



GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC

Subject Code: 2931106

Semester – III

Subject Name: Robotics and Automation

Type of course: Open Elective Subject

Prerequisite: Sensor/ Transducer, Fundamental of engineering mechanics, Control systems design

Rationale: In near future, robots will be used widely in the fields of manufacturing, medicine, search and rescue, service, and entertainment. So, it is very much important to teach robotics as the synergistic integration of mechanics, electronics, controls, and computer science. This subject is intended to make student aware with basics of robot sensors, controls and transformations along with essential kinematics and dynamics

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE (E)	PA (M)	ESE (V)	PA (I)		
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Contents	Total hrs	Weight age (%)
1	Introduction to Robotics: Definition and origin of robotics, different types of robotics, various generations of robots, degrees of freedom, Asimov's laws of robotics, dynamic stabilization of robots.	08	16
2	Robotic controllers and actuators: Microprocessors and Microcontrollers based robotic controllers, Peripheral Interfacing with microcontrollers and its programming in C, Arduino platform as robotic controller, Drivers & Actuators interfacing with robotic controller, DC Motors, and Stepper Motors Interfacing and its programming.	10	16
3	Grippers, sensors and actuators: Types of grippers, Properties of grippers, Types of sensors along with working principle, sensor properties, Translational and rotary actuators and their selection	08	16
4	Kinematics and Path Planning: Kinematics and Path Planning Solution of inverse kinematics problem, multiple solution Jacobean work envelop, hill climbing techniques.	08	16



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5	Robot languages and Programming: Robot Languages, Classification of Robot Languages, Computer Control and Robot Software, Robot Operating Systems (ROS), Raspberry Pi based programming for robots.	08	16
6	Case Study: Multiple robots, machine interface, robots in manufacturing and non- manufacturing applications, robot cell design, selection of robot.	08	20
	Total	50	100

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
7	14	14	14	14	7

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:

Sr. No.	Title and Publications
1	S. K. Saha, "Introduction to Robotics", Tata McGraw Hill Education Pvt. Ltd., New Delhi.
2	S. R. Deb and S. Deb, "Robotics Technology and Flexible Automation", Second Edition, Tata McGraw Hill Education Pvt, Ltd., New Delhi
3	R. K. Mittal, I. J. Nagrath, "Robotics and Control", Tata McGraw-Hill Publishing Company Ltd.
4	Dhananjay Gadre, "Programming and Customizing the AVR Microcontroller", TMH, 1st Edition, 2001.
5	Beginning Arduino by McRoberts Michael, Publication: Technology in Action

Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	Learn about the fundamentals, history and components for designing robots.	20
CO-2	Study about Electronics controller for robotics applications and actuators for	30



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	robotic movements.	
CO-3	Learn about Interfacing and programming various sensors and robot gripper mechanism with robotic controllers	20
CO-4	Evaluate the various parts of mechanical and it's dynamics system of robots	10
CO-5	Learn about the various programming languages used for robot controller program development	20

List of Experiments:

1. Introduction to Robotic controller card like Arduino UNO board.
2. Interfacing drivers for Arduino Controller for Robotic application
3. Various sensor interfacing with Robotic Controller like Arduino UNO board
4. To simulate simple robotic system using Matlab/ Msc Adam software
5. Matlab program for simple and inverse kinematics of simple robot configuration
6. To simulate joint torque control of manipulator
7. To study feedback control of robot manipulator
8. To study adaptive control of robot manipulator
9. To study different methods of speed control of dc Motor.
10. To study speed control of stepper motor using microcontroller.
11. To study robotic programming language like AL and AML.