Institute Level Open Elective (IOC)

[IOC-21001] Programmable Logic Controllers and Its Applications

Teaching Scheme

Lectures: 3 Hrs/week

Examination Scheme

T1 and T2: 20 Marks each
End-Sem Exam: 60 Marks

Course Description:

This course develops functional design, hardware configuration, programming and application of Programmable Logic Controllers (PLC). The design and programming of control circuits using examples from industrial applications will be emphasized.

Course Outcomes:

- **Explain** the generic architecture and constituent components of a Programmable Logic Controller.
- **Develop** a ladder logic program using modern engineering software tools and technique for analog and discrete control.
- **Apply** knowledge gained about PLCs to real-time industrial applications.
- **Select** proper PLC configuration, analog and discrete input-output devices, communication protocols for industrial control.

Course Contents

Unit I **(7 hrs)**

Introduction to PLC: Definition and Evolution of PLC, PLC Architecture, PLC Input and Output modules, central processing unit, CPUs and Programmer/monitors, Solid state memory, the processor, Input modules (Interfaces), Power supplies, PLC classifications and their general specifications, selection criteria for PLC.

Unit II **(8 hrs)**

Programming of PLC: Fundamentals of PLC ladder diagram, Basic components and their symbols in ladder diagram, Boolean logic and relay logic, Analog and discrete Input-output (I/O) devices, Programming instructions set, Timer and counter types along with wave form, shift registers, sequencer function, latch instruction; Arithmetic and logical instruction with various examples.

Unit III **(8 hrs)**

Advanced PLC Function, Analog PLC operation, PID control of continuous processes, PLC interface, and developing ladder logic for sequencing of motors, tank level control, ON-OFF temperature control, elevator, bottle filling plant and car parking. Motors Controls: AC Motor starter, AC motor overload protection, DC motor controller, Variable speed (Variable Frequency) AC motor Drive.

Unit IV **(7 hrs)**

Overview of Open systems interconnection (OSI) Model, Functions of OSI Model Layers, OSI Protocols, Functions of Transmission control protocol / Internet protocol (TCP/IP) Layers, TCP/IP protocol, DNP3 protocol, IEC61850 layered architecture, Control and Information Protocol (CIP), DeviceNet, ControlNet, EtherNet/IP, Flexible Function Block process (FFB), Process Field bus (Profibus).

Text Books

- Computer-based Industrial Controls by Krishan Kant, 2nd edition, PHI India, New Delhi, 2004.
- Computer Control of Process by M. Chidambaram, 1st edition, Narosha Publishing. 2005.
- Introduction to Programmable controller by Garry Dunning, 2nd Edition, Thomson Asia, Pte, Ltd, Singapore, 2002.
- Programmable Logic Controllers Programming Methods and Applications by John R. Hackworth, Frederick D., Hackworth Jr., 3rd edition, Pearson Education, 2005.
- Programmable Logic Controllers with Applications by P. K. Srivstava, BPB Publications, 1 st edition, 2001.
- Programmable Controllers Theory and Implementation by L. A. Bryan, E. A. Bryan, Industrial Text Company Publication, 2nd edition, 1998.

Reference Books

- Distributed Computer Control for Industrial Automation by D. Popovic and Vijay Bhatkar, 1st edition, Marcel Dekker Inc., 1998.
- Programmable Logic Controllers: Principles and Application by John W. Webb, Ronald A. Reis, 5 th Edition, McGraw Hill Inc., 2006.
- Securing SCADA System by Ronald L. Krutz, 1st edition, Wiley Publishing, 2007.
- Programmable Controllers by Batten G. L., 2nd Edition, McGraw Hill Inc., 2004.
- Instruments Engineers Handbook Process Control ,VoL-II by Bela G. Liptak, CRC Press, 4 th edition, 2006.