NIRMA UNIVERSITY

Institute:	Institute of Technology
Name of Programme:	B. Tech in Electronics and Instrumentation Engineering
Course Code:	2EI701
Course Title:	Process Automation
Course Type:	([√] Core/ [] Value Added Course/[] Departmental Elective/ [] Institute Elective/[]University Elective/[]Any other)
Year of introduction:	2021-2022

Credit Scheme					
L	T	Practical component			C
		LPW	PW	W	S
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Course Learning Outcomes (CLO):

At the end of the course, students will be able to –

1. discuss the fundamentals of programmable logic controller
2. design program using standards programming languages
3. illustrate the SCADA, HMI, DCS and industrial networking
4. develop an application orientated project using PLC

Syllabus: **Total Teaching hours: 45**

Unit	Syllabus	Teaching hours
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., Ladder programming, Instructions set of PLC.	10

Unit III	**Advanced Programming Languages**	10

Programming of PLC using structured text, Instruction list, Function block diagram, Sequential Flow chart

Unit IV	**Human Machine Interface**	05

Introduction of HMI, Screens Design, Mapping of Variables, Software tools for HMI design, Case studies

Unit V	**Supervisory Control & Data Acquisition**	12

Introduction of SCADA, Selection criteria of SCADA, Hardware selection for SCADA, Communication protocols, DNP3, MODBUS, Profibus, Industrial Ethernet overview, TCP/IP overview.

Unit VI	**Distributed Control System**	06

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.

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 List of Experiments:

1. Understand the basic of sensors and actuators for process automation.
2. Overview and demonstration of IEC standards programming languages for PLC.
3. Introduction of the IQR/FX/Q series PLC.
4. Programming of PLC using ladder language.
5. Programming of PLC using Functional Block Diagram (FBD) language.
6. Programming of PLC using Structure Text (ST) language.
7. Programming of PLC using Sequential Function Chart (SFC) language.
8. Understand the basic of HMI and its programing.
9. Interfacing of PLC and HMI
10. Understand the concept of SCADA.
11. Design any small-scale application using PLC
12. Design industrial standards HMI screen for small-scale application

Suggested Readings/ References:	1. Frank D. Petruzella, Programmable logic controller, Tata-McGraw Hill publication
	2. John W. Webb and Ronald A. Reis, Programmable Logic Controllers: Principles and Applications, PHI Publication
	3. W. Boltan, Programmable Logic Controllers, Elsevier Publication
	4. John R. Hackworth and Frederick D. Hackworth Jr., Programmable Logic Controllers Programming methods and application, Pearson Publication
	5. Stuart A. Boyer, SCADA: Supervisory control and data acquisition system, ISA Publication
	6. Ronald L Krutz, Securing SCADA system, Wiley Publication
	7. Bela G. Liptak, Instrument Engineers' Handbook: Process Software and Digital Networks, CRC Press
	8. Steve Mackay, Edwin Wright, Deon Reynders, and John Park, Practical Industrial Data Networks: Design, Installation and Troubleshooting, Elsevier Publication

Suggested Case List: --

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

w.e.f. academic year 2024-25 and onwards.