Lok Jagruti Kendra University
University with a Difference

Diploma
in
Automation & Robotics

Course Code: 025120602
Industrial Automation

Programme / Branch Name		Diploma in Automation & Robotics			
Course Name	Industrial Automation			**Course Code**	025120602
Course Type	HSSC	BSC	ESC	PCC	OEC	PEC

Legends: HSSC: Humanities and Social Sciences Courses   BSC: Basic Science Courses
ESC: Engineering Science Courses   PCC: Program Core Courses
OEC: Open Elective Courses   PEC: Program Elective Courses

1. Teaching and Evaluation Scheme

Teaching Hours / Week				Evaluation Scheme			
L	**T**	**P**	**Total Credit**	**CCE**	**SEE (Th)**	**SEE (Pr)**	**TOTAL**
3	0	2	4	50	50	50	150

Legends:

L: Lectures   T: Tutorial   P: Practical
CCE: Continuous & Comprehensive Evaluation
SEE (Th):   Semester End Evaluation (Theory)
SEE (Pr):   Semester End Evaluation (Practical)

2. Prerequisites

- ✓ Fundamentals of Electrical Engineering
- ✓ Applied Physics
- ✓ Metrology & Measurements
- ✓ Fluid Mechanics & Machines
- ✓ Machine Tools & Techniques

3. Rationale

Industrial automation involves the use of control systems, computer systems, and information technologies to manage and control various processes in industries such as manufacturing, energy, transportation, and utilities. This includes processes such as assembly line operations, material handling, and process control. The study of industrial automation provides a solid foundation for understanding the principles and practices of automation and control systems, and prepares students for careers in fields such as manufacturing, engineering, and technology.

4. Objectives

- ✓ Understanding the principles and applications of automation in industrial settings.
- ✓ Learning about the basic concepts, such as feedback control systems, sensors, actuators, and control devices.
- ✓ Acquiring skills in the design and implementation of automation system.
- ✓ Understand design and implement control systems, such as supervisory control and data acquisition (SCADA) systems.
- ✓ Developing knowledge of robotics and automation in manufacturing.
- ✓ Learning about the use of control systems to optimize processes and improve production efficiency.

5. Contents

Unit No.	Unit Name	Topics	Learning Outcome	% Weightage	Hours

1.	**Basics of Automation**	1.1. Introduction to Automation
		1.2. Types of Automation
		1.3. Advantages and Disadvantages in Automation
		1.4. Concept of Automation Terminology.
		  1.1.1. Link and joints
		  1.1.2. Degree of Freedom
		  1.1.3. Orientation Axis
		  1.1.4. Tool Center Point.
		1.5. Positioning Concept of Automation.(Accuracy, repeatability,Resolution, Payload)
			• Understanding of the basic concepts of automation, including control systems and process automation.
			• Understand the terminology and positioning concept in Industrial Automation.
				10	6

2.	**Sensors and Actuators**	2.1. General characteristics of Sensor.
		2.2. Classification of Sensors
		  2.2.1. Internal Sensors
		  2.2.2. External Sensors
		2.3. Basic terms utilized for sensor Characteristics. Range,Precision, Accuracy, Repeatability, Linearity, Dynamic Response.)
		2.4. Angular Position Sensors for Measurement.
		  2.4.1 LVDT
		  2.4.2. Photodiodes
		2.5. Sensors for Velocity and Acceleration.
		  2.5.1 Accelerometers
		  2.5.2 Tachometers
		2.6. Sensors for Force Measurement.
		  2.6.1 Piezoresistive
		  2.6.2 Tactile sensors
		2.7. Timers and Switches (Rotary Encoders)
		2.8. Stepper Motors
			• Understanding the types and functions of sensors.
			• Understanding the types and functions of actuators,types of actuators, including motors, solenoids, and hydraulic systems.
			• Understanding of sensor and actuator selection of appropriate sensors and actuators for a given application, taking into account factors such as accuracy, reliability, and cost.
				25	14

#		Topics	Learning Outcomes		
		2.9. Principle of Stepper Motor Operation. 2.10. Hydraulic Actuation Systems. 2.11. Classification of Pumps 2.12. Linear Hydraulic Actuators 2.13. Principles of Pneumatic Actuation System 2.14. Pneumatic Valves & Function of Pressure Regulator Valve			
3.	**Robotics Motion Control Systems**	3.1. Definition and origin of Robotics. 3.2. Degree of Freedom 3.3. Dynamic Stabilization of Robots. 3.4. Microprocessor and Microcontroller based Robotic Controller. 3.5. Peripheral Interfacing of Microcontrollers 3.6. Arduino Platform for Robotic Control. 3.7. Grippers Interfacing with Robotic Controller by Arduino.	• Undertand basic principles of motion control in robotics. • Knowledge of robotic sensors (Arduino) types of sensors used in robotics, including position, force, and torque sensors, and how they are used to provide feedback for motion control.	30	8
4.	**SCADA and HMI Development**	4.1. Introduction about SCADA 4.2. Fundamental Principles of SCADA Systems 4.3. SCADA Hardware (PLC) and Software 4.4. Advantages and Disadvantages of SCADA in Industrial Automation. 4.5. HMI Components 4.6. HMI Development and Data Processing 4.7. Cyber Security control in Industrial Automation.	• Understanding of industrial automation and control systems • Knowledge of communication protocols used in SCADA systems. • Ability to acquire and process data in SCADA systems. • Competence in maintenance and troubleshooting of SCADA and HMI systems	20	8
5.	**Process Control and Instrumentation**	5.1. Introduction to Hardware Elements Process Control System. 5.2. Basic Action in Process Control	• Understanding of the basic concepts of process control and instrumentation, including	15	6

		5.3. Feedback Control System (Cascade Control) 5.4. Measurement principles of temperature, pressure, level and flow measuring instruments. 5.5. Selection and installation of instruments for the measurement of temperature, level, flow and pressure for Industrial Automation..	measurement, control systems, and process optimization • Implementing control systems for industrial processes.		

	Total Hours	**42**

6. List of Practicals / Exercises

The practicals/exercises have been properly designed and implemented in an attempt to develop different types of skills, so that students can acquire the competencies/programme outcomes. Following is the list of practicals/exercises.

Sr. No.	Practical / Exercises	Key Competency	Hours
1.	To understand the concept of Automation Prepare flow diagram and Model of Basic Links and joints.	To Prepare a Model of Joints for specific motion.	4
2.	To Understand Measurement devices perform a complete measuring function, from initial detection to final Indication by using Sensors and Transmitters.	Prepare a Flow Chart use of Industrial Grade sensors (Proximity Sensors) and there working in specific application like (Bottle Filling plant, Heating Device, Motion feed control, Direction control etc)	4
3.	To demonstrate of various types Pressure control Valves devices used in automation Purpose.	Prepare a diagram chart of Control valves with there application.	4
4.	To understand the various modules used in Arduino for variables like (Force, Temperature , Humidity , Pressure)	To Prepare a sheet with Images and make a flow diagram this modules & utilization in Automation field.	2
5.	To prepare a model of Gripper using Arduino module.	To make model of Gripper with the help to plastic or Acrylic.	8

6.	To study the application of SCADA in Industrial Automation.	To make a Report over SCADA utilization in Modern Industrial field.	2
7.	Seminar presentation	Prepare the seminar and make presentation on power point.	4
		Total Hours	**28**

7. Suggested Specification Table for Evaluation Scheme

Unit No.	Unit Name	Distribution of Topics According to Bloom's Taxonomy					
		R %	**U %**	**Ap %**	**C %**	**E %**	**An %**
1.	Basics of Automation	28	35	29	-	8	-
2.	Sensors and Actuators.	38	41	14	-	7	-
3.	Robotics Motion Control Systems.	26	45	25	-	4	-
4.	SCADA and HMI Development	35	43	15	-	7	-
5.	Process Control and Instrumentation	22	48	30	-	-	-

Legends: R: Remembering   U: Understanding
            App: Applying   C: Creating
            E: Evaluating   An: Analyzing

8. Textbooks

1) Industrial Automation and Robotics by A.K Gupta, S.K Arora , Mercury Learning Information.
2) Industrial Automation: A Engineering Approach by Port Dickson, KPT publication.

9. Reference Books

1) Industrial Automation by Frank Lamb The McGraw Hill Companies.
2) Fundamentals of Robot Technology: An Introduction to Industrial Robots by DJ Todd, Kogan Page.
3) Introduction to Industrial Automation by Stamatios Manesis & George Nikolakopoulos, CRC Press.
4) Automating Manufacturing Systems with PLCs" by Hugh Jack.
5) Industrial Instrumentation and Control By. S.K. Singh The McGraw Hill Companies.

10. Open Sources (Website, Video, Movie)

1) https://nptel.ac.in/courses/108105063
2) https://www.youtube.com/watch?v=ap4IINMk0BQ
3) https://instrumentationtools.com/industrial-automation-and-control-systems/
4) https://www.youtube.com/watch?v=LIQ9imlgH-U
5) https://www.classcentral.com/tag/industrial-automation-systems
6) https://www.se.com/in/en/work/services/field-services/industrial-automation/training-services/