COURSE HANDOUT

Automation with PLC and SCADA (ECE-403)

ECE-4th SEMESTER

ACADEMIC YEAR (2023-24)

Mr. Bhanu Pratap Singh Jamwal

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Department of Electronics and Communication

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Course Code	Course Name	Course Type	Cd	L	T	P	Marks		
							Sessional	Final Exam	Total
ECE-403	Automation with PLC and SCADA	PCC	4	3	1	0	50	100	150
Faculty Details	bhau.ee@mietjammu.in								

Section-A

Unit 1: Programmable Logic Controllers (PLCs): Introduction; definition & history of the PLC; Need of automations in industries; Principle of operation; various components of PLC: CPU & programmer/ monitors; PLC input & output modules; the processor; power supplies, PLC wiring. PLC advantages & disadvantages; PLC versus Computers, PLC Applications. Programming equipment; proper construction of PLC ladder diagrams; process scanning consideration, Introduction to PLC Trainer Device and PLC Software, Fundamental Commands of PLC

(08 Hrs)

Unit 2: PLC Hardware Components: The I/O section, Discrete I/O Modules, Analog I/O Modules, Special I/O Modules, I/O specifications, sourcing and sinking concept. CPU, Memory Types, Programming Devices. Fundamentals of Logic: The Binary Concept, AND, OR and NOT functions, Boolean Algebra, Developing circuits from Boolean expressions, Producing the Boolean equation from given circuits, Hardwired logic versus programmed logic, Programming word level logic instructions. Converting Relay schematics and Boolean equations into PLC Ladder Programs, Writing a ladder logic program directly from a narrative description.

(12 Hrs)

Unit 3: Programming Timers, Mechanical Timing relay, Timer instructions, ON delay timer instruction, Off-delay timer instruction, Retentive Timer, Cascading Timers, examples of timer function industrial application; industrial process timing application. PLC Networking: Introduction, Levels of Industrial Control, Types of Networking, Network communications. Analog PLC Operation, Analog PLC Application Examples
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(08 Hrs)

Section-B

Unit 4: Programming Counters: Up-counter, down counter, Up-Down counter, Cascading counters, Incremental encoder counter applications, combining counter and timer functions, examples of counter function with industrial application, Cascading of Timers and Counters. Various Brands of PLCs and their evaluation. Overview of Siemens PLC, Allen Bradley PLC, Schneider electric PLC, Omron PLC, Mitsubishi PLC. Comparison of various instructions.

(10 Hrs)

Unit 5: PLC Networking Introduction, Levels of Industrial Control, Types of Networking, Network communications. Analog PLC Operation, Types of Analog PLCs, PLC Analog Signal Processing, PLC Analog Application Examples. SCADA: Introduction, Fundamental Principles of Modern SCADA System, Advantages and Disadvantages, SCADA Hardware and Software, Remote Terminal Unit (RTU), Local Area Network & Modems, Emerging New Technologies in SCADA System.

(10 Hrs)

Text Books

S.No.	Name of the Books	Author	Publisher Name	Edition (Pub. yr.)
1	Introduction to Programmable Logic Controllers	Gary Dunning	Thomson	2nd (2002)
2	Programmable Logic Controllers: Principles and Application	John W. Webb, Ronald A. Reis	PHI Learning, New Delhi	5th (2002)
3	SCADA supervisory control and data acquisition	Stuart A Boyer	ISA	4th (2016)

Reference Books

S.No.	Name of the Books	Author	Publisher Name	Edition (Pub. Yr.)
1	Programmable Controllers Theory and Implementation	L.A. Bryan, E. A. Bryan	Industrial Text Company Publication	2nd (1998)
2	Programmable Logic Controllers	W. Bolton	Elsevier	5th (2009)

COURSE PLAN		
Unit-I Programmable Logic Controllers		
S.No	**Topics**	**Recommended Books**
1	Introduction; Definition & history of the PLC; Need of automations in industries	Book 1, Ch.1
2	Principle of operation; Various components of PLC: CPU & programmer/ monitors; PLC input & output modules	Book 1, Ch.1
3	The processor; power supplies, PLC wiring. PLC advantages & disadvantages;	Book 1, Ch.1
4	PLC versus Computers, PLC Applications. Programming equipment	Book 1, Ch.2
6	Proper construction of PLC ladder diagrams; process scanning consideration,	Book 1, Ch.2
7	Introduction to PLC Trainer Device and PLC Software, Fundamental Commands of PLC	Book 1, Ch.2
Unit-II PLC Hardware Components		
8	The I/O section, Digital I/O Modules, Analog I/O Modules	Book 1, Ch.2
9	Special I/O Modules, I/O specifications, sourcing and sinking concept.	Book 1, Ch.2
10	CPU, Memory Types, Programming Devices.	Book 1, Ch.3
11	Fundamentals of Logic: The Binary Concept, AND, OR and NOT functions, Boolean Algebra, Developing circuits from Boolean expressions	Book 1, Ch.5
12	Producing the Boolean equation from given circuits, Hardwired logic versus programmed logic,	Book 1, Ch.5
13	Programming word level logic instructions. Converting Relay schematics and Boolean equations into PLC Ladder Programs	Book 1, Ch.5
14	Writing a ladder logic program directly from a narrative description.	Book 1, Ch.5
Unit-III Programming Timers		
15	Mechanical Timing relay, Timer instructions	Book 2, Ch.4
16	ON delay timer instruction, Off-delay timer instruction,	Book 2, Ch.4
17	Retentive Timer, Cascading Timers, examples of timer function industrial application; industrial process timing application.	Book 2, Ch.4
18	PLC Networking: Introduction, Levels of Industrial Control, Types of Networking, Network communications. Analog PLC Operation, Analog PLC Application Examples	Book 2, Ch.4
19	Types of Networking, Network communications.	Book 2, Ch.4

20	Analog PLC Operation, Analog PLC Application Examples	Book 2, Ch.4
Unit-IV Programming Counters		
22	Up-counter, down counter, Up-Down counter	Book 2, Ch.5
23	Cascading counters, Incremental encoder counter applications	Book 2, Ch.5
24	Combining counter and timer functions, examples of counter function with industrial application	Book 2, Ch.5
25	Cascading of Timers and Counters.	Book 2, Ch.5
26	Various Brands of PLCs and their evaluation.	https://www.pekoprecision.com/blog/most-popular-plc-brands/
27	Overview of Siemens PLC, Allen Bradley PLC, Schneider electric PLC, Omron PLC, Mitsubishi PLC.	https://plcynergy.com/plc-brands/
28	Comparison of various instructions.	Book 1, Ch.8
Unit-V PLC Networking		
29	Levels of Industrial Control, Types of Networking, Network communications.	Book 2, Ch.6
30	Analog PLC Operation, Types of Analog PLCs	Book 2, Ch.6
31	PLC Analog Signal Processing, PLC Analog Application Examples.	Book 2, Ch.6
32	SCADA: Introduction, Fundamental Principles of Modern SCADA System	Book 3, Ch.1
33	Advantages and Disadvantages, SCADA Hardware and Software	Book 3, Ch.1
34	Remote Terminal Unit (RTU), Local Area Network & Modems,	Book3, Ch. 3
35	Emerging New Technologies in SCADA System.	https://www.parasyn.com.au/article/next-generation-scada-systems/

ADDITIONAL WEB RESOURCES

1.	**MOOC:** Industrial Automation with PLC & SCADA https://nielit.gov.in/calicut/content/online-course-industrial-automation-plc-scada
2.	**NPTEL:** Video lectures on "Industrial Automation and Control" Lecture series by Prof. S Mukhopadhyay Department of Electrical Engineering, IIT Khargpur https://onlinecourses.nptel.ac.in/noc21_me67/preview

GRADING AND ASSESSMENT

- **Sessional Test**: 20 marks
- **Assignment**: 20 marks
- **Attendance**: 10 marks
- **Final Examination**: 100 marks

COURSE POLICIES

- **Attendance**: Minimum 75% attendance is mandatory to appear in the final examination of the course.
- **Academic Integrity**: MIET's academic integrity policies apply. Plagiarism will not be tolerated.
- **Late Submissions**: Assignments and projects must be submitted by the specified timelines.

FACULTY INFORMATION

- **Office Hours**

  Monday (12:05 PM - 12:55 PM)
  Friday (12:05 PM - 12:55 PM)

- **Contact Information**
  bhanu,ee@mietjammu.in