



SARVAJANIK
UNIVERSITY

INCLUSIVE | INTEGRATED | INNOVATIVE

SARVAJANIK UNIVERSITY
Sarvajani College of Engineering and Technology



Bachelor of Technology (B. Tech.)
Instrumentation and Control

Major Equipment Needed: Dead weight tester, universal calibrator, Temperature bath, Voltage/ current Simulator, RTD/ Thermocouple calibrators, Flow meters, etc.

B. Tech. III Semester –6

Subject Name: Industrial Automation with PLC

Subject Code: BTIC15601

Type of course: Open Elective Course

Prerequisite (if any): Digital Electronics, Basic Instrumentation

List of Courses where this course will be prerequisite: Distributed Control System, Safety Instrumented System, SCADA system

Rationale:

This course will provide the students the platform for learning Programmable Logic Controller (PLC) Programming. PLC is a very important device to control any system and is widely used in industries now a day. This course gives a detailed practice for PLC programming skill development.

Teaching and Examination Scheme:

TEACHING SCHEME				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	
2	0	2	3	60	25	15	30	20	150

CA1: Continuous Assessment (assignments/projects/open book tests/closed book tests **CA2: Sincerity in attending classes/class tests/ timely submissions of assignments/self-learning attitude/solving advanced problems** **TEE: Term End Examination** **TEP: Term End Practical Exam (Performance and viva on practical skills learned in course)** **CA3: Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/viva on practical skills learned in course**

Content:

Sr. No.	Content	Total Hrs	Module Weightage
	Industrial Automation and need of PLC Utility of Automation, structure of Automated Process, Automation Hierarchy in industries, Various Automation components: Need of PLC in industrial Automatic Introduction to PLC, PLC components, PLC advantage & disadvantage, PLC vers Computers, The I/O section, Discrete I/O Modules, Analog I/O Modules, Special I/O Modules, I/O specifications, Programming Devices, Various Brands of PLCs	5	17%

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	Basics of PLC Programming Processor Memory Organization, Program Scan, PLC Programming languages, Relay type instructions, Instruction addressing, Branch Instructions, Internal Relay Instructions, Input -Output Image table, Latch-Unlatch instructions, Ladder Programming for Boolean equations, ladder logic program from a narrative description.	3	10%
	Various I/O Devices interfacing with PLC. Different types of Input devices : Switches: Push button Switches, Toggle Switches, Proximity switches, Motor starters, Transmitters etc. Their working, specification and interfacing with PLC. Different types of Output devices : Electromagnetic Control Relays, Contactors, Motors, Pumps, Solenoid Valves etc. Their working, specification and interfacing with PLC.	5	17%
	Logical, Arithmetic and Data handling Instructions: Different Logical operation Instructions: Different Integer Math Instructions: Addition, Subtraction, Multiplication, Division, Increment, Decrement- Integer, Byte, Double Word. Different Floating-Point Math Instructions: Addition, Subtraction, Multiplication, Division, Square Root. Different Comparison instructions, Data handling instructions, Program Control Instructions.	8	26%
	Programming Timers and counters Timer instructions, ON delay timer instruction, Off-Delay timer instruction, Retentive Timer, Cascading Timers, examples of timer function industrial application; industrial process timing application. Counter Instructions, Up-counter, down counter, Up-down counter, examples of counter function industrial application.	7	23%
	Analog PLC Operation Introduction, Types of PLC Analog Modules and Systems, Analog input and Discrete output control.	2	7%

Suggested Specification table with Marks (Theory): (For B Tech only)

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10%	20%	40%	10%	10%	10%

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.



Reference Books:

Sr	Title of book /article	Author(s)	Publisher and details ISBN	Year publication	Publication Edition
1	Programmable logic controller	Frank D. Petruzella	McGraw Hill, ISBN13: 9781264163342	2023	6 th Edition
2	Programmable Logic Controllers: Principles and Applications	John W. Webb and Robert A. Reis	Prentice Hall Education, ISBN-13-978-8120323087	2002	5 th Edition
3	Introduction to programmable logic controller	Gary dunning	Thomson Press (India) Ltd ISBN:9788131503027	1998	3 rd Edition
4	Programmable Logic Controllers and Industrial Automation	MadhuchhandaMitra SamarjitSengupta	PenRam International Publishing Pvt Ltd.ISBN:9781-87972-63-1	2017	2 nd edition
5	Programmable Controllers	Thomas A Hughes	ISA	2004	4 th Edition

Course Outcomes:

After studying the subject, Students will be able to

Sr. No.	CO statement	Marks weightage
CO-1	Describe the hardware structure of PLC and interfacing of input-output modules, power supply and computer with PLC.	10%
CO-2	Discuss the various I/O devices used in industrial automation and their interfacing with PLC.	20%
CO-3	Apply different timer and counter instructions in industrial applications through simulation tasks and problem-solving exercises.	30%
CO-4	Demonstrate the proficiency in logical, arithmetic, and data handling instructions in PLC programming.	30%
CO-5	Identify the utility of industrial automation and the role of Programmable Logic Controller	10%

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	(PLC) in automated processes.	
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How strongly Pos are addressed by each CO of a subject is indicated by level 1: Slight (Low)2: Moderate (Medium)3: Substantial (High)

Mapping CO-POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3														
CO2			3		3								3		
CO3					3								3		
CO4		2			3								3	3	3
CO5									3			3	3	3	3

List of Open learning website:

<https://plc-coep.vlabs.ac.in/>
<http://www.plcdev.com/book/export/html/9>
<https://instrumentationtools.com/learn-programmable-logic-controller-plc/>

List of Open Source Software:

<https://plc-coep.vlabs.ac.in/>

FOR LAB SESSIONS:

List of Experiments:

1. Introduction to ladder programming & to implement basic logic gates and boolean equations.
2. Develop, Simulate and Test Ladder diagram for a. A Door Bell Operation. b. Security Lock. c. Railway Platform selection for Trains
3. Develop, Simulate and Test Ladder diagram for Bottle Filling system
4. Develop, Simulate and Test Ladder diagram for Traffic Light Control System and sequential motor control system.
5. Develop Simulate and Test Ladder diagram for an alarm annunciator system.
6. Develop Simulate and Test Ladder diagram for Batch Mixer system.
7. Design ladder diagram for level control system.
8. Develop and test PLC program for ON-OFF and PID Controller for Temperature control Application.
9. Design ladder programming using timer and counter and higher arithmetic and comparison instructions.

Major Equipment Needed: Computers, simulation software, PLCs, Input/ Output devices.