MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

Industrial Automation (ICE 3252)

Introduction

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Syllabus

Hours/ week: 4L **Number of credits: 4**

Computers in Process Control: Data loggers, Data Acquisition Systems (DAS), Direct Digital Control (DDC). Supervisory Control and Data Acquisition Systems (SCADA), sampling considerations. **(03 hrs)**

Programmable Logic Controller (PLC): Definition, overview of PLC systems, PLC architecture, input/output modules, power supplies and isolators. **(03 hrs)**

Ladder logic Programming: General PLC programming procedures, programming on-off inputs/ outputs. Auxiliary commands and functions, PLC Basic Functions, register basics, timer functions, counter functions. Arithmetic functions, number comparison functions, Skip and MCR functions, data move systems. PLC Advanced intermediate functions: Utilizing digital bits, sequencer functions, matrix functions. PLC-PID functions, PLC Advanced functions, analog PLC operation. **(14 hrs)**

Alternate Programming Languages: General programming procedures to construct Instruction List (IL), Structured Text (ST), Sequential Flow Chart (SFC), Functional Block Diagrams (FBD). Basic Instructions of alternate programming languages. Problems on alternate programming languages. **(07 hrs)**

PLC Maintenance: networking of PLC, PLC installation, troubleshooting and maintenance, wiring of sensors and output devices to the PLC**. (02 hrs)**

Interface and Backplane Bus Standards for Instrumentation Systems: Communication Hierarchy- Communication System Requirements. - Network Topologies -Protocol -Functions of Various Layers, Field bus: Introduction, concept. HART protocol: Method of operation, structure, operating conditions and applications. Smart transmitters, smart valves and smart actuators. MOD bus: Transmission mode, General message form, Data types, Data addressing, cyclic redundancy check calculation. Profibus: Communication Profiles, Physical Profiles, Application Profiles, Protocol Architecture, IEC 1158-2 Transmission Technology. **(10 hrs)**

Distributed Control Systems (DCS): Definition, configuration of DCS, Local Control Unit (LCU) architecture, LCU languages, LCU – Process interfacing issues, redundancy concept. **(04 hrs)**

Operator interfaces: Low level and high level operator interfaces – Displays – Engineering interfaces – Low level and high level engineering interfaces – Factors to be considered in selecting DCS – Case studies in DCS. **(05 hrs)**

References:

1. John. W. Webb Ronald A Reis, *Programmable Logic Controllers - Principles and Applications*, PHI, (4e). 1998.

2. Lukcas M.P, *Distributed Control Systems*, Van Nostrand Reinhold Co., 1986.

3. Frank D. Petruzella, *Programmable Logic Controllers,* MGH, (2e), 1997.

4. Liptak, B.G., *Instrument engineers' handbook, volume two: Process control and optimization*, CRC press, 2018.

	At the end of this course, the student should be able to:	No. of Contact Hours	Marks
CO1:	Review the computer based control and PLC architecture and maintainance.	8	16
CO2:	Analyse the function blocks of PLC programming.	6	12
CO3:	Develop PLC programmes using different programming methods.	15	30
CO4:	Comprehend the structure and working of various types of communication protocols used in automation domain.	10	22
CO5:	Understand the architecture interface concepts of DCS	9	20
	Total	48	100

Pre-requisites:

- Knowledge of Control system elements.
- Knowledge of closed loop control system.
- Basics of data acquisition systems
- Basics of communication

Assessment..

- Continuous Assessment - 20Marks
- Internal assessment - 30 Marks
- End semester exam - 50 Marks.
- Total: 100 Marks

- Minimum 18 in the end sem to clear the course

- Attendance : 75%