



Training Program:

Advanced PLC (IEC61131) Programming

COURSE AIMS:

This course aims to enable the participant to:

- Identify and explain the main design characteristics, internal architecture and operating principles of programmable logic controllers.
- Describe and identify the characteristics of commonly used input and output devices.
- Explain the processing of inputs and outputs by PLCs.
- Describe communication links involved with PLC systems, the protocols and networking methods.
- Develop ladder programs for the logic functions AND, OR, NOR, NAND, NOT and XOR.
- Develop ladder programs involving internal relays, timers, counters, shift registers, sequencers and data handling.
- Develop functional block diagram, instruction list, structured text and sequential function chart programs.
- Identify safety issues with PLC systems.
- Identify methods used for fault diagnosis, testing and debugging.

COURSE OBJECTIVES:

Technological advances in recent years have resulted in the development of the programmable logic controller and a consequential revolution of control engineering. This course is an introduction to programmable logic controllers and aims to ease the tasks of practicing engineers coming first into contact with programmable logic controllers, and as an introduction for first year undergraduate courses in engineering. The course addresses the problem of different programmable control manufacturers using different nomenclature and program forms by describing the principles involved and illustrating them with examples from a range of manufacturers. **The text includes:**

- The basic architecture of PLCs and the characteristics of commonly used input and outputs to such systems.
- A discussion of the number systems: denary, binary, octal, hexadecimal and BCD.
- A painstaking methodical introduction, with lots of illustrations, of how to program PLCs, whatever the manufacturer, and make use of internal relays, timers, counters, shift registers, sequencers and data handling facilities.
- Consideration of the standards given by IEC 1131-3 and the programming methods of ladder, functional block diagram, instruction list, structured text and sequential function chart.
- To assist the participants to develop the skills necessary to write programs for programmable logic controllers, many worked examples, multi-choice questions and problems are included in the course with answers to all multi-choice questions and problems given at the end of the course.

COURSE OUTLINE:

❖ Programmable logic controllers

- Controllers
- Hardware
- Internal architecture
- PLC systems
- Problems

❖ Input-output devices

- Input devices
- Output devices
- Examples of applications
- Problems

- ❖ Number systems

- The binary system
- Octal and hexadecimal
- Binary arithmetic
- PLC data
- Problems

- ❖ I/O processing

- Input/output units
- Signal conditioning
- Remote connections
- Networks
- Processing inputs
- I/O addresses
- Problems

- ❖ Ladder and functional block programming

- Ladder diagrams
- Logic functions
- Latching
- Multiple outputs
- Entering programs
- Function blocks

- Program examples
- Problems

- ❖ IL, SFC and ST programming methods

- Instruction lists
- Sequential function charts
- Structured text
- Problems

- ❖ Internal relays

- Internal relays
- Ladder programs
- Battery-backed relays
- One-shot operation
- Set and reset
- Master control relay
- Problems

- ❖ Jump and call

- Jump
- Subroutines
- Problems

- ❖ Timers

- Types of timers
- Programming timers
- Off-delay timers
- Pulse timers

- Programming examples
- Problems

- ❖ Counters

- Forms of counter
- Programming
- Up and down counting
- Timers with counters
- Sequencer
- Problems

- ❖ Shift registers

- Shift registers
- Ladder programs
- Problems

- ❖ Data handling

- Registers and bits
- Data handling
- Arithmetic functions
- Closed loop control
- Problems

- ❖ Designing systems

- Program development
- Safe systems
- Commissioning
- Fault finding

- System documentation
- Problems
- ❖ Programs
- Temperature control
- Valve sequencing
- Conveyor belt control
- Control of a process
- Problems