

GUJARAT TECHNOLOGICAL UNIVERSITY

Instrumentation and Control Engineering

B. E. SEMESTER: VII

Subject Name: **Programmable Automation Controller**

Subject Code: **171702**

Teaching Scheme				Evaluation Scheme			
Theory	Tutorial	Practical	Total	University Exam (E)		Mid Sem Exam (Theory) (M)	Practical (Internal)
				Theory	Practical		
4	0	2	6	70	30	30	20

Sr. No	Course Content	Total Hrs.
1.	<p>PLC Basics:</p> <p>An Overall Look at Programmable Logic Controllers.</p> <p>Introduction; definition & history of the PLC; manufacturing & assembly process; PLC advantage & disadvantage; overall PLC system; CPU & programmer/monitors; PLC input & output modules; printing PLC information.</p> <p>The PLC: A Look Inside.</p> <p>Introduction; the PLC as a computer; the central processing unit; solid state memory; the processor; I/O modules; power supplies.</p> <p>General PLC Programming Procedures.</p> <p>Introduction; programming equipment; programming formats; proper construction of PLC ladder diagrams; process scanning consideration; PLC operational faults.</p> <p>Devices to Which PLC Input and Output Modules Are Connected.</p> <p>Introduction; input ON/OFF switching device; input analog device; output ON/OFF device; output analog device.</p>	6
2.	<p>Basics PLC Programming:</p> <p>Programming On/Off Inputs to Produce On-Off Outputs.</p> <p>Introduction; PLC input instruction; output: coils, inductors & others; operational procedures; contact & coil input/output programming examples; a look at fail-safe circuit; industrial process examples.</p>	4

	<p>Relation of Digital Gate Logic to Contact/Coil Logic.</p> <p>Digital logic gates; Boolean algebra PLC programming; conversion examples.</p> <p>Creating Ladder Diagrams from Process Control Descriptions.</p> <p>Ladder diagram & sequence listing; large process ladder diagram construction; flow charting as programming method.</p>	
3.	<p>Basic PLC Functions:</p> <p>Register.</p> <p>Introduction; general characteristics of registers; module addressing; holding registers, input registers: single & group; output registers: single & group.</p> <p>PLC Timer Functions.</p> <p>Introduction; PLC timer functions; examples of timer function industrial application; industrial process timing application.</p> <p>PLC Counter Functions.</p> <p>Introduction; PLC counters; examples of counter function industrial application.</p>	6
4.	<p>Intermediate Functions:</p> <p>PLC Arithmetic Functions.</p> <p>Introduction; PLC addition & subtraction; the PLC repetitive clock; PLC multiplication, division & square-root: PLC trigonometric & log function; other PLC arithmetic functions.</p> <p>PLC Number Comparison Functions.</p> <p>Introduction; PLC basic comparison function; PLC basic comparison function application; PLC advanced comparison function.</p> <p>Numbering Systems and PLC Number Conversion Functions.</p> <p>Introduction; numbering system: decimal, binary & BCD; PLC conversion between decimal & BCD; OCTAL & HEX DECIMAL numbering system; other numbering & code system.</p>	8
5.	<p>Data Handling Functions:</p> <p>The PLC SKIP and MASTER CONTROL RELAY Functions.</p> <p>Introduction; the SKIP function & application; the MASTER CONTROL RELAY function & application.</p>	6

	<p>Jump Functions.</p> <p>Introduction; jump with non-return; jump with return.</p> <p>PLC Data Move Systems.</p> <p>Introduction; PLC MOVE function & application; moving large blocks of PLC data; PLC table & registers moves; other PLC MOVE functions.</p> <p>Other PLC Data Handling Functions.</p> <p>Introduction; PLC FIFO functions; the FAL function; the one shot (ONS), clear (CLR) & SWEEP functions.</p>	
6.	<p>PLC Functions Working with Bits:</p> <p>PLC Digital Bit Functions and Applications.</p> <p>Introduction; bit pattern in a register; changing a register bit status; shift register function; shift register application.</p> <p>PLC Sequencer Functions.</p> <p>Introduction; electromechanical sequencing; the basic PLC sequencer function; a basic PLC sequencer application with timing; other PLC sequencer function; cascading sequencer.</p> <p>Controlling a Robot with a PLC.</p> <p>Introduction; basic two axis ROBOT with PLC sequencer control; industrial three axis ROBOT with PLC control.</p> <p>PLC Matrix Functions.</p> <p>Introduction; applying matrix functions to reduce program length; the PLC AND & OR matrix function; the PLC COMPLEMENT & COMPARE matrix function; combination PLC matrix operation.</p>	8
7.	<p>Advanced PLC Functions:</p> <p>Analog PLC Operation.</p> <p>Introduction; types of PLC; analog modules & systems; PLC analog signal processing; BCD or multi-bit data processing; PLC analog output application examples.</p> <p>PID Control of Continuous Processes.</p> <p>Introduction; PID principles; typical continuous process control curves; PID modules; PID tuning; typical PID functions.</p> <p>Networking PLCs.</p> <p>Introduction; levels of industrial control; types of networking; network</p>	8

	communication; PLCs & the internet; cell control by PLC networks.	
8.	Alternative Programming Languages Introduction; ladder logic & beyond; when ladder logic is not enough; state languages: high level programming for the PLC.	2
9.	PLC Auxiliary Commands and Functions Introduction; MONITOR mode function; FORCE mode function; MONITOR & FORCE functions for the five PLC programming formats; 5 PRINT functions.	2
10.	Installation, Troubleshooting, and Maintenance. Introduction; consideration of the operating environment receiving, checks, testing & assembly; electrical connecting , grounding & suppression; circuit protection & wiring; troubleshooting PLC malfunction; PLC maintenance.	2
11.	Selecting a PLC. PLC versus the PC based control; factors to consider in selecting the PLC.	2

Reference Books:

1. Programmable Logic Controllers: Principles and Applications, by John W. Webb and Ronald A. Reis, Pub: Prentice – Hall India
2. Programmable Logic Controllers: Programming methods and applications, by John R. Hackworth and Frederick D. Hackworth Jr., Pub: Pearson