



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Diploma Engineering

Level: Diploma

Branch: Power Electronics

Subject Code: DI04024061

Subject Name: Industrial Automation

W. E. F. Academic Year:	2025-26
Semester:	4 th
Category of the Course:	Professional Elective - I

Prerequisite:	Fundamental knowledge of Digital Electronics and Computer
Rationale:	Industrial Automation has become an essential pillar of modern manufacturing and industrial operations. With industries continually adopting advanced technologies to enhance productivity, quality, and safety, engineers must possess a strong foundational understanding of automated systems. In today's competitive world, manufacturing units increasingly rely on programmable systems such as PLCs, SCADA, robotics, sensors, actuators, and industrial communication networks to achieve precision, consistency, and real-time monitoring.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
01	Explain the concept of Automation.	R, U
02	Explain working of PLC.	R, U
03	Develop Ladder Program for various Logical Conditions.	A
04	Explain the fundamentals of Robotics.	R, U, A
05	Explain Communication and Networking recommended for Automation.	R, U

*Revised Bloom's Taxonomy (RBT)

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Tutorial / Practical		
				ESE(E)	PA(M)	PA(I)	ESE(V)	
3	0	2	4	70	30	20	30	150



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Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	Introduction to Automation Automation: Definition, Mechanization vs Automation, Advantages, Goals, Social Issues, Low-Cost Automation, Types of Automation, Current Emphasis, Reasons for Automation, Reasons for No Automation, Issues for Automation in Factory Operations, Strategies for Automation.	06	17
2.	Introduction to PLC PLC: Introduction, History, Definition, Classification, Advantages, Characteristics, Operation, Block Diagram and functions, Programming Languages, Selection Criteria, PLC v/s Relay Control, PC v/s PLC, commercially available PLC Brands, Delta EX2 Series; Parameters. I/O module: Classification, Parallel I/O System, Serial I/O System. Sinking and Sourcing in PLC Interfacing.	08	20
3.	Basic Ladder Programming Ladder diagram: Rules for PLC ladder diagrams, Logic Gates Diagram, Combinational circuit Diagram with the help of Truth Table and Equation, Logical Equation and statement-based diagram, Programming using Latching- Unlatching and Interlock Concept.	13	30
4.	Robotics: History, Definition, Industrial Robot, Laws of Robotics, Motivating Factors, Advantages and Disadvantages of Robots, Characteristics of an Industrial Robot, Components of an Industrial Robot, Comparison of the Human and Robot Manipulator, Robot Wrist and End of Arm Tools, Robot Terminology, Robotic Joints, Classification; On the Basis of Co-Ordinate Systems, Power Source, Method of Control, Programming Method. Robot: Selection, Work cell, Machine Vision, Robotics and Machine Vision, Accidents and Safety.	13	21
5.	Communications Communication interface: Simplex, Half duplex, Full duplex, RS 232- DB-25 connector, DB-9 connector, RS 422, EIA 485 interface. Industrial network: Bus topology, Ring topology, Star topology, Tree topology.	05	12
	Total	45	100 %



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Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (in %)					
R Level	U Level	A Level	N Level	E Level	C Level
20	40	40	0	0	0

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:

(a) Books:

S. No.	Title of Book	Author	Publication with place, year and ISBN
1	Industrial Automation and Robotics	A. K. Gupta/S. K. Arora/J. R. Westcott.	Laxmi Publications Pvt. Ltd. ISBN: 978-1-938549-30-4
2	DVP-ES2 / EX2 / EC5 / SS2 / SA2 / SX2 / SE & TP Operation Manual - Programming	Delta Electronics, Inc	Delta Electronics, Inc DVP-0139720-14 2023/02/10
3	Programmable Logic Controllers	W. Bolton	Elsevier Ltd. Sixth edition 2015 ISBN 978-0-12-802929-9
4	Programmable Logic Controllers, Hardware and Programming	Max Rabiee	The Good Heart-Willcox Company, Inc, Fourth Edition, 2018 ISBN 978-1-63126-932-5
5	Programmable Logic Controllers and Industrial Automation an Introduction	Mitra Madhuchanda Gupta Samarjit Sen	Param International Publishing (India) Pvt. Ltd., New Delhi. ISBN 978-81-87972-17-4

(b) Open-source software and website:

1. https://www.youtube.com/watch?v=x3MUGVKWXdw&list=PLWF9TXck7O_xtginyRk5DMGHN0cHKAcu
2. <https://www.youtube.com/watch?v=8GedzJwfhjQ>
3. <https://www.electrical4u.com/programmable-logic-controllers/>
4. <https://dipslab.com/plc-input-output-modules-2/>
5. <https://instrumentationtools.com/basics-of-plc-programming/>



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6. <https://automationforum.co/plc-learning-series-8-rules-for-ladder-diagram-programming/#:~:text=PLC%20learning%20series%205%3A%208%20Rules%20for%20ladder,address%20can%20be%20used%20as%20inputs%20address%3A%20>
7. <https://dipslab.com/rules-plc-ladder-diagram-programming/>
8. <https://www.youtube.com/playlist?list=PL0SiuA-KTuIHFufeksUIsLnk4FzSa4OSN>
9. <https://www.youtube.com/watch?v=gairfgMphLg&list=PL0SiuA-KTuIHIGEQu22BuobWv4VjBu9hq>
10. https://www.youtube.com/watch?v=ETIR_YVqBc0&list=PLjwh8WIIwKDhcB9eFIWra67bL32E8dGeS
11. <https://www.youtube.com/watch?v=copaO5k7sDo&list=PLB0MB4KNytIvB8gSiTzM7yY-N2ej4b776>
12. https://www.youtube.com/watch?v=EJXaB_tZ5XA

Suggested Course Practical List:

S. No.	Practical Outcomes (PrOs)
1	To study scope of Industrial automation in Future with current scenario.
2	To study hardware and software associated with PLC
3	Execute/Prepare ladder diagram of AND, OR, NOT, NAND, NOR, X-OR, X-NOR gate
4	Execute/Prepare ladder diagram for Half-Full Adder and Subtractor.
5	Execute/Prepare ladder diagram for any Three combinational circuits.
6	Execute/Prepare ladder diagram for any Three logical equations.
7	Execute/Prepare ladder diagram for any Three statement-based problems.
8	Execute/Prepare ladder diagram for any Three problems based on latching-unlatching and interlock concept.
9	Develop ladder diagram for a temperature, level, flow control system
10	Execute/Prepare allover ladder diagram for industrial process and control.
11	To study characteristics of Industrial Robot.
12	Test the performance of 4 Axis/5 Axis Robot.
13	Test the performance of Robot in Pick & Place/Sorting/Color Matching Application.
14	To study robotic selection and safety criteria for Industrial Robot.
15	Interface personal computers in network using different topology.
16	Study Interface of RS232, RS 422, and EIA 485 communication standards for interface in automation.



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List of Laboratory/Learning Resources Required:

S. No.	Equipment Name with Broad Specifications
1.	PLC Trainer Kit PLC: Delta DVP EX2 Series Analog MPU (100 -240VAC), 8 Digital Input: 24VDC, 5mA 6 Digital Output: (< 250VAC, 30VDC), 4 Analog Input: (-10 ~ + 10 V , -20 ~ + 20 Ma) Analog Output: (-10 ~ + 10 V , -20 ~ + 20 Ma), Com Port: Built-in 1 RS-232 and 2 RS-485 ports; Compatible with Modbus ASCII/RTU protocol,
2.	Different types of application Modules: Traffic Light Module, Vehicle Parking Module, Elevator Lift Module, Washing Machine Control Module, Bottle Filler Control Module, Packing Module, Level & Pump Control Module, Fan Control Module, Star/Delta Starter Control Module, Safety Door Control Module, Conveyor Belt Control Module, Stepper Motor Module, DC Motor Control Module
3.	4 Axis/5 Axis Robotic Arm
4.	Robot Work Cell.

Suggested Project List:

1. Make any one working module for commercial application to interface with PLC.
2. Develop a small application that contain at least 01 sensor, 01 switch and 01 output controllable device to perform automation.

Suggested Activities for Students:

1. Compare and analyze any Two Unitary PLC and Any Two Modular PLC Datasheets.
2. List field applications of Automation in Industry with Automation Components.
3. Case study of Industrial Automation with PLC, DCS, SCADA, Robot.
4. Prepare Hazard Analysis report for various materials being generated as Waste in Industrial Automation Fields.

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