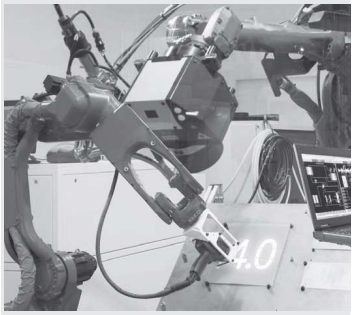
19ME402 ROBOTICS



Source:
https://www.google.com/search?q=robotics

Hours Per Week :

L	T	P	C
3	-	2	4

Total Hours :

L	T	P
45	-	30

WA/RA	SSH/HSH	CS	SA	S	BS
5	40	-	8	-	-

COURSE DESCRIPTION AND OBJECTIVES:

This course deals with the robot kinematics, trajectory planning, robot applications, real world interface and problem associated with their design. The objective of this course is to develop real time interfacing of robots for industrial and societal needs.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes:

COs	Course Outcomes	POs
1	Understand brief history of robot, construction and various types of links and joints of a manipulator.	1
2	Analyze the kinematics of robots and control systems.	2,5
3	Design the robot end effector based on applications.	2
4	Acquire knowledge about various sensors and robot vision.	1
5	Develop various real time robots for industrial and societal applications.	2,3,5

SKILLS:

- ✓ *Determine the position and orientation of the end effecter with respect to base frame.*
- ✓ *Design and analysis of various types of grippers.*
- ✓ *Develop programs for robots as per end application.*
- ✓ *Apply respective path planning algorithms for required trajectory.*
- ✓ *Operate and Jog on real time industrial welding robots.*

UNIT- I **L-9**

INTRODUCTION: Introduction to Robotics, Laws of Robotics, Robot components, Robotic configurations, Work space analysis, Robot languages, Mappings - changing descriptions from frame to frame, translations, rotations and transformations; Kinematic Modelling of the manipulator, D-H Representation, Forward and Inverse Kinematics.

UNIT- II **L-9**

END EFFECTORS AND SENSORS: Classification of end effectors, Tools as end effectors - mechanical, adhesive, vacuum, magnetic grippers, gripper force analysis and gripper design; Sensors - types and applications, position sensors, potentiometers, resolvers, encoders, velocity sensors.

UNIT- III **L-9**

ACTUATORS AND CONTROL SYSTEMS: Pneumatic actuators, Hydraulic actuators, Electrical actuators, Servo motor, Stepper motors, Feedback components; Introduction to control systems, Open loop and closed loop systems - examples, elements of closed loop systems, block diagram reduction techniques, transfer function, mechanical and electrical systems; Introduction to P, PI and PID controllers.

UNIT- IV **L-9**

TRAJECTORY PLANNING: Introduction to trajectory planning, Definitions and planning tasks, Joint space techniques, Cartesian space techniques, Position and orientation trajectories, Point-to-point planning, Continuous path generation.

UNIT- V **L-9**

INDUSTRIAL ROBOTS: Types of industrial robots, Load handling capacity, General considerations in robotic material handling, Material transfer, Machine loading and unloading, Robot centered cell, Application of robots - Arc welding, Spot welding, Spray painting, assembly and medical.

LABORATORY EXPERIMENTS

LIST OF EXPERIMENTS **TOTAL HOURS: 30**

1. To demonstrate different types of links and joints used for robots.
2. Demonstration of cartesian/ cylindrical/ spherical/ articulate/ SCARA robot.
3. To develop a program for solving the Robot Arm Kinematics using MATLAB.
4. To validate the program using - Arduino/Raspberry pi.
5. To create interface for servo/stepper motors with joints.
6. To develop a model robot for pick and place operation.
7. To analyze and test the path planning algorithm on real time robot (like Three wheeled robot).
8. Implementation of trajectory planning algorithm for straight line motion using MATLAB.
9. To develop an algorithm for object recognition.
10. Hands on practice real time industrial MIG welding robot.

TEXT BOOKS:

1. Spong M. and Vidyasagar M, “Robot Dynamics and Control”, 2nd edition, John Wiley & Sons, 2008.
2. Nicholas Odrey, Mitchell Weiss, Mikell Groover, Roger Nagel , Ashish Dutta, “Industrial Robotics - SIE: Technology - Programming and Applications”, 2nd edition, Paper back, McGraw-Hill Education (India) Pvt Ltd., 2017.

REFERENCE BOOKS:

1. K.S. Fu., R.C.Gonalez and C.S.G.Lee, “Robotics Control sensing, Vision and Intelligence” 1st edition, 2nd reprint, McGraw Hill International, 2008.
2. Saeed B.Niku, “Introduction to Robotics Analysis, Systems, Applications”, 2nd edition, PHI Learning Publication, 2009.
3. S.K. Saha, “Introduction to Robotics”, 2nd edition, Tata McGraw-Hill, 2009.
4. D. K Pratihar, “Fundamentals of Robotics”, Narsa Publishers, 2018.
5. R.K. Mittal & I.J.Nagrath, “Robotics and Control”, 2nd edition, 6th reprint, Tata McGraw-Hill, 2007.
6. Mikell P. Groover, Mitchell Weiss, “Industrial Robotics, Technology, Programming and Applications”, 2nd edition, McGraw-Hill International, 2008.