PROCESS AUTOMATION (404210)

Teaching Scheme:
Lectures: 4 Hrs/ Week

Examination Scheme:
In Semester Assessment:
Phase I : 30
End Semester Examination:
Phase II: 70

Course Objectives:

- To give the students a comprehension of Process Control Instrumentation Design.
- To give the students a comprehension of the relation between Instrumentation and controller design in industrial applications.
- To make the students able to analyze the control loops and to achieve the control actions with different Controllers

Course Outcomes:

After successfully completing the course students will be able to

- Describe process control principles.
- Solve issues related to efficient controller design.
- Understand Advance Process Automation Techniques.
- Utilize knowledge of PLC programming for Process Automation.
- Design GUI for process industry using LABVIEW Software.

Unit I : **Introduction** **8L**

Basic Principle of Process Automation, Block Diagram of process control. Process characteristics, Control system Parameters, Control system Evaluation, Evaluation Criteria, Analog and Digital Processing, Process Control Drawings, Comparison of Pneumatic & Electro pneumatic control system.

Unit II : **Process Controllers** **8L**

Controller modes, Electronic controllers, Pneumatic controllers, Hydraulic controllers, Realization of controllers using Operational amplifier circuits. Feed forward controller, Tuning of PID controllers: Ziegler Nichols Method, Frequency Response Method, Process reaction curve(PRC),Concept of adaptive and inferential control

Unit III : **Final Control Operation** **8L**

Signal conversion: Analog signals, Digital signals, Pneumatic signal, Actuators: Electrical actuators, Pneumatic actuators, Hydraulic actuators, Control element: Mechanical, Electrical, Fluid Valves, Principle of control valve, Characteristics of Valve, selection of control valve, Different types of control valves and their applications.

Unit IV : **Discrete state process control** **8L**

Definition, Characteristics of the system, Relay controllers and Ladder Diagram Elements & Examples, Programmable Logic controllers (PLCs): Functions of PLC, Advantages, Architecture, PLC Operation, Scan time, Types, selection of PLC, Interfacing Input and Output devices with PLC, Ladder Programming, and PLC based automated systems.

Unit V : **Advanced Process Automation Techniques** **8L**

Statistical Process Control, Fuzzy logic systems, Artificial Neural Network (ANN) based controllers, Model Predictive control, Linear Quadratic Gaussian control.
Instrumentation schemes for boiler, Heat exchanger, Distillation column control, Evaporator, Compressor.

Unit VI : **Computers in Instrumentation** **8L**

Direct digital control systems, Distributed control systems (DCS): Introduction, DCS flow sheet symbols, architecture of DCS controller, DCS communication, DCS supervisory computer tasks, Features and advantages of DCS. Supervisory control and Data acquisition (SCADA): SCADA introduction, elements of SCADA, Features of SCADA, and MTU- functions of MTU, RTU- Functions of RTU, and Applications of SCADA. Types of Recorders and their working, Introduction to Virtual Instrumentation (LABVIEW).

Text Books

1. Curtis Johnson, "Process Control Instrumentation Technology"; 8th Edition, Pearson Education.
2. George J Clir, Bo Youn, "Fuzzy Sets and Fuzzy Logic Theory and Applications", Prentice Hall of India Pvt. Ltd.
3. S.K Singh, "Industrial Instrumentation and Control", Third Edition, McGraw Hill companies.

Reference Books

1. K. Krishna Swamy, "Process Control"; New Age International Publishers.
2. K. Astram, T Haggland, "PID Controllers, Theory, Design and Tuning";2nd Edition, ISA
3. Andrews, Applied Instrumentation in Process Industries