B.Tech III Year I Semester

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) PULIVENDULA

19AME65b- PROGRAMMING OF ROBOT AND ITS CONTROL
(Open Elective - II)

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Course Objectives: The objectives of the course are to make the students learn about
- Learn the fundamental concepts of industrial robotic technology.
- Apply the basic mathematics to calculate kinematic and dynamic forces in robot manipulator.
- Understand the robot controlling and programming methods.
- Describe concept of robot vision system.

UNIT – 1: Fundamentals of Robots: 10 Hrs

Introduction, definition, classification and history of robotics, robot characteristics and precision of motion, advantages, disadvantages and applications of robots.

Learning Outcomes:
At the end of this unit, the student will be able to
- Outline the advantages, disadvantages and applications of robot.   L2
- Compare the types of robot manipulators based on applications.   L2

UNIT – II: Robot Actuators And Feedback Components: 10 Hrs

Actuators, Pneumatic, Hydraulic actuators, Electric & Stepper motors, comparison. Position sensors - potentiometers, resolvers, encoders - velocity sensors, Tactile sensors, Proximity sensors.

Learning Outcomes:
At the end of this unit, the student will be able to
- Compare the types of actuators used in robot manipulator.   L2
- List out the various types of robots and feedback components.   L2

UNIT – III: Robot Programming   10Hrs

Methods of programming - requirements and features of programming languages, software packages, problems with programming languages. VAL, RAIL, AML, C, C++.

Learning Outcomes:
At the end of this unit, the student will be able to
- List out the various methods of robot programming   L2
- Explain the requirements and features of programming   L2

UNIT – IV: Control of Manipulators: 8 Hrs

Open- and close-loop control, the manipulator control problem, linear control schemes, characteristics of second-order linear systems, linear second-order SISO model of a manipulator joint, joint actuators, partitioned PD control scheme, PID control Scheme, computer Torque control, force control of robotic manipulators, description of force-control tasks, force control strategies, hybrid position/force control, impedance force/torque control.

Learning Outcomes:
At the end of this unit, the student will be able to
- Explain the basic concepts of robot controlling systems.   L2
- Outline PD and PID control schemes.   L2
- Use the force control strategies to determine the forces in robot.   L3
- Explain the force control and torque control techniques.   L2

UNIT – V: Robot Vision: 8 Hrs

Introduction, architecture of robotic vision system, image processing, image acquisition camera, image enhancement, image segmentation, imaging transformation, Camera transformation and calibrations, industrial applications of robot vision.

Learning Outcomes:
At the end of this unit, the student will be able to

- Identify the components of robot vision system. L3
- Explain the concept of image enhancement, segmentation and transformation. L2
- List the various components of robot vision system. L1
- Illustrate the industrial applications of robot vision system. L2

Text Books:
1. Mikell P. Groover and Mitchell Weiss, Roger N. Nagel,Nicholas G.Odrey , Industrial Robotics — Mc Graw Hill, 1986.
2. R K Mittal and I J Nagrath, Robotics and control, Illustrated Edition, Tata McGraw Hill India 2003..

Reference Books:
1. Saeed B. Niku, Introduction to Robotics – Analysis, System, Applications, 2nd Edition, John Wiley & Sons, 2010.
2. H. Asada and J.J.E. Slotine, Robot Analysis and Control, 1st Edition Wiley- Interscience, 1986.
3. Robert J. Schillin, Fundamentals of Robotics: Analysis and control, Prentice-Hall Of India Pvt. Limited, 1996.
4. Mohsen shahinpoor, A robot Engineering text book, Harper & Row Publishers,1987.
5. John.J.Craig Addison, Introduction to Robotics: Mechanics and Control, Wesley, 1999.
6. K.S. FU, R.C. Gonzalez and C.S.G Lee, Robotics: Control, sensing, vision, and intelligence . Mc Graw Hill, 1987.
7. Richard D. Klafter, Thomas Robotic Engineering an integrated approach, PHI publications 1988.

Course Outcomes:
At the end of this Course the student will be able to

- Explain fundamentals of Robots. L2
- Apply kinematics and differential motions and velocities. L3
- Demonstrate control of manipulators. L2
- Understand robot vision. L2
- Develop robot cell design and programming. L3

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