GUJARAT TECHNOLOGICAL UNIVERSITY

Master of Engineering
Subject Code: 3722813
Semester – II
Subject Name: Advance Robotics

Type of course: Elective IV

Prerequisite: Nil

Rationale:
Robotics are one of the most demanding subject to be handled as a whole in a due to the extreme diversity of scientific technologies it incorporates. It uses quite many fields of technology, for example; mechanical engineering, electrical engineering, computer sciences, electronics, sensors, actuators and artificial intelligent. It is a multidimensional area which takes advantage of all engineering studies that exist in our life besides a hard mathematical module application which is required to be applied. To understand the mechanical design of a robot students need to study robot control devices, motion control system and End effectors, also student require to study machine vision technology.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
03	0	02	04	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	INTRODUCTION: Automation and Robotics, Robot anatomy, robot configuration, motions joint notation work volume, robot drive system, control system and dynamic performance, precision of movement.	07
2	CONTROL SYSTEM AND COMPONENTS: Basic concept and modals controllers control system analysis, robot activation and feedback components. Positions sensors, velocity sensors, actuators sensors, power transmission system.	08
3	MOTION ANALYSIS AND CONTROL: Manipulator kinematics, position representation forward transformation, homogeneous transformation, manipulator path control, robot dynamics, configuration of robot controller.	08
4	END EFFECTORS: Grippers-types, operation, mechanism, force analysis, tools as end effectors consideration in gripper selection and design.	08
5	SENSORS: Desirable features, tactile, proximity and range sensors, uses sensors in robotics	06

6	MACHINE VISION: Functions, Sensing and Digitizing-imaging, Devices, Lighting techniques, Analog to digital single conversion, Image storage, Image processing and Analysis-image data reduction, Segmentation feature extraction. Object recognition, training the vision system, Robotics application.	08

Suggested Specification table with Marks (Theory): (For BE only)

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
20	**20**	**20**	**20**	**10**	**10**

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:

1. Introduction to Robotics Analysis, Systems, Applications by Saeed B Niku PHI.
2. A Robot Engg text book by Moshen Shahinpoor, Harper and Row Publishers,NY.
3. Fundamentals of Robotics – Analysis and Control, Robert J Schilling, PHI.
4. Robotic technology, Principles and practice – Werner G Holz book – Van Nostrand Reinhold Co NY.
5. Robotic Engineering – An Integrated Approach by Richard D Klaffer, Thomas A Chmielewski, Michael Negin – PHI.
6. Robot Dynamics and Control – Mark W Spong, M Vidyasagar – Wiley India.
7. Intro to Robotics, Mechanics and Control by John J Craig, Pearson Education.
8. Modelling and Control of Vehicular and robotic systems by Sisil Kumararawadu – Narosa publishing house.
9. Industrial Robots by Ganesh S Hegde – Laxmi Publications.

Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	Acquire the knowledge of control system of robotics to apply for industrial application	30
CO-2	Understand robot sensors, motion and end effectors for different application.	40

CO-3	Understand machine vision technology and application in industry.	30

Term Work:
The term work shall be based on the topics mentioned above.

List of Experiments:

As per syllabus content

Major Equipment:

Industrial Robot

List of Open Source Software/learning website:

NPTEL