



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Diploma Engineering

Level: Diploma

Branch: Power Electronics Engineering

Subject Code: DI04024051

Subject Name: Industrial Programmable Logic Controller

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:	PLCs are designed to improve efficiency and productivity in industrial processes. By understanding PLC programming, you can optimize control systems, reduce downtime, and improve overall operational performance. PLCs are widely used in various industries, such as manufacturing, energy, and process control. As industries continue to automate their operations, the demand for professionals with PLC programming skills is increasing. Overall, a learning of PLC course provides you with valuable skills and knowledge in industrial automation, making you a sought-after professional in a variety of industries.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
01	Explain working of PLC.	R, U
02	Select appropriate Input-Output Modules.	R, U
03	Develop Ladder Program for various Logical Conditions.	A
04	Develop Ladder Program for Timers, Counters, Comparison Functions and Mathematical Functions.	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 PLC PLC: Introduction, History, Definition, Classification, Advantages, Characteristics, Operation, Block Diagram and functions, Scan Method, Programming Languages, Selection Criteria, PLC v/s Relay Control, PC v/s PLC, Applications, IEC Standards, commercially available PLC Brands, Delta EX2 Series; Parameters	08	17
2.	Input / Output Modules I/O module: Classification, Parallel I/O System, Serial I/O System. Sinking and Sourcing in PLC Interfacing. Discrete input modules: DC input, AC input, Rectifier with filter, Isolation, logic section Spoliations. Discrete output modules: operating principles, Specifications. Advantages and disadvantages of Output Modules. Analog input modules: single ended, differential input, specifications. Special I/O Modules; Parameters.	07	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.	10	30
4.	Special Function Programming Timers: Classification, Characteristics, Function in PLC, Ladder diagram using timer. Counter: Classification, Characteristics, Ladder diagram using counter. Ladder Programs using Comparison Function: Equal, Not Equal, Less Than, Less Than or Equal, Greater Than, Greater Than or Equal. Ladder Programs using Mathematical Function: Addition, Subtraction, Multiplication, Division.	12	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	20	60	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	Programmable Logic Controllers	Frank D. Petruzella	McGraw-Hill Education, 2017 ISBN 978-0-07-337384-3
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 GoodHeart-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
6	Practical Guide to Programmable Logic Controllers	AutomationDirect.com	AutomationDirect.com
7	Programmable Controllers Theory and Implementation	L. A. Bryan E. A. Bryan	Industrial Text Company Second Edition ISBN 0-944107-32-X

(b) Open-source software and website:

1. <https://www.electrical4u.com/programmable-logic-controllers/>
2. <https://dipslab.com/plc-input-output-modules-2/>
3. <https://instrumentationtools.com/basics-of-plc-programming/>
4. <https://automationforum.co>
5. <https://dipslab.com/rules-plc-ladder-diagram-programming/>
6. <https://www.youtube.com/playlist?list=PL0SiuA-KTuIHFufeksUIsLnk4FzSa4OSN>



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7. <https://www.youtube.com/watch?v=gairfgMphLg&list=PL0SiuA-KTuIHIGEQu22BuobWv4VjBu9hq>
8. https://www.youtube.com/watch?v=ETIR_YVqBc0&list=PLjwh8WIIwKDhcB9eFIWra67bL32E8dGeS
9. <https://www.youtube.com/watch?v=copaO5k7sDo&list=PLB0MB4KNytIvB8gSiTzM7yY-N2ej4b776>
10. https://www.youtube.com/watch?v=EJXaB_tZ5XA

Suggested Course Practical List:

S. No.	Practical Outcomes (PrOs)
1	To study hardware and software associated with PLC
2	To Study Input-Output Modules of PLC and Prepare I/O module chart
3	Assemble various modules and component of PLC to make a PLC system.
4	Execute/Prepare ladder diagram of AND, OR, NOT, NAND, NOR, X-OR, X-NOR gate
5	Execute/Prepare ladder diagram for Half-Full Adder and Subtractor.
6	Execute/Prepare ladder diagram for any Three combinational circuits.
7	Execute/Prepare ladder diagram for any Three logical equations.
8	Execute/Prepare ladder diagram for any Three statement-based problems.
9	Execute/Prepare ladder diagram for any Three problems based on latching-unlatching and interlock concept.
10	Execute/Prepare ladder diagram for any Three statement based logical conditions- for Timer
11	Execute/Prepare ladder diagram for any Three statement based logical conditions- for Counter.
12	Execute/Prepare ladder diagram for any Three statement based logical conditions- for implementation of Comparison function.
13	Execute/Prepare ladder diagram for any Three statement based logical conditions- for implementation of Mathematical function.
14	Develop ladder diagram for a temperature, level, flow control system
15	Execute/Prepare allover ladder diagram for industrial process and control.
16	Interface personal computers in network using different topology.
17	Study Interface of RS232, RS 422, and EIA 485 communication standards for interface in automation.

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)



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S. No.	Equipment Name with Broad Specifications
	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.	Analog, Digital and special I/O Modules

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 interface with PLC.

Suggested Activities for Students:

1. Compare and analyze any Two Unitary PLC and Any Two Modular PLC Datasheets.
2. Observe the output parameter as well waveform using simulation and compare it with practical results.
3. Prepare Hazard Analysis report for various materials being generated as Waste in Industrial Automation Fields.
4. Use PLC for Interfacing various I/O Modules.

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