications for Instrumentation and Control", Elsevier, 2003

REFERENCES:

1. Perry Marshall and John Rinaldi, "Industrial Ethernet", The Instrumentation, Systems and Automation Society, 2005
2. Richard Zurawski ,"Industrial Communications Technology Handbook", CRC Press, 2005

3. FIBRE OPTICS AND LASER INSTRUMENTATION Elective (Semester II)

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& splicers-Fibre termination-Optical source –Optical detectors.

UNIT II
INDUSTRIAL APPLICATION OF OPTICAL FIBRES

Fibre Optic sensors-Fibre Optic Instrumentation system-Different types of modulators-Interferometric method of measurement of length-More fringes-Measurement of pressure-, temperature, current, voltage, liquid level and strain.

UNIT III
LASER SORUCES, DETECTORS AND CONNECTORS

Laser basic concepts – LED structures – LED characteristics – Optical detection principles – PN photodiode – PIN photodiode – Avalanche photodiode – connectors- splices-connectors – fibre couples

UNIT IV
INDUSTRIAL APPLICATION OF LASERS

Laser for measurement of distance, length, velocity, acceleration, current, voltage and Atmospheric effect-Material processing-Laser heating, welding, melting and trimming of material-Removal and vaporization.

UNIT V
HOLOGRAM AND MEDICAL APPLICATIONS

Holography-Basic principle-Methods-Holographic interferometry and application, Holography for non-destructive testing-Holographic components-Medical applications of lasers, laser and tissue interactive-Laser instruments for surgery, removal of tumors of vocal cards, brain surgery, plastic surgery, gynecology and oncology.

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.

1. NANO ELECTRONICS AND SYSTEMS Elective (Semester III)

UNIT I

INTRODUCTION, 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-Electro-mechanical 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

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

UNIT - I
INTRODUCTION:
System trade offs 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.

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

3. ROBOTICS **Elective (Semester III)**

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.

UNIT -VI

PLC: Buildings blocks of automation, Controllers – PLC – Role of PLC in robotics and FA – Architecture of PLC – Advantages – Types of PLC – Types of programming – Simple process control programs using Relay Ladder Logic and Boolean logic methods – PLC arithmetic functions.

UNIT -VII

FACTORY AUTOMATION: Flexible Manufacturing systems concept – Automatic feeding lines, ASRS, transfer lines, automatic inspection – computer manufacture – CNC, intelligent automation, industrial networking, bus standards, HMI systems, DCS and SCADA, Wireless controls.

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.
3. Mikelic. P.Groover et. Al., "industrial robotics: Technology, programming and Application" McGraw Hill, New York, 2008.
4. Saeed B

1. BIOMEDICAL INSTRUMENTATION Supportive paper I

UNIT-I HUMAN PHYSIOLOGICAL SYSTEMS

Cells and their structure – Nature of Cancer cells – Transport of ions through the cell membrane – Resting and action potentials –Characteristics of Resting potential - Bio-electric potentials – Nerve tissues and organs – Different systems of human body – Design of Medical Instruments – Components of the Bio-Medical Instrument System – Electrodes – Half cell potential Electrode – purpose of the electrode paste – Electrode material – Types of Electrodes – Micro electrodes and types – depth and needle electrodes – surface electrodes and types – Distortion in the measured Bioelectric signals using electrodes – Chemical electrodes and types.

UNIT-II TRANSDUCERS

Transducers – active transducers and types of active transducers - passive transducers and types of passive transducers - Strain gauge – Photoelectric type resistive transducers – Thermistor type transducers – Metallic wire transducers – Capacitive transducers – Inductive transducers – LVDT – Magnetostrictive ultrasonic transducers – Piezoelectric ultrasonic transducers.

UNIT-III BIOPOTENTIAL RECORDERS

Characteristics of the recording system – writer and pen damping effects - Electrocardiography (ECG) Origin of cardiac action potential – ECG lead configurations and types – ECG Recording set up – Analysis of Recorded ECG signals – Vectorcardiography – Phonocardiography – Echocardiography – Electroencephalography (EEG) - Origin of EEG – Brain waves – placement of electrodes - EEG Recording set up – Analysis of EEG – Electromyography (EMG) - EMG Recording set up – Electroretinography (ERG) – Electrooculography (EOG)

UNIT-IV PHYSIOLOGICAL ASSIST DEVICES

Pacemakers – methods of stimulation – difference between internal and external pacemaker - Different mode of operation - Pacemakers batteries and types – Artificial heart valves – requirements for the design of artificial heart valves – Different types natural heart valves - Different types artificial heart valves – Defibrillators – Different types of defibrillators - Nerve and muscle stimulators – Stimulation of nerves – versatile electro diagnostic/therapeutic stimulator – peripheral nerve stimulator – External Bladder stimulator - Heart-lung machine – Mechanical functions of the heart – Model of the heart lung machine – Oxygenators – Different types of oxygenators – Blood pumps – Kidney machine - Dialysis and types.

UNIT-V SPECIALISED MEDICAL EQUIPMENT

Audiometers – Disorders of Hearing - Automatic Bekesy audiometer – X-ray machine – angiography – Endoscopes – Different types of endoscopes - Computer tomography – Application of Computer tomography - Ultrasonic imaging systems – Magnetic resonance imaging

TEXT BOOK:

1.john G.webster , editor ," medical instrumentation application and design ", john Wiley & sons ,inc noida .3rd edition 2001

2. ELECTRONIC TEST INSTRUMENTS Supportive Paper II

UNIT I ANALOG METERS

D.C,A.C voltmeters, ammeters, multimeter,power meter, Q-meter, true RMS meter, vector impedance meter, vector voltmeter, component measuring instrument.

UNIT II SIGNAL SOURCES

Sine wave generator-Frequency synthesized sine wave generator-Sweep frequency generator, pulse and square wave generator-Function generator-Wave analyzer-Applications-Harmonic distortion analyzer-Spectrum analyzer-Applications-Audio Frequency generator-Noise generator.

UNIT III OSCILLOSCOPES

General purpose oscilloscope-Screens for CRT graticules-Vertical & horizontal deflection systems- Time base operation, triggers – sweep control, z axis input - Delay line-Multiple trace-Dual beam & dual trace-Probes-Oscilloscope techniques-special oscilloscopes-Storage oscilloscope-sampling oscilloscope-digital CRO.

UNIT IV DIGITAL INSTRUMENTS

Digital method for measuring frequency, period, phase difference, pulse width, time interval, total count-Digital voltmeter-Types-Automatic polarity indication, automatic ranging, and auto zeroing-DMM-Microprocessor based DMM-DPM-swept – spectrum analyzer-network analyzer-discharge analyzer- logic probes-logic analyzer.

UNIT V DISPLAY AND RECORDING DEVICES

Bar graph display-Segmental and dot matrix display-X-Y recorders, magnetic tape recorders-Digital recording-Data loggers-Interference and screening-Electrostatic and electromagnetic interference & earth loops.

TEXT BOOKS

1.Albert D. Herlfrick & William D. Cooper, "Modern electronic Instrumentation & Measurement Techniques" Prentice Hall of India,2002.
2.A.J.Bouwens,'Digital Instrumentation" Tata Mc Graw Hill, 1997.
3.RobertA.Witte,'Electronic Test Instruments,Theory and applications' Prentice Hall, 1993.

REFERENCE BOOKS

1.B.M.Oliver and J.M.Cage,"Electronic Measurements & Instrumentation" Mc Graw Hill International Edition, 1975.
2.Joseph, J.Carr,"Elements of Electronic Instrumentation & Measurements" III edition, Pearson Education,2003.
3.C.S.Rangan, G.R.sarma, V.S.V.Mani,"Instrumentation Devices & systems" Tata Mc Graw Hill, 2002
4.D.A.Bell, "Electronic Instrumentation and Measurements" Prentice Hall of India,2002.
5.Rajendra Prasad,"Electronic Measurements and Instrumentation", Khanna Publishers, Delhi,2003.
6.B.R.Gupta,"Electronics and Instrumentation"S.Chand Co. (P)Ltd., Delhi,2003.

3. MICROPROCESSORS AND ITS APPLICATIONS Supportive Paper - III

UNIT I
INTRODUCTION
Architecture and Programming of 8085 - functional Block diagrams, bus systems,instruction set, addressing modes - timing diagram and assembly level programmes; Interfacing RAM and ROM sections.

UNIT II
PERIPHERAL DEVICES
Programmable peripheral interface (8255); Data transfer schemes-programmed and DMA controller 8257- Interrupts and DMA - Interrupt features, types of interrupts-methods of servicing interrupts programmable interrupt controller, Need for Direct memory access-programmable DMA controller.

UNIT III
8031/8051 MCU FAMILY
Microcontrollers- architecture of 8051- memory organisations, addressing modes - instruction set -simple programs - interrupt structure Interfacing with external ROM and RAM, Typical applications -MCS 51 family features.

UNIT IV
MOTOROLA , PIC MICROCONTROLLERS
Introduction to Motorola MC 68HC 11/12, Microcontroller – Programming model, instruction set, Assembly level programming – PIC series of microcontrollers

UNIT V
INTERFACING APPLICATIONS
Interfacing applications- ADC, DAC, motor control, waveform generation, -interfacing of simple keyboards and LED displays.
Seven segment LED display systems-stepper motor control -speed control of DC motor using thyristor converters.

REFERENCES:
1. Ramesh Gaonkar, 'Microprocessor Architecture, Programming and applications', With the 8085/8080A,3rd Edition ,Penram International Publishing house, 2002.
2. Muhammad Ali Mazidi , Janice Gillispie Mazidi, "The 8051 Microcontroller and Embedded Systems", Pearson, 4th edition 2002.
3. Kenneth J.Ayala,' The 8051 Micro controller', Penram International Publishing, 1996.
4. Raj kamal, Microcontrollers, Programming, Interfacing and system Design, Peasrson 2005
5. J.Morton,'The PIC Mircrocontroller, 'Elsevier 2005
6. Peatman J.B. 'Design with PIC mircrocontrolllers' Pearon,2003.

QUESTION PATTERN

Part A
Answer all questions 10 x 2 = 20
(10 Questions without choice)
1,2 - from Unit I

3,4 - from Unit II

5,6 - from Unit III

7,8 - from Unit IV

9,10 - from Unit V

Part B
Answer all questions 5 x 5 = 25
(5 Questions either/or pattern)
1. (a) or (b) from Unit I

2. (a) or (b) from Unit II

3. (a) or (b) from Unit III

4. (a) or (b) from Unit IV

5. (a) or (b) from Unit V

Part C
Answer any three questions 3 x 10 = 30
(**Three** questions with choice out of **Five** Questions)
16. One question from Unit I

17. One question from Unit II

18. One question from Unit III

19. One question from Unit IV

20. One question from Unit V