**RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL**

**New Scheme Based On AICTE Flexible Curricula**

**Electronics & Instrumentation Engineering, VII-Semester**

## EI 701- Analytical & Industrial Instrumentation

**Unit I:** Introduction to Chemical instrumental analysis, advantages over classical methods, Classification: Spectral, electro analytical and other separation methods, Laws of photometry (Beer and Lambert's law), Basic Components of analytical instruments. Chromatography: Classification, Gas chromatography: principle, constructional details, GC detectors, Estimation of oxygen, hydrogen, methane, carbon dioxide, CO, etc. in binary or complex gas mixtures. Zirconia-probe oxygen analyser. Paramagnetic oxygen meters.

**Unit II:** Colorimeters, spectrophotometers (UV-Visible), monochromators, filters, grating, prism, dual wavelength and double monochromator systems, rapid scanning spectrophotometers, IR spectrophotometers.

**Unit III:** Flame Photometry: Principle, constructional details, flue gases, atomizer, burner, optical system, recording system. Atomic absorption spectrophotometers: Theoretical concepts, instrumentation: hollow cathode lamps, burners and flames, plasma excitation sources, optical and electronic system

**Unit – IV:** Measurement of pH, Conductivity, particle counting, detection on the basis of scattering-Nephalometer, Laboratory Instruments: Centrifuge, oven, water bath, Incubators, stirrers, Densitometer,

**Unit-V:** Mass Spectrometer (MS): Principle, ionization methods, mass analyzer types – magnetic deflection type, time of flight, quadruple, double focusing, detectors for MS, applications X-ray spectrometry: Instrumentation for X-ray spectrometry, X-ray diffractometer.

**Some Suggested Textbooks/ Reference books:**

1.Instrumental Methods of Analysis, Willard, Merritt, Dean, Settle, CBS Publishers & Distributors, New Delhi, Seventh edition.
2. Handbook of Analytical Instruments, R. S. Khandpur, Tata McGraw–Hill Publications, 3rd edition
3. Instrumental Methods of Chemical Analysis, Galen W. Ewing, McGraw-Hill Book Company, Fifth edition.
4. Introduction to Instrumental Analysis, Robert D. Braun, McGraw-Hill Book Company

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**Departmental Elective EI 702 (A) Data Communication & Computer Networks**

**Unit-1.** Introduction to computer network: Network uses, Hardware and software .Types of network .Structure and architecture. Seven layers OSI reference model & TCP-IP reference model. Services and interfaces. Circuit switching, packet switching and hybrid switching.

**Unit-2.** Data transmission and its types, Wireless transmission, Characteristic, Capacity Speed & Delay of transmission, Bandwidth, Data rate, Throughput serial and parallel communication, Synchronous and Asynchronous communication. Simplex and Duplex communication.

**Unit-3.** Physical layer: Transmission media, Terminals modems. Digital transmission, switching methods. Multiplexing, Medium access sub layers, Local area networks protocols. IEEE standards 802.3, 802.4 & 802.5.

**Unit-4.** Data link layer & network layer .Design issues. Elementary data link protocol, Sliding window protocol. Routing algorithms. Traffic monitoring, Bridge and gateways. ATM.

**Unit-5.** Design and Performance issues and protocols of Transport layer, Session layer, Presentation layer & Application layer. DNS, SNMP (Simple network management protocol) .Network security.

**BOOKS AND REFERENCES RECOMMENDED:**

1.Tanenbaum A S., Computer networks, 4th Edition, Pearson Education
2. Martin James, Computer Network & Distributed processing, Pearson Education .
3. Gallo, Hancock, Computer Communications and Networking Technologies.
4. Behrouz A. Forouzen, Data communication and Networking.

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**Departmental Elective EI 702 (B) Process Control**

**UNIT-1.** Introduction to process control. Control system Evaluation, Objective. ON-OFF control. Time proportional control, proportional control, Integral control, Derivative control, Typical PID controller characteristics and related terminology.

**UNIT-2.** Pneumatic controller: P, PD, PI, PID controllers. Hydraulic controller: P, PI, PD, PID controller, Electronic controller. Complex control schemes: ratio control systems, split range controls, cascade controls, feed forward control. Tuning of controllers: Ziegler-Nicolas methods and other methods.

**UNIT-3.**Introduction to programmable logic controllers: Evolution, basic block diagram, characteristics, advantages, types, PLC Vs PC. Ladder diagram, Ladder design, development of Ladder diagrams for various logic gates, logics. PLC timers and counters, Application of PLCs: Industrial applications.

**UNIT-4.** Final control elements: Mechanical, Electrical, Fluid valves: control valve principles, valvesport and plug and characteristics, control valve types, Valve sizing and selection. Type of actuators: Pneumatic actuators, Hydraulic actuators.

**UNIT-5.** Feedback and connecting elements in the loop flow, pressure level and temperature control loops, Pneumatic transmission, electric transmission, Thermal element lag, pressure element lag.

## Text Books :

1. Eckman- Automatic Process Control.
2. D.Patranabis- Principles of Process Control.
3. Curties D. Johnson- Process Control Instrumentation Technology.

## References Books:

1. S. K. Singh - Industrial Instrumentation.
2. Mitra& Gupta- Programmable Logic Controller and Industrial Automation

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**Departmental Elective EI 702 (C) Power Plant Instrumentation**

## UNITI - METHODS OF POWER GENERATION

Power generation - types - importance of instrumentations in power generation - basic building block for all types of power generation plants - details of boiler processes - P&I diagram of boiler - cogeneration. 170 EIE-2013 SRM (E&T)

## UNIT II - PARAMETERS OF POWER PLANT AND ITS MEASUREMENT

Electrical and non electrical parameter measurement -correction factor for steam temp and temp-steam pressure - drum level measurement -radiations detector -smoke density measurement -dust monitor - speed vibration, shell temperature monitoring & control - steam pressure control lubricant temp control of turbines.

## UNIT III - ANALYZERS IN POWER PLANTS

Flue gas oxygen analyzer - analysis of impurities in feed water and steam - dissolved oxygen analyzer - chromatography - PH Meter - Fuel analyzer –pollution monitoring instruments.

## UNIT IV - CONTROL LOOPS IN BOILER

Combustion Control-air/fuel ratio control - furnace draft control - drum level control - main steam and reheat steam temp control - super heater control - attemperator - deaerator control - distributed control system in power plants - interlocks in boiler operation.

## UNIT V - NUCLEAR POWER PLANT

Nuclear power plant instrumentation - P&I diagram of different types of nuclear power plant - radiations detection instruments - process sensors for nuclear power plants - Spectrum Analyzer - nuclear reactor control systems and allied instrumentation.

## TEXT BOOKS

1. Sam Dukelow. G *“The control of Boilers”*, instrument society of America, 1991.
2. Modern power station practice, Vol.6, *"Instrumentation Controls and Testing”*, Pergamon Press, Oxford, 1971. A 153.

## REFERENCES

1. Elonka. S.M, and Kohan. A.L, *“Standard Boilers Operations”*, McGraw Hill, New Delhi, 1994.
2. Jain. R.K, *“Mechanical and industrial Measurements”*, Khanna Publishers, New Delhi, 1995.

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**Open Elective EI 703 (A) VLSI Design**

**Unit-I**
Introduction to CMOS circuit, Circuit & System representation. Behavioural representation, structural representation. Physical representation MOS transistor theory. NMOS and PMOS enhancement transistor. Threshold voltage, body effect. MOS device design equation. Basic DC equation, second order effects, MOS models.

**Unit-II**
The complementary CMOS inverter-DC character, Static load MOS inverters. The differential inverter. Tristate inverter. Bipolar devices, diodes, transistors, BICMOS inverters.

**Unit-III**
Review of silicon semiconductor technology and basic CMOS technology-n-well and p-well process. Interconnect and circuit Twin-tub process layout design rules and latch-up, latch-up triggering and prevention.

**Unit-IV**
Circuit characterization and performance estimation resistance and capacitance estimation, Switching characteristics, CMOS gate transistor sizing, power dissipation. Basic physical design of simple logic gates. CMOS logic structure.

**Unit-V**
CMOS design methods. Design strategies. Programmable logic, programmable logic structure, reprogrammbale gate arrays. Exiling programmable gate array. Algotonix, concurrent logic, sea of gate and gate array design VHDL as a tool.

**References:**
1. Neil, H.E. Wasdte, Kamran Eshraghian, Principles of CMOS VLSI design, Pearson Education.
2. Wyne Wolf, Modern VLSI Design-system on silicon, PHI.
3. Phillip E. Allen and Douglas R holding, CMOS Analog Circuit Design, 2nd edition, Oxford University press.

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**Open Elective EI 703 (B) Data Acquisition System**

**Unit-1** Fundamentals of Data Acquisition Systems, Sensors and Transducers, DAQ Hardware & Software, Noise Parameters of a DAQ System, Accuracy and Precision, Settling Time, Acquisition Time, DC Input Characteristics, Grounding Issues, Types of Measurement Systems, Measuring Signal Sources, NI-DAQ, Overview of NI-DAQmx VIs, NI-DAQmx Task State Model, Triggering, Anti-aliasing Filters, , DAQ Device Architectures, Multiple-Point (Buffered) Analog Input, Signal Conditioning, Filtering, Isolation

**Unit-2** Data Acquisition Systems: Hardware, Plug-in DAQ Systems, Signal Conditioning,A/D & D/A Converters. Digital Signal Processing, Architecture of a DSP, Microprocessor and Microcontrollers, CPU Structure, Microcontrollers, Microcontroller MAXQ612/622, Amplifier, design for Low-Noise. Maxim Integrated, MAX9632, Multiplexer/Demultiplexer,

**Unit-3** Power Management, Automotive Power-Management MAX16920, Power-Management ICs for Single-Cell, MAX8662/MAX8663, Timing System, Timing Parameters for Combinational Logic, Timing Parameters for Sequential Logic, Clock Skew & Jitter, MAX9155-Clock, Filtering, Digitally Programmed, Dual Second-Order, Continuous Low-Pass Filter, MAX270/271, Memory Board, 1024-Bit, 1-Wire EEPROM of Maxim Integrated, Bus Interface, MAX3421E, USB Peripheral/Host Controller with SPI Interface, Communication Bus, Bus USB and FireWire , Standardization and Technical Details , USB Connectors , Power Supply , USB Packet and Format , FireWire , USB Peripheral Controller with SPI Interface, MAX3420E , Serial Communications, RS232 , MAX220-MAX249. Wireless, Ethernet, andBluetooth , GSM for Data Acquisition Systems , GPS Receiver, MAX2769, PCI and PCI Express, Standard VME.

**Unit-4** Signal Processing, Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT), , Power Spectrum, Spectral Leakage and Smoothing Windows. Filtering, Ideal Filters, Practical (Nonideal) Filters, Advantages of Digital Filters over Analog Filters, IIR and FIR Filters, IIR Filter Comparison, Transient Response of IIR Filters. Digital Signals, Digital I/O, Counters Signals, Counter Chips, Counter I/O, Edge Counting, Pulse Generation, Pulse Measurement, Frequency Measurements, Position Measurement, Synchronization, Explicit State Transitions, Single & Multiple Device Synchronization.

**Unit-5** Design of Data Acquisition Systems, Design of High Speed Computer-Based DAS, Requirements, Analysis of Accuracy (Static&Dynamic), Portable DAS, Design Guidelines for High-Performance, Multichannel, Software for Data Acquisition Systems, Introduction, LabVIEW, Android for DAQ, Design of Firmware, VME Bus, Smart Data Acquisition System, MAX1329, Circuit Applications.

**BOOKS & REFERENCES RECOMMENDED:**


1. Data Acquisition Systems from Fundamentals to Applied Design, Di Paolo Emilio, Maurizio, Springer, New York..
2. Data Acquisition for Sensor Systems, Taylor, H.R, Springer US Practical Data Acquisition for Instrumentation and Control Systems, John Park, ASD, IDC Technologies, Perth, Australia
3. Data Acquisition and Signal Conditioning Course Manual, National Instruments Corporate Headquarters, Texas, USA

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**Open Elective EI 703 (C) Neural Networks & Fuzzy Logic**

## UNIT I ARCHITECTURE OF NEURAL NETWORKS:

Architectures: motivation for the development of natural networks-artificial neural networks-biological neural networks-area of applications-typical Architecture-setting weights-common activations functionsBasic learning rules- Mcculloch-Pitts neuron- Architecture, algorithm, applications-single layer net for Page 1 of 7 pattern classification- Biases and thresholds, linear separability - Hebb'srule-algorithm -perceptron - Convergence theorem-Delta rule

## UNIT II BASIC NEURAL NETWORK TECHNIQUES:

Back propagation neural net:standard back propagation-architecture algorithm- derivation of learning rulesnumber of hidden layers--associative and other neural networks- hetro associative memory neural net, auto associative net- Bidirectional associative memory-applications-Hopfield nets-Boltzman machine

## UNIT III COMPETITIVE NEURAL NETWORKS:

Neural network based on competition: fixed weight competitive nets- Kohonenself organizing maps and applications-learning vector quantization-counter propagation nets and applications adaptive resonance theory: basic architecture and operation-architecture, algorithm, application and analysis of ART1 & ART2

## UNIT IV SPECIAL NEURAL NETWORKS:

Cognitron and Neocognitron - Architecture, training algorithm and application-fuzzy associate memories, fuzzy system architecture- comparison of fuzzy and neural systems.

## UNIT V FUNDAMENTALS OF FUZZY LOGIC:

Basic concepts: fuzzy set theory- basic concept of crisp sets and fuzzy sets- complements-unionintersection- combination of operation- general aggregation operations- fuzzy relations-compatibility relations-orderings- morphisms- fuzzy relational equations-fuzzy set and systems

**Text book(s)**

1. Kliryvan- Fuzzy System & Fuzzy logic Prentice Hall of India, First Edition.
2. Lawrence Fussett- fundamental of Neural network Prentice Hall, First Edition.

**Reference Books:**

1. Bart Kosko, ―Neural network and Fuzzy System‖ - Prentice Hall-1994.
2. J.Klin and T.A.Folger, ―Fuzzy sets‖ University and information- Prentice Hall -1996.
3. J.M.Zurada, ―Introduction to artificial neural systems‖-Jaico Publication house,Delhi 1994.
4. VallusuRao and HayagvnaRao , ―C++ Neural network and fuzzy logic‖-BPB and Publication, New Delhi,1996. 5. Intelligent Systems and Control-http://nptel.ac.in/courses/108104049/16

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**EI-704 DIGITAL DESIGN USING VHDL/VERILOG**

**Departmental Laboratory**

## PART – A PROGRAMMING (using VHDL and Verilog)

1. Write Verilog code to realize all the gates.

2. Write a Verilog program for the following combinationaldesigns a). 2 to 4decoder
   b). 8 to 3 (encoder without priority & with priority) c). 8 to 1 multiplexer
   d). 4 bit binary to grayconverter
   e). Multiplexer, de-multiplexer,comparator.

3 Write a HDL code to describe the functions of a full adder using three modeling styles

4 Develop theVerilog code for the following flip-flops SR, D, JK &T.

5 Design 4 bit binary, BCD counters (Synchronous reset and asynchronous reset) and "any sequence"counters

**PART – B: INTERFACING**

1. Write HDL code to display messages on an alpha numeric LCD display.

2. Write HDL code to interface Hex key pad and display the key code on seven segment display.

3. Write HDL code to control speed, direction of DC and stepper motor.

4. Write HDL code to accept 8 channel analog signal, Temperature sensors and display the data on LC panel or seven segment display

5. Write HDL code to generate different waveforms (Sine, Square, Triangle, Ramp etc.,) using DAC change the frequency and amplitude.

6. Write HDL code to simulate Elevator operation

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**EI 705 ANDROID APPLICATION DEVELOPMENT**

## Open Elective Laboratory

**List of Experiments:**

1. Introduction to Android Operating System
2. Program for First Android Application.
3. Program for building a simple user interface using a XML for UI layout.
4. Program for developing an Android Application using a linear layout.
5. Program for developing an Android Application using a Relative layout.
6. Program for developing an Android Application using a Table layout.
7. Program for developing an Android Application using a Absolute layout.
8. Program for developing an Android Application using a Frame layout.
9. Developing an android application using Relative layout to display Date and time.