

Process Automation [PA]

B.E. Sem. VII [INST]

EVALUATION SYSTEM

	Time	Marks
Theory Exam	3 Hrs.	100
Practical Exam	–	–
Practical & Oral Exam	–	25
Term Work	–	25

SYLLABUS

1. Automation Fundamentals

Automation and its importance, automation applications, expectations of automation.

Types of plant and control – categories in industry, open loop and close loop control functions, continuous processes, discrete processes, and mixed processes.

Automation hierarchy – large control system hierarchy, data quantity & quality and hierarchical control.

Control system architecture – evolution and current trends, comparison of different architectures.

2. Programmable Logic Controller

Hardware : Evolution of PLC, Definition, functions of PLC, Advantages, Architecture, working of PLC, Scan time, Types & Specifications. DI-DO-AI-AO examples and ratings, I/O modules, local and remote I/O expansion, special purpose modules, wiring diagrams of different I/O modules, communication modules. Memory & addressing- memory organization (system memory and application memory), I/O addressing, hardware to software interface.

Software : Development of Relay Logic Ladder Diagram, introduction to PLC Programming, programming devices, IEC standard PLC programming languages, LD programming- basic LD instructions, PLC Timers and Counters: Types and examples, data transfer & program control instructions, advanced PLC instructions, PID Control using PLC.

Case study : PLC selection and configuration for any one process applications.

3. Distributed Control System

Introduction to DCS – Evolution of DCS, DCS flow sheet symbols, architecture of DCS – controller, Input and output modules, communication module, data highway, local I/O bus, workstations, specifications of DCS.

Introduction to Hierarchical Control and memory: Task listing, Higher & Lower Computer level tasks.

Supervisory computer tasks and DCS configuration – Supervisory Computer functions, Control techniques, Supervisory Control Algorithm, DCS & Supervisory Computer displays, advanced control Strategies, Computer interface with DCS.

DCS – system integration with PLCs and computer: Man machine interface- sequencing, supervisory control, and integration with PLC, personal computers and direct I/O, serial linkages, network linkages, links between networks.

4. Database & Alarm Management

Database management, Historical Data use in logs, reports and trend displays, System Status Display, Process Reports, different types of logs and reports.

Philosophies of Alarm Management, Alarm reporting, types of alarms generated and acceptance of alarms.

5. Supervisory Control and Data Acquisition (SCADA)

SCADA introduction, brief history of SCADA, elements of SCADA. Features of SCADA , MTU- functions of MTU, RTU- Functions of RTU, Protocol Detail. SCADA as a real time system. Communications in SCADA- types & methods used, components, Protocol structure and Mediums used for communications. SCADA Development for any one typical application.

6. OPC, Historian, MES, Integration with enterprise system.

7. Safety Instrumented System (SIS)

Need for safety instrumentation- risk and risk reduction methods, hazards analysis. Process control systems and SIS. 7.2 Safety Integrity Levels (SIL) and availability. Introduction to the international functional safety standard IEC61508.

Reference :

1. Understanding Distributed Processor Systems for Control (*Samuel M. Herb*) ISA Publication.
2. Programmable Logic Controller (*Thomas Hughes*) ISA Publication.
3. SCADA supervisory control and data acquisition (*Stuart A. Boyer*) ISA Publication.
4. Safety Shutdown Systems (*Gruhn and Cheddie*) – ISA, 1998,
5. Distributed Computer Control for Industrial Automation (*Poppovik Bhatkar*) Dekkar Publication.
6. Computer Aided Process Control (*S.K.Singh*) Prentice Hall of India.
7. Computer Based Process Control (*Krishna Kant*) Prentice Hall of India
8. The Management of Control System: Justification and Technical Auditing (*N.E. Battikha*) ISA.
9. Introduction to Programmable Logic controller (*Gary Dunning*) Thomas Learning, edition, 2001.
10. Programmable Logic Controllers – Principles and Applications (*John. W.Webb Ronald A Reis*) Third edition, Prentice Hall Inc., New Jersey, 1995.
11. Instrument engineers handbook- Process control (*Bela G. Liptak*) Chilton book company- 3rd edition.
12. (*D.J. Smith & K.G.L. Simpson*)

