Gyanmanjari Innovative University

Course Syllabus
Gyanmanjari Institute of Technology
Semester-5

Subject: Industrial Automation - BETEC15307

Type of course: Professional Elective Courses

Prerequisite: Basic Electrical Engineering, Fundamentals of Electronics, Digital Electronics

Rationale:
Automation is essential in modern industries for improving efficiency, accuracy, and safety. This course provides fundamental knowledge of industrial automation systems, including sensors, actuators, control strategies, and system integration using PLC, DCS, and supervisory systems. It also introduces emerging trends such as IIoT and smart manufacturing, enabling students to understand and apply automation concepts in real-world industrial environments.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks					Total Marks
				Theory Marks		Practical Marks		CA	
CI	T	P	C	ESE	MSE	V	P	ALA	
3	0	2	4	60	30	10	20	30	150

Legends: CI-Classroom Instructions; T – Tutorial; P - Practical; C – Credit; ESE - End Semester Examination; MSE- Mid Semester Examination; V – Viva; CA - Continuous Assessment; ALA- Active Learning Activities.

Course Content:

Unit No.	Course content	Hrs	% Weightage
1.	**Fundamentals of Industrial Automation** Evolution and importance of industrial automation, levels and architecture of automation systems, types of automation: fixed, programmable and flexible, basic control strategies: open-loop and closed-loop systems, introduction to industrial communication systems, role of computers in automation and control.	09	20%

2.	**Industrial Sensors, Actuators and Interfacing Technique** Classification of sensors and transducers, measurement of industrial parameters: temperature, pressure, flow, level, displacement and speed, selection criteria and characteristics of sensors, signal conditioning techniques, industrial actuators: relays, solenoids, control valves and motors, introduction to power electronic devices for control applications, interfacing of sensors and actuators with control systems	09	20%
3.	**Programmable Logic Controllers** Introduction to programmable controllers and PLC architecture, input and output modules and signal handling, PLC programming fundamentals, ladder logic and function block concepts, timers, counters and sequencing operations, PLC communication and networking basics, selection and installation of PLC systems, applications of PLC in industrial automation	09	20%
4.	**Distributed and Supervisory Control Systems** Overview of distributed control systems (DCS) and system architecture, functions and components of DCS, configuration and communication in DCS, supervisory control and data acquisition (SCADA) systems, SCADA architecture and functions, human machine interface (HMI), data acquisition and monitoring, integration of PLC with DCS and SCADA systems, advantages and applications in process industries	09	20%
5.	**Industrial Robotics and Smart Automation** Introduction to industrial robotics and robot configurations, components and basic kinematics of robots, types of industrial robots and applications such as pick and place and welding, introduction to Industrial Internet of Things (IIoT), architecture of IIoT systems, smart sensors and connected devices, basics of cloud-based monitoring and data analytics in industry, concept of Industry 4.0 and smart manufacturing systems	09	20%

Continuous Assessment:

Sr. No	Active Learning Activities	Marks
1.	**Comprehensive Automation System Design** Students will design a complete industrial automation system for a real-world application (e.g., water level control, automated packaging, or conveyor system). The design should include selection of sensors, actuators, control strategy, and overall system architecture with proper justification. Upload Document on GMIU Web Portal.	10
2.	**PLC-Based Control Implementation** Students will develop and simulate a PLC-based control system for an industrial process (e.g., traffic light control, bottle filling, or motor control). The activity should include ladder logic design, sequence of operations, and analysis of system behavior. Upload Document on GMIU Web Portal.	10

3.	**Industrial Automation System Case Study with Modern Integration** Students will study an existing industrial automation system and analyze its components such as sensors, PLC/DCS, and supervisory systems. Additionally, they will propose enhancements using IIoT or smart monitoring concepts and evaluate the benefits. Upload Document on GMIU Web Portal.	10
Total		30

List of Practicals

Sr. No	Descriptions	Unit No	Hrs
1	Study of PLC hardware, input-output modules, power supply, and basic wiring of field devices.	3	2
2	Implementation of basic logic operations (AND, OR, NOT, NAND, NOR) using ladder diagrams.	3	2
3	Development of ladder logic for latching and unlatching operations.	3	2
4	Implementation of ON-delay and OFF-delay timers using ladder logic.	3	2
5	Implementation of up-counter and down-counter operations using PLC.	3	2
6	Design of sequential control using ladder logic for step-by-step operation.	3	2
7	Traffic light control system using ladder diagram programming.	3	2
8	Bottle filling system using PLC with sensors and actuators.	3	2
9	Conveyor belt control system with start/stop, interlocking, and safety conditions.	3	2
10	Motor forward and reverse control using PLC with interlocking protection.	3	2
11	Alarm and indicator system design using ladder logic.	3	2
12	Basic interfacing of sensors and actuators with PLC and testing through ladder programs.	2	2
13	Study of SCADA interface for industrial monitoring and control applications.	4	2
14	Study of DCS architecture and communication system using simulation tools.	4	2
15	Mini project on PLC-based industrial automation with smart monitoring concepts.	5	2
	TOTAL		**30**

Suggested Specification table with Marks (Theory):60

Distribution of Theory Marks (Revised Bloom's Taxonomy)						
Level	Remembrance (R)	Understanding (U)	Application (A)	Analyze (N)	Evaluate (E)	Create (C)
Weightage	20%	30%	15%	10%	20%	05%

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.

Course Outcome:

After learning the course the students should be able to:	
CO1	Explain the fundamentals, architecture, and significance of industrial automation systems.
CO2	Select and analyze appropriate sensors, actuators, and interfacing techniques for industrial applications.
CO3	Design and implement control logic using programmable logic controllers (PLC) for real-world problems.
CO4	Analyze and interpret the working of distributed control systems (DCS) and SCADA in industrial environments.
CO5	Evaluate modern automation technologies including industrial robotics, IIoT, and smart manufacturing systems

Instructional Method:

The course delivery method will depend upon the requirement of content and the needs of students. The teacher, in addition to conventional teaching methods by black board, may also use any tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.

From the content 10% topics are suggested for flipped mode instruction.

Students will use supplementary resources such as online videos, NPTEL/SWAYAM videos, e-courses, Virtual Laboratory

The internal evaluation will be done on the basis of Active Learning Assignment

Practical/Viva examination will be conducted at the end of semester for evaluation of performance of students in the laboratory.

Reference Books:

[1] S.K. Singh, Industrial Instrumentation and Control, McGraw Hill Education

[2] C.D. Johnson, Process Control Instrumentation Technology, Pearson Education

[3] Frank D. Petruzella, Programmable Logic Controllers, McGraw Hill

[4] Gary Dunning, Introduction to Programmable Logic Controllers, Cengage Learning

[5] Krishna Kant, Computer-Based Industrial Control, PHI Learning