

GUJARAT TECHNOLOGICAL UNIVERSITY

MECHATRONICS ENGINEERING

B. E. SEMESTER: VII

Subject Name: **Robotics (Department Elective –I)**

Subject Code: **172005**

Teaching Scheme				Evaluation Scheme			
Theory	Tutorial	Practical	Total	University Exam (E)		Mid Sem Exam (Theory) (M)	Practical (Internal)
				Theory	Practical		
4	0	2	6	70	30	30	20

Sr. No	Course Content	Total Hrs.
1.	INTRODUCTION: Definition, robot anatomy, spatial coordinates, geometric configurations and work envelope; Machine intelligence; Applications and robot selection, safety, economic justification, future of robotics.	05
2.	ROBOT PROGRAMMING: Introduction; On-line programming : Manual input, lead through programming, teach pendant programming; Off-line programming languages, Simulation.	06
3.	KINEMATICS OF ROBOTIC MANIPULATORS: Introduction to manipulator kinematics, homogeneous transformations and robot kinematics, Denavit-Hartenberg (D-H) representation, concept of forward and inverse kinematics.	14
4.	CONTROL OF ROBOT MANIPULATOR: open and closed loop control system, control system concepts, linear control schemes, PID control system, types of motion control, electric drives and motor control, planning of trajectories.	07
5.	CONTROL COMPONENTS AND SENSORS: Mechanical control by stops and cams, solenoids, relays; Internal Sensors : Limit switches, potentiometers, resolvers and synchros, tachometers, encoders and decoders; External sensing : Simple touch sensing, strain sensing, tactile sensing, acoustic sensing, magnetic sensing, capacitive sensing, laser sensing.	07
6.	END EFFECTORS : General design considerations, mechanical grippers, vacuum pads, electromagnets; End effector power sources.	07

7.	MACHINE VISION : Vision sensors and their operation, image acquisition and processing, object recognition and interpretation.	04
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List of Experiments

1. Review of RCS – 6, SCORBOT ER – V plus and Virtual Reality Software.
2. Programming for part handling using SCORBOT (on Scorbace Pro and ACL).
3. Programming for snake configuration using RCS – 6.
4. Programming on Virtual Reality – Room No. 1, 2.
5. Programming to generate a cube of given dimensions in space using SCORBOT(onScorbace Pro and ACL).
6. Programming for Golfer Configuration using RCS – 6.
7. Programming for decision making between two and three objects using SCORBOT (on Scorbace Pro and ACL).
8. Programming for Drawbot configuration using RCS – 6.
9. Programming to test the input and output function using SCORBOT (on Scorbace Pro and ACL).
10. Programming for Finger configuration using RCS – 6.

Text Books:

1. Industrial Robotics
Groover M.P.
McGraw Hill International

Reference Books:

1. A Robot Engineering Textbook
Mohsen Shahinpoo
Harper & Row Publishers
2. Robotics and Control
R.K. Mittal, I.J. Nagrath
Tata McGraw-Hill
3. Robotics
Gonzalez Fu and Lee
4. Introduction to Robotics: Analysis, Systems, Applications
Saeed B. Niku
PHI publishers