NIRMA UNIVERSITY

Institute:	Institute of Technology
Name of Programme:	BTech in Electronics and Instrumentation Engineering
Semester:	VI
Course Code:	3EI106CC24
Course Title:	Process Automation
Course Type:	Core
Year of Introduction:	2024-25

L	T	Practical component				C
		LPW	PW	W	S	
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Course Learning Outcomes (CLOs):

At the end of the course, the students will be able to –
1. discuss the fundamentals of programmable logic controller **(BL2)**
2. design program using standard programming languages **(BL3)**
3. illustrate the SCADA, HMI, DCS and industrial networking **(BL3)**
4. develop an application-orientated project using PLC. **(BL4)**

Contents	**Teaching hours (Total 45)**
Unit-I **Introduction** Process automation, history of automation, application area of PLC, HMI, SCADA and DCS.	02
Unit-II **Programmable logic controller** Introduction, Importance of PLC, type of PLC's and basic architecture of CPU, Different modules of PLC, Programming standards, software tools for PLC Programming, IEC standards for Programming language of PLC., Advanced Ladder programming, Instructions set of PLC.	08
Unit-III **Advanced programming languages** Programming of PLC using structured text, Instruction list, function block diagram, Sequential Flow chart.	12
Unit-IV **Human machine interface** Introduction of HMI, Screens Design, Mapping of Variables, Software tools for HMI design, Case studies.	05
Unit-V **Supervisory control & data acquisition** Introduction of SCADA, Selection criteria of SCADA, Hardware selection for SCADA, Communication protocols, DNP3, MODBUS, Profibus, Industrial Ethernet overview, TCP/IP overview.	12
Unit-VI **Distributed control system** Evolution of DCS, Design and specification architecture, merits and demerits, Direct digital control, supervisory control and distributed digital control system, Evolution of hierarchical system structure.	06

Self Study:
The self -study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

Laboratory Work:
Laboratory Work will consist of minimum 10 experiments based on the above syllabus.

Suggested Reading:

1. Programmable Logic Controllers, Frank Petruzzula, Tata Mc-Graw Hill
2. Programmable Logic Controllers Principles and Applications, John W. Webb, Ronald A. Reis, Prentice Hall of India publications
3. SCADA: Supervisory control and data acquisition system, Stuart A. Boyer,, ISA Publication
4. Securing SCADA system, Ronald L Krutz, Wiley Publication

Suggested List of Experiments:

1.	Understand the basics of sensors and actuators for process automation.	**(02 Hrs)**
2.	Overview and demonstration of IEC standards programming languages for PLC.	**(02 Hrs)**
3.	Introduction of the IQR/FX/Q series PLC.	**(02 Hrs)**
4.	Programming of PLC using ladder language.	**(02 Hrs)**
5.	Programming of PLC using Functional Block Diagram (FBD) language.	**(02 Hrs)**
6.	Programming of PLC using Structure Text (ST) language.	**(02 Hrs)**
7.	Programming of PLC using Sequential Function Chart (SFC) language.	**(02 Hrs)**
8.	Understand the basics of HMI and its programming.	**(02 Hrs)**
9.	Interfacing of PLC and HMI	**(04 Hrs)**
10.	Understand the concept of SCADA.	**(04 Hrs)**

L = Lecture, T = Tutorial, P = Practical, C = Credit