

IAGE - 317

Distributed Control System

(Process Automation)

(02 credits – 50 marks)

Course Outcomes:

On completion of the Course, students should be able to

1	Recall basics of automation , PLC, DSC and SCADA
2	Classify and compare types of plant and control, PLC and SCADA
3	Illustrate Control system architecture, Architecture and working of PLC, DCS architecture and specifications
4	Analyze the various systems of SCADA
5	Summarize advanced PLC instructions, integration of PLC and computer, integration of DCS and computer
6	Program DCS for control of remote process

Course Contents:

Module- 1: Automation Fundamentals

(07 Hrs)

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.

Module -II: Programmable Logic Controller

(07 Hrs)

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.

Module -III: Distributed Control System**(07 Hrs)**

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.

Module- IV: SCADA**(07 Hrs)**

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

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

Module-V: Tutorials, assignments and presentation based on Module I to IV

Reference:

1. Samuel M. Herb, "Understanding Distributed Processor Systems for Control", ISA Publication.
2. Thomas Hughes, "Programmable Logic Controller", ISA Publication.
3. Stuart A. Boyer, "SCADA supervisory control and data acquisition", ISA Publication.
4. Poppovik Bhatkar, "Distributed Computer Control for Industrial Automation", Dekkar Publication.
5. S.K.Singh, "Computer Aided Process Control", Prentice Hall of India.
6. Krishna Kant, "Computer Based Process Control", Prentice Hall of India
7. N.E. Battikha, "The Management of Control System: Justification and Technical Auditing", ISA.
8. Gary Dunning, "Introduction to Programmable Logic controller", Thomas Learning, edition, 2001.