

GUJARAT TECHNOLOGICAL UNIVERSITY

BRANCH NAME: Electronics & Communication (11), Electronics & Telecommunication (12)

SUBJECT NAME: INDUSTRIAL AUTOMATION (Department Elective-II)

SUBJECT CODE: 2171103

B.E. 7th SEMESTER

Type of course: Department Elective course

Prerequisite: Knowledge of Basic Electrical Engineering, Basic Electronics, Digital Electronics, Electronics Measurement and Instruments

Rationale: Automation is playing a key role in Industries. Industries rely heavily on automation for economic viability and mass production. It is important for the students to learn basic of automation, how system works and importance of PLC, SCADA and robots in automation. This course will provide opportunity to learn industrial automation techniques.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks						Total Marks
L	T	P		Theory Marks			Practical Marks			
				ESE (E)	PA (M)		PA (V)		PA (I)	
					PA	ALA	ESE	OEP		
3	0	2	5	70	20	10	20	10	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	Introduction: Automation overview, Requirement of automation systems, Architecture of Industrial Automation system, Introduction of PLC and supervisory control and data acquisition (SCADA). Industrial bus systems: modbus & profibus	5	15%
2	Automation components: Sensors for temperature, pressure, force, displacement, speed, flow, level, humidity and pH measurement. Actuators, process control valves, power electronics devices DIAC, TRIAC, power MOSFET and IGBT. Introduction of DC and AC servo drives for motion control.	6	15%
3	Computer aided measurement and control systems: Role of computers in measurement and control, Elements of computer aided measurement and control, man-machine interface, computer aided process control hardware, process related interfaces, Communication and networking, Industrial communication systems, Data transfer techniques, Computer aided process control software, Computer based data acquisition system, Internet of things (IoT) for plant automation	8	20%

4	Programmable logic controllers: Programmable controllers, Programmable logic controllers, Analog digital input and output modules, PLC programming, Ladder diagram, Sequential flow chart, PLC Communication and networking, PLC selection, PLC Installation, Advantage of using PLC for Industrial automation, Application of PLC to process control industries.	8	20%
5	Distributed Control System: Overview of DCS, DCS software configuration, DCS communication, DCS Supervisory Computer Tasks, DCS integration with PLC and Computers, Features of DCS, Advantages of DCS.	8	20%
6	Overview of Industrial automation using robots: Basic construction and configuration of robot, Pick and place robot, Welding robot.	3	10%
Total		39	

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
5	15	25	10	10	5

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:

[1] Industrial Instrumentation and Control By. S.K. Singh The McGraw Hill Companies

[2] Process Control Instrumentation Technology By. C.D. Johnson, PHI

[3] Industrial control handbook, Parr, Newnem

[4] Programmable logic controller, Dunning, Delmar

Course Outcome:

After learning the course the students should be able to:

1. Understand various automation components and systems
2. Draw block diagram of industrial automation and control system
3. Explain architecture of industrial automation system
4. Measure industrial parameters like temperature, pressure, force, displacement, speed, flow, level, humidity and pH.

5. Explain fundamentals of process control
6. List basic devices used in automated systems
7. Use programmable logic controllers for industrial automation
8. Draw block diagram of supervisory control and data acquisition (SCADA).
9. Integrate SCADA with PLC systems
10. Use Internet of Things for industrial automation
11. Know use of robot for industrial applications

Suggested List of Experiments:

(General guidelines.. Institute may change list of experiments based on laboratory set up available)

1. Use industrial grade sensors and transducer introduction and characteristics like proximity detector, linear encoder, rotary encoder, touch sensor, force sensor, accelerometer, RTDs, loadcells and LVDT for measurement
2. Use Various actuators such as relay, solenoid valve, process control valve and motors for control applications
3. Simulate analog and digital function blocks
4. Relay logic diagram and ladder logic diagram
5. Understand and perform experiments on timers and counters
6. Logic implementation for traffic Control Application
7. Logic implementation for Bottle Filling Application
8. Tune PID controller for heat exchanger using DCS
9. FBD for autoclavable laboratory fermentor
10. Develop graphical user interface for the plant visited by you
11. Industrial visit report

There may be separate list of experiment where laboratory setup is developed by Siemens under Centre of Excellence.

Design based Problems (DP)/Open Ended Problem:

1. Design of low cost PLC Systems
2. Design of humanoid robots

Major Equipment:

1. ADC, DAC and Controller, Switches, LEDs, Solenoid valves
2. Relay, motor
3. PLC with software
4. MATLAB or LABView or other similar software
5. AC Servo drives and DC Servo drives
6. Zigbee and Bluetooth based short range automation system.
7. IoT boards.
8. Robot for demonstration

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.