Government of Karnataka

DEPARTMENT OF COLLEGIATE AND TECHNICAL EDUCATION

Program	Automobile Engineering	Semester	V
Course Code	20AT53I	Type of Course L:T:P	104:52:312
Specialization	Automation & Robotics	Credits	24
CIE Marks	240	SEE Marks	160

Introduction :

Welcome to the curriculum for the Specialisation Pathway – **Automation and Robotics**. This specialisation course is taught in Bootcamp mode. Bootcamps are 12 weeks, intense learning sessions designed to prepare you for the practical world – ready for either industry or becoming an entrepreneur.

Manufacturing industries are moving towards complete automation, also using robots to perform most of the operations. Industrial automation systems are used to control and monitor a process, machine or device in a computerized manner that usually fulfils repetitive functions or tasks. They are intended to operate automatically and systematically in order to reduce and improve human work in the industry. Automotive industries are switching to PLC technology for data acquisition and control. Industrial automation systems are used to control and monitor a process, machine or device in a computerized manner that usually fulfils repetitive functions or tasks. This course attempts to provide basic theoretical and practical aspects of automation technologies to develop operational competency, also gives a knowledge on robotics. Hence this course is the foundation for diploma engineers who want to further specialise in the field of industrial automation and robotics.

You will be assisted through the course, with development-based assessments to enable progressive learning. In this course, you'll learn how to Automate different activities in various applications and also incorporate Robots for required activities in an automation system.

Leading to the successful completion of this bootcamp, you shall be equipped to either do an **Internship** in an organisation working on **Automation and Robotics** or take up a **Project** in the related field. After the completion of your Diploma, you shall be ready to take up roles like Automation Engineer, Floor shop Manager, Production In-charge and also can become Entrepreneur in the related field and more.

Pre-requisite

Before the start of this specialisation course, you will have prerequisite knowledge gained in the first two years on the following subjects:

1st year -Engineering Mathematics, Communication Skills, Computer Aided Engineering Drawing, Statistics & Analysis, Basic IT Skills, Fundamentals of Electrical and Electronics Engineering, Project Management skills, Mechanical Science & Engineering and Automotive Engines.

2nd year-Automobile Chassis and Transmission System, Automotive Electrical System, Thermal Engineering and Engine Testing, Automotive Manufacturing Processes, Advanced Automotive Systems, Design and Drafting, Vehicle Body Engineering and Dynamics and Fuel and Pollution Control. In this year of study, you shall be applying your previous years learning along with specialised field of study into projects and real-world applications.

Course Cohort Owner

A Course Cohort Owner is a faculty from the core discipline, who is fully responsible for one specialised field of study and the cohort of students who have chosen to study that specialised field of study.

Instruction to course coordinator.

1. Each Specialized field of study is restricted to a Cohort of 20 students which could include students from other relevant programs.
2. One faculty from the Core Discipline shall be the Cohort Owner, who for teaching and learning in allied disciplines can work with faculty from other disciplines or industry experts.
3. The course shall be delivered in boot camp mode spanning over 12 weeks of study, weekly developmental assessments and culminating in a mini capstone.
4. The industry session shall be addressed by industry experts (in contact mode/online / recorded video mode) in the discipline only.
5. The cohort owner shall be responsible to identify experts from the relevant field and organize industry session as per schedule.
6. Cohort owner shall plan and accompany the cohort for industrial visits.
7. Cohort owner shall maintain and document the industrial assignments, weekly assessments, practices and mini project.
8. The cohort owner shall coordinate with faculties across programs needed for their course to ensure seamless delivery as per time table
9. The cohort owner along with classroom can augment or use for supplementally teaching on line courses available although reliable and good quality online platforms like Karnataka LMS, Infosys Springboard, NPTEL, Unacademy, SWAYAM etc.
10. Report should be maintained for industrial/field visit, such report shall be considered as industrial assignment.

Course outcome: A student should be able to

CO1	Select the right sensor and/or actuator for automating a given application and demonstrate process variables using sensors and/or transducers.
CO2	Perform specified control functions using a Programmable Logic Controller (PLC) and list various applications of embedded systems
CO3	Design and test an automation system for a required operational specification and troubleshoot to resolve any given issue
CO4	Identify the possibilities of automation in a production system
CO5	Develop, simulate, interface and Execute Robot Program for a specified process

Detailed course plan

(Week 1):

Week	CO	PO	Days	1st session (9am to 1 pm)	L	T	P	2ND session (1.30pm to 4.30pm)	L	T	P
1			1	About Specialization – Future-Companies and Service sectors in India and outside India, Career opportunities. Importance and scope of automation & robotics in automobile industry.	2		2	About Automation & robotics- History-Importance- with an Example of a company (like Toyota, M&M, Volvo etc....) brief how/why the need for automation and use of robots evolved in automobile industry.	3		
1	1	1		Introduction: 1. Need and benefits of Industrial Automation, Automation Hierarchy, Basic components of automation system, description of each component. 2. Automation technology as a part of engineering sciences, Key development milestones in the history of automation technology, Effects of automation on people. 3. Types of automation system :-Relay logic and PLC.	4			*Study the following appliances/ automation systems and identify various elements used and their function in: automotive Air conditioning System/ autonomous car/ any automation related to automotive industry.*			3
	1	1	3	Programmable logic controller: 1. Introduction, Compare Relay Logic Control and PLC Logic Control, Internal Architecture of PLC	4			Input devices: • Mechanical Switches • Proximity Switches	3		

				2. I/O Modules (Interfaces), Memory organization.				2. Input devices: • Photo electric Sensors and Switches • Encoders • Temperature Sensors • Position/Displacement Sensors			
	1	1	4	*Demonstrate the working of below shown switches / Sensor.* *a. Various industrial Switches (Push Button, ON/OFF, Toggle, Emergency, Rotary Switches etc.)* *b. Proximity- Inductive, Capacitive and Optical Sensor* ***Note: Connect each sensor directly to the LED/Lamp with appropriate power supply***			4	*Demonstrate the working of below shown switches / Sensor.* *a. Temperature Sensor* *b. Float Sensors* ***Note: Connect each sensor directly to the LED/Lamp with appropriate power supply***			3
			5	**Developmental Assessment**				Assessment Review and corrective action			3
			6	**Industrial Class + Industrial Assignment** **Industry Class on:** Arrange a talk from need for Industrial Automation and Programmable logic controller	2		3				
(Week 2):											

2	1	1	1	Tutorial (Peer discussion on Industrial assignment)	-	4	-	1. Input devices: • Strain Gauges • Pressure Sensors • Liquid level detectors 2. Input devices: • Fluid flow measurement • Smart Sensors 3. Output Devices: • Relay • Directional control Valve	2	1	
	1	1	2	1. ADC and DAC 2.Motors- DC motor, Synchronous motor, Servo motor, 3.Induction motor, Stepper motor	4			*Demonstrate the Forward and Reversal of Stepper,* *Servo and DC Motors with the help of Drivers.* ***Note: Demonstrate the above without using any controllers***	1		2
	2	2	3	PLC Programming: 1. Programming standards, List Different PLC Programming, Ladder diagram, 2. Standard IEC 1131-3 Symbols used for I/O Devices 3. Ladder diagram for logic gates. AND, OR, NOT, NAND, NOR, XOR, XNOR	2	2		Write the ladder diagrams for different applications Ex: A system where there has to be no output when any one of four sensors gives an output, otherwise there is to be an output			3
	2	2	4	*Write ladder diagram to test digital logic gates and* *Execute/Simulate the same.*			4	1. *Writing Equivalent ladder diagram for Electric Switch, Belt drive, motor circuit Latching, Sequential O/P*			3
			5	**Developmental Assessment**				Assessment Review and corrective action			3

			6	Industry Class on selection parameters of PLC for a given application	2		2	Industry Weekly Assignment(1PM-2PM)				1
(Week 3):												
3	2	1	1	Tutorial (Peer discussion on Industrial assignment)		4		Introduction to Timer functions. Applications of timing functions in process control - - On Delay Timer Function, Off-delay Timer Function	3			
	2	1	2	PLC counter functions, Applications of PLC counter function in process control	2	2		Write a Ladder Program to count the number of Items moving on a conveyor Belt and Execute/Simulate the same				3
	3	2	3	Develop a PLC ladder diagram to construct an alarm system which operates as follows. - If one input is ON nothing happens. - If any two inputs are ON, a red light goes ON. - If any three inputs are ON, an alarm sirens sound. - If all are ON, the relevant department is notified.			4	Simulate the PLC ladder diagram developed for an alarm system and also Demonstrate by interfacing with PLC	3			
	3	2	4	Develop automatic door system using optical sensor and linear actuator			4	Execute automatic door system using optical sensor and linear actuator				3
			5	**CIE 1 – Written and Practice Test**				Assessment Review and corrective action				3
			6	**Industrial Class + Industrial Assignment** Industry Class on prevailing PLC Simulation software's and its merits and demerits	2		3					
(Week 4):												
4	3	2	1	Tutorial (Peer discussion on Industrial Visit), Report submission on visit.		4		*Design ladder diagram for car parking.* (Hint: car is to be detected and enter the parking space				3

								to a particular location if space is available. If there is no space, a lamp should indicate that parking is full)			
	2	3	2	*Simulate a ladder diagram for car parking.*			4	*Design ladder diagram for operating and controlling the Lift.*			3
	2, 4	2, 7	3	*Write a ladder diagram and simulate a circuit for a process control application in which a paint spray has to run for 40 seconds when the count reaches the value of 25.*			4	Embedded System- Block Diagram of Embedded System	3		
	2, 4	2, 7	4	2)Applications of Embedded System • Robotics Drones • Braking System • Air conditioning, Refrigerator • Engine control System	3		1	Applications of Embedded System • Keyless entry in Automobiles. You tube Presentation on Applications of Embedded System	1		2
			5	**Developmental Assessment**				Assessment Review and corrective action			3
	2		6	**Industrial Class + Industrial Assignment** Industry Class on prevailing PLC Simulation software's and its merits and demerits	2		3				
(Week 5):											
5	4	1	1	Tutorial (Peer discussion on Industrial assignment)		4		Demonstrate the selection criteria, specification and Application: of Optical (Photoelectric) Sensors, Capacitive proximity sensors, Inductive proximity Sensors, optical proximity sensors, Pressure sensors, Resistive Temperature Detectors (RTDs), Thermocouples, Thermistors, Light Dependant Resistors (LDR) (Refer manufacturer's catalogue)			3

	4	1	2	Select a suitable type of sensor used to recognize the Presence or absence of an object as they pass along a conveyor. Explain your choice and then draw a wiring diagram that shows how it will be wired to an appropriate PLC			4	Explain the importance of Flexible Manufacturing systems Explain the types of FMS • Single-machine cell • Flexible Manufacturing Cell • Flexible Manufacturing system • Dedicated FMS • Random Order FMS	3		
	4	1	3	Explain the Components of FMS • Work stations • Material Handling and Storage System • Computer control system Explain the FMS Layout Configuration • Inline Layout • Loop Layout • Open Field Layout • Robot Centered Cell	4			**You Tube Videos on FMS Systems + Discussion+ Report Writing**			3
	4	1	4	Explain an Overview on • AGV Guided Technology • AGV Management • AGV Safety Systems **You Tube Videos on AGVs**	2		2	Explain an Overview on • Automated storage/Retrieval systems • Components of AS/RS 1. Storage structure 2. S/R machine 3. storage modules (e.g., pallets for unit loads) 4. Pickup-and-deposit stations		1	2
			5	**CIE 2 – Written and Practice Test**				Assessment Review and corrective action			3
	4		6	**Industrial Class + Industrial Assignment** Industry Class on communication protocols in automation	2		3				
(Week 6):											

6	5	1	1	Tutorial (Peer discussion on Industrial assignment)		4		Virtual tour on industrial Application of a Robot			3
	5	1, 2, 4	2	1.INTRODUCTION-Robotics, Industrial robot 2.Automation and robotics: Types of Automation 3.Reasons for implementation of automated systems in manufacture industries, need for using robotics in industries. 4.CAD/CAM & Robotics, Specifications of robotics	4			Explain the overview of Robots & Its Importance in Production system 1. Types of robots: Manipulators, Mobile robots- Wheeled & legged robots, Aerial robots. 2. Basic components of Robots: Base, Link & joint, Wrist, End effector, Actuator, sensor, Controller.	3		
	5	1, 2, 4	3	1.Configurations of robots – Articulated Robot, Polar configuration, SCARA, Cartesian Co-ordinate Robot, Delta Robot. 2. Wrist configuration 3. Work Volume 4. Degree of Freedom- Forward and Back, Up and Down, Left and Right, Pitch, Yaw, Roll	4			1. Joint Notation & Type of joints in robot- Linear Joint (L Joint), Orthogonal Joint (O Joint), Rotational Joint (R Joint), Twisting Joint (T Joint), Revolving Joint (V Joint) 2. Types of sensors used in industrial robot & their application- Tactile Sensor, Proximity Sensors, Optical Sensors, Other Sensors (Temperature, Pressure, Voltage, Current, Acoustics sensors etc.)	3		
	5	1, 2, 4	4	1.End Effectors- Grippers, Tools 2.Types of grippers 3.Factors to be considered for selecting a Gripper 4.Robotic Drives- Electric Drive, Pneumatic Drive, Hydraulic Drive	2		2	Explain the Robot Control systems- • Point- to Point control Systems • Continuous Path Control • Intelligent control	1		2
	5		5	**Developmental Assessment**				Assessment Review and corrective action			3
	5		6	**Industrial Class + Industrial Assignment** Industry Class on smart manufacturing	2		3				

(Week 7):											
7	5	1, 2, 4	1	Tutorial (Peer discussion on Industrial assignment)		4		**Present a Robotic Coordinate system using a robot** • Joint co-ordinate system • Rectangular co-ordinate system • User or object coordinate system • Tool coordinate system. **Steps to define user co-ordinate system.** • Defining X, Y, Z co-ordinate system • Verifying co-ordinate system by multiple motion movements.	1		2
	5	1, 2, 4	2	Present an overview of the Robotic Cell • Identify the Robotic Cell Components & Application tools			4	**Perform Mechanical Installation check of robot** • Checking of proper installation of the safety sensors • Checking of Physical grouting of robot and other peripheral devices (cable trays, fences, fixtures, electric boxes etc.).			3
	5	2, 4	3	**Perform Electrical Installation check of robot** • Checking of the electric connections- Earthing cable, power cable, Pneumatic pipes etc	2		2	**Powering on the Robot and making the cell Healthy for programming** • Turning in the main supply to robot, turn on the stabilizers, Robot Controller. • Check the pneumatic clamps in fixtures, Grippers on robots. • Starting Up and Shutdown Steps in Robot • Check the Booting of the teach pendant			3

	5	1, 2, 4	4	**Demonstrate and practice Robot Programming Methods** • **Teach pendant Programming** • **Programming by using Languages** • **Offline Programming and Simulations**			4	**Demonstrate and practice Robot Programming Methods** • **Teach pendant Programming** • **Programming by using Languages** • **Offline Programming and Simulations**			3
	5		5	**CIE 3 – Written and Practice Test**				Assessment Review and corrective action			3
	5	1, 2, 4	6	**Industrial Class + Industrial Assignment** Industry Class on Robotic Programing + Industry Assignment	2		3				
(Week 8):											
8	5	2, 4	1	Tutorial (Peer discussion on Industrial assignment)		4		**Able to work with Teach Pendant key functions & user interface for teach pedant** • Run Teach mode: Play mode, Remote mode • Run Steps to define Tool co-ordinate system: • Run TCP (Tool center point definition).	3		
	5	2, 4	2	**Able to work with Teach Pendant key functions & user interface for teach pedant** • Tool/ work object definition and their calibration • Creating user defined work objects • Create Box, circle, triangle work object definition • Multi-mode selection in virtual programming pendant			4	**Demonstration and practice of existing program & execution techniques** • Understanding Robot Program Structure. • Different Motion Types used in Programming (PTP, Linear, Circular, Spline) Via Point and Process Points.			3

	5	2, 4	3	**Demonstration and practice of existing program & execution techniques** Understanding Different Motion Parameters used in Program Point Recording			4	• **Identify the program motion command movements** • **Practice on Teach table or fixture for all move commands**				3
	5	2, 4	4	**1.Identify the program motion command movements** **2.Practice on Teach table or fixture for all move commands**			4	**1.Identify the program motion command movements** **2.Practice on Teach table or fixture for all move commands**				3
	5		5	**Developmental Assessment**				Assessment Review and corrective action				3
	5	2, 4	6	**Industrial Class + Industrial Assignment** Industry Class on Robotic Programing + Industry Assignment	2		3					
(Week 9):												
9	5	2, 4	1	Tutorial (Peer discussion on Industrial assignment) & Report Submission on mines visit.		4		**Demonstrate and practice the Pick & Place Application commands used in material handling and its Parameters settings**				3
	5	2, 4	2	**Create a robot program for pick & place by using move commands**	1		3	**Create a robot program for pick & place by using move commands**				3
	5	2, 4	3	**Explain and Present the Arc Welding Application commands used in welding and also, weld Parameter's settings**			4	**Create a robot program for welding application**				3
	5	2, 4	4	**Create a Robot program for welding application**			4	**Create a Robot program for welding application**				3
	5		5	**CIE 4 – Written and Practice Test**				Assessment Review and corrective action				3

	5	2, 4	6	**Industrial Class + Industrial Assignment** Industry Class on interfacing of Robots with peripheral devices	2		3				
(Week 10):												
10	5	2, 4	1	Tutorial (Peer discussion on Industrial assignment)		4		**Simulate a welding program with the help of simulation software & compare the tool path with manual program**	1		2
	5	2, 4	2	**Simulate a welding program with the help of simulation software & compare the tool path with manual program**	2		2	**Simulate a welding program with the help of simulation software & compare the tool path with manual program**			3
	5	2, 4	3	**Execution of Welding process by using Robot** • Selection of Welding tool for robot • Assembling of welding torch to manipulator.			4	**Execution of Welding process by using Robot** • Identify the PLC and robot communication for communicate with HMI. • Build the conveyor system and its communication with PLC.			3
	5	2, 4	4	**Execution of Welding process by using Robot** • Selection of welding source programming file • Adjust the Voltage and Amps rating Start ending and main conditions • Identify architecture of welding robot system • Power source connection with robot controller.			4	**Execution of Welding process by using Robot** • Working using ARCON, ARCOFF. Working using WEAVON, WEAVOFF • Practical welding demonstration • Quality check of welding and improvement with changing weld parameters			3

	5		5	**Developmental Assessment**				Assessment Review and corrective action			3
	5	2, 4	6	**Industrial Class + Industrial Assignment** Industry Class on prevailing Robot simulation software's	2		3				
(Week 11):											
11	5	2, 4	1	Tutorial (Peer discussion on Industrial assignment)		4		**Execution of Welding process by using Robot** • Practical welding demonstration • Quality check of welding and improvement with changing weld parameters			3
	5	2, 4	2	**Execution of Welding process by using Robot** • Practical welding demonstration • Quality check of welding and improvement with changing weld parameters			**4**	**Simulate a Pick & Place program with the help of simulation software & compare the tool path with manual program**			**3**
	5	2, 4	3	**Simulate a Pick & Place program with the help of simulation software & compare the tool path with manual program**			**4**	**Simulate a Pick & Place program with the help of simulation software & compare the tool path with manual program**			**3**
	5	2, 4	4	**Execution of Pick & Place process by using Robot** • Mounting the suitable Gripper on Robot Flange • List out gripper application in robot program & develop machine setting to assign the operation			**4**	**Execution of Pick & Place process by using Robot** • Identify the basic Pick & Place Program structure in robot with the help of teach pendant • Creating a program of pick and place with the help of gripper.			**3**

				• Interfacing Grippers to Robot using robot I/O • Interfacing Grippers to Robot using PLC I/O				• Understanding HAND INSTRUCTIONS in Robot • Understanding HANDLING WINDOW in Robot • Low Air Pressure Interlock • Creating the program with gripper application Practice for program creation with gripper application			
	5		5	Weekly Assessment **CIE 5 – Written and Practice Test**				Assessment Review and corrective action			3
	5	2, 4	6	**Industrial Class + Industrial Assignment** Industry Class on prevailing Robot simulation software's	2		3				
(Week 12):												
12	5	2, 4	1	Tutorial (Peer discussion on Industrial Visit) & report submission on Industry visit		4		• **Creating the program with gripper application** • **Practice for program creation with gripper application**			3
	5	2, 4	2	• **Creating the program with gripper application** • **Practice for program creation with gripper application**			4	**Simulate a spray-painting program with the help of simulation software & compare the tool path with manual program**	1		2
	5	2, 4	3	**Simulate a spray-painting program with the help of simulation software & compare the tool path with manual program**	2	2		**Execution of spray-painting process by using Robot** • Mounting the suitable Gripper on Robot Flange			3

								• List out gripper application in robot program & develop machine setting to assign the operation			
	5	2, 4	4	**Execution of spray-painting process by using Robot** • Identify the basic spray-paint Program structure in robot with the help of teach pendant • Creating a program to spray-paint with the help of gripper. • Understanding HAND INSTRUCTIONS in Robot • Understanding HANDLING WINDOW in Robot			4	**Execution of spray-painting process by using Robot** • Identify the basic spray-paint Program structure in robot with the help of teach pendant • Creating a program of spray-paint with the help of gripper.			3
	5		5	**Developmental Assessment**				Assessment Review and corrective action			3
	5	2, 4	6	**Industrial Class + Industrial Assignment** Industry Class on prevailing Robot simulation software's	2		3				
(Week 13): **Student can choose either Internship/ Project**											
13		2, 3, 4, 6		**Internship** **a) Secondary research on various industries and their operations to identify at least 3 companies along with the areas of work interest and develop an internship plan that clearly highlights expectations from the industry during the internship.** **b) Design and develop a cover letter for an internship request to all 3 identified companies and the resume to be submitted to potential companies.**				**Project:** **a) Identification of the problem statement (from at least 3 known problems) the students would like to work as part of the project – either as provided by faculty or as identified by the student. Document the impact the project**			40Hrs

				c) Prepare for an internship interview to highlight your interests, areas of study, career aspirations and personnel competence – including the areas of learning you expect to learn during internship.	**will have from a technical, social and business perspective.** **b) Design and develop the project solution or methodology to be used to solve at least one of the problems identified.** **c) Prepare a project plan that will include a schedule, WBS, Budget and known risks along with strategies to mitigate them to ensure the project achieves the desired outcome.**	

CIE and SEE Assessment Methodologies

CIE Assessment	Assessment Mode	Duration In hours	Max Marks
Week 3	CIE 1– Written and practice test	4	30
Week 5	CIE 2– Written and practice test	4	30
Week 7	CIE 3– Written and practice test	4	30
Week 9	CIE 4– Written and practice test	4	30
Week 11	CIE 5– Written and practice test	4	30
	On line Course work (Minimum 10 hours online course with certification from (SWAYAM/NPTEL/Infosys Springboard)		40
	Profile building for Internship / Submission of Synopsys for project work		20
Portfolio evaluation (Based on industrial assignments and weekly developmental assessment) *			30
TOTAL CIE MARKS (A)			**240**
SEE 1 - Theory exam (QP from BTE) Conducted for 100 marks 3 hrs duration reduced to 60 marks		**3**	**60**
SEE 2 – Practical		**3**	**100**
TOTAL SEE MARKS (B)			**160**
TOTAL MARKS (A+B)			**400**

* The industrial assignment shall be based on peer-to-peer assessment for a total of 10 marks (on a scale of 1 to 10) and in the event of a group assignment the marks awarded will be the same for the entire group, the developmental assessment will be for a total of 20 marks and based on MCQ/case study/demonstration and such other assignment methods

Assessment framework for CIE (1 to 5)

Note: Theory to be conducted for 1 hour and practice for 3 hours, total duration of exam – 4 hours

CIE 1- Model Question Paper

Programme	**Automobile Engineering**	**Semester**		**V**	
Course	**AUTOMATION & ROBOTICS**	**Max Marks**		**30**	
Course Code	**20AT53I**	**Duration**		**4 hours**	
Name of the course Coordinator					
Note: Answer one full question from each section.					
Qn.No	**Question**	**CL L3/L4**	**CO**	**PO**	**Marks**
Section-1 (Theory) – 10 marks					
1.a)	Construct Standard symbols used for input & output devices in PLC (Any 3)	L3	1	1	5
b)	How the ladder diagram is different from normal circuit diagram	L4	2	2	5
2.a)	Build Ladder Diagram for any 4 logic gates. Compare any three gates with circuit diagram & truth table.	L4	1	1	5
b)	Develop a PLC ladder diagram to construct a signal, if one input is ON, red light will switch ON and if two inputs are ON, Green light will switch on	L3	3	3	5
Section-2 (Practical) - 20 marks					
3)	Select a suitable Sensor / Switch for a given Process Variable and activate • Selection of Sensor/Transducer – 05Marks • Activation and Result – 15 Marks	L4	1	1	20
4)	Develop and simulate a simple ladder diagram for a given Case • Writing Ladder Program – 10 Marks • Simulate and Troubleshoot - 10 Marks	L4	2	2	20

Note : Theory questions shall be aligned to practical questions

Assessment framework for SEE 1 (Theory)

Programme	:	**Automobile Engineering**	
Semester	:	**V**	
Course	:	AUTOMATION & ROBOTICS	**Max Marks : 100**
Course Code	:	20AT53I	**Duration : 3 Hrs**

Instruction to the Candidate: Answer one full question from each section.

Q.No	Question	CL	CO	Marks
	Section-1			
1.a)	Draw a ladder diagram for a given truth table A B Y 0 0 1 0 1 0 1 0 0 1 1 0	L3	1	10
b)	Justify the statement "Automation increases the manufacturing flexibility" with relevant example.	L4		10
2.a)	The conveyer is transporting only metals. Suggest the appropriate sensor for detecting these objects and explain how that particular sensor works with sketch	L4		10
b)	Justify the importance of Emergency stop in automation	L3		10
	Section-2			
3.a)	Write a PLC Ladder Program Providing lubricant for the gear box before the lathe spindle starts to run which aims to ensure that the oil pump motor starts first and the main motor starts subsequently.	L4	2	10
b)	Compare PLC with Relay logic Circuit	L3		10
4.a)	Write a PLC Ladder Program such that Once the photoelectric sensor detects 10 products, the robotic arm will begin to pack up. When the action is completed, the robotic arm and the counter will be reset	L4		10
b)	Construct the relay circuit to switch ON 220V motor using 24V DC signal (Use IEC symbols)	L3		10
	Section- 3			

5.a)	Design a ladder diagram in the parking area, such that the Number of parking space available has to be shown and once the car enters the parking & car has to be detected while entering the parking space and the number of available parking space has to be minus one.	L4	3	10
b)	Develop a PLC ladder diagram to construct a signal, if one input is ON, red light will switch ON and if two inputs are ON, Green light will switch on	L3		10
6.a)	Write a ladder diagram and simulate a circuit for a process control application in which a paint spray has to run for 40 seconds when the count reaches the value of 25.	L4		10
b)	Develop a PLC ladder diagram to construct a signal, if any 2 inputs are ON, an alarm sirens sound, If 3 inputs are ON, the relevant department is to be notified.	L3		10
	Section-4			
7.a)	Compare thermocouple and RTD. Which type of sensor are used in automobile industry, justify your answer.	L3	4	10
b)	The automobile company has a huge demand for "A" model car, also they have orders for model "B" as well, both run in same assembly line. But there is a problem that the few sensors used in model "A" is getting delayed. How can you manage to solve this problem by using FMS.	L4		10
8.a)	The conveyor is transporting only metal. Suggest the appropriate sensor for detecting these objects. Explain its working with sketch.	L3		10
b)	The AMRS system increases productivity and save floor space, Justify the statement.	L4		10
	Section-5			
9.a)	Compare the various attributes of robot with those of human being. Explain the robot structure with sketch	L4	5	10
b)	A robot does replace humans where the complicated works are involved. In Robots What do you understand by degrees of freedom, how many DOF's are required to position an end effector at any point in 3D space	L3		10
10.a)	Is robotics an automation. Sketch and explain servo control system for point-to-point positioning.	L4		10
b)	Classify the robots according to the coordinates of motion. with a sketch and example, explain the features of each type.	L3		10

Scheme of Evaluation for SEE 2:

Sl. No	Description	Marks
Problem Statement	A concrete manufacturing company are involved in supplying quality concrete products to the building industry. Their supply was getting delayed due to conventional process of handling the products. The process involved lifting 3 concrete slabs at a time and place on the infeed conveyor. After processing they are placed into 2 stacks of products on to the outfeed conveyor. Device a robot program to provide solution for the above process.	
1	Analyse of the problem	20
2	Writing robot program to solve the above problem	20
3	Simulate the program	20
4	Check for results	20
5	Viva voce	20
Total		**100**

Equipment:

Sl. No.	Particulars	Quantity
1	PLC Trainer Kit with the following Modules • Door Controller • Car Parking Application • Water Level Controller • Conveyor Controller Application • Lift control Application With different Length Patch Cords	5
2	Switches • Mechanical Switches	5

	• Proximity Switches • Photo electric Sensors and Switches	
3	Sensors • Temperature Sensors • Position/Displacement Sensors • Strain Gauges • Pressure Sensors • Liquid level detectors • Fluid flow measurement • Smart Sensors • Proximity Sensors	5
4	Induction Motor with DOL Starter (3 Phase Ac 50 Hz)	1
5	Synchronise Motor with DOL Starter (3 Phase Ac 50 Hz)	1
6	Stepper Motor (Standard size)	1
7	Relays (Standard size)	10
8	Counter and Timers (Standard size)	10
9	Robot	1
10	Any open source simulation software	

References

Sl. No	Description
1	Programmable logic Controllers By W. BOLTON
2	Digital electronics By FLYOD
3	Automation , Production systems and Computer integrated Manufacturing By MIKELL GROOVER
4	Sensors Hand book-SABRIE SOLOMAN-MC-GRAW HILL publications
5	Electric Motors and Drives BY AUSTIN HUGHES and BILL DRURY
6	Exploring PLC with applications By PRADEEP KUMAR SRIVATSAVA
7	Hand book of Modern Sensors" Physics , Designs and Applications- JACOB FRADEN-Springer Publications
8	Automating Manufacturing Systems with PLC by Hugh Jack
9	Thomas Braunl, Embedded Robotics: Mobile Robot Design and Application with Embedded Systems, 2nd ed., Springer, 2006.
10	John M. Holland, Designing Autonomous Mobil Robots: Inside the Mind of an Intelligent Machine, Newnes, 2003.
11	Industrial Robotics technology, programming and Application by Mikelle P Groover
12	Springer Handbook of Automation by Shimon Y. N