

IV B.Tech. II Semester Regular Examinations, April/May -2005
ROBOTICS & AUTOMATION
(Common to Electronics and Instrumentation and Bio Medical Engineering)
Time: 3 hours **Max Marks: 80**

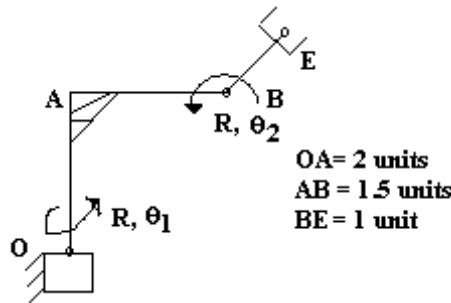
Answer any FIVE Questions
All Questions carry equal marks

1. (a) What are the various generations Robot? Discuss them with suitable examples.
(b) With the help of line diagram explain basic components of a Robot system.
2. Explain with the help of neat sketches, the function and working of Hydraulic Pneumatic and Electrical power drives used in Robots.
3. What is robot vision? What are the types of vision sensors used to take the image of an object? Explain them briefly. Enumerate their advantages and limitations.
4. What is the function of gripper? Discuss various types of Grippers used in industrial Robots. What are the important steps to be considered while designing Grippers used for handling Fragile objects objects?
5. (a) Discuss Newton-Euler formulations used for construction of Robot dynamic model.
(b) Sketch and explain the working of an acoustic sensor used in robot.
6. (a) Explain the various capabilities and limitations of the robot languages.
(b) Discuss the general properties of inverse kinematics problem.
7. Explain the following robot cells with the help of neat sketches.
 - (a) In-line robot cell
 - (b) Mobile robot cell
8. (a) Discuss the applications of robot in the medical field.
(b) What is meant by multiple robots? Briefly explain about multiple robots.

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1. Describe different drives used for the actuation of joints in robots.
2. Describe range sensing by
 - (a) Triangulation
 - (b) Structured lighting
3. Discuss the design considerations of mechanical grippers.
4. Obtain the dynamic equations for a RP planar manipulator using Lagrangean formulation.
5. Formulate the Jacobian matrix for the manipulator shown in figure.



6. What is meant by robotic cell and explain its applications in manufacture.
7. Explain the methods used to describe orientation of the hand.
8. (a) Explain the following terms:
 - i. Degrees of freedom
 - ii. Redundant degrees of freedom
- (b) A homogeneous transformation matrix represents an object (camera) as seen from the base is given by

$$[T] = \begin{bmatrix} 0 & -1 & 0 & 10 \\ 1 & 0 & 0 & 9 \\ 0 & 0 & -1 & 1 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

Find the matrix representing the base as seen from the camera.

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1. Discuss different configurations of robots used.
2. Explain with sketches Hydraulic and Pneumatic drives used in actuation of robots.
3. Describe optical sensors with sketches.
4. Mention the types of end effectors and describe any two of them.
5. Differentiate between Newton-Euler formulation and Lagrangian formulation for obtaining dynamic equations.
6. Explain Euler angle representation of orientation and obtain Euler angles using inverse kinematics.
7. A point is represented in frame 1 by $[8, 10, 15]^T$ as coordinates. Frame 2 is obtained by rotation about X-axis by 60° followed by a rotation of 30° about current Z-axis. Find the coordinates of the above point in frame 2.
8. Describe non-manufacturing applications of robot.

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1. Describe polar configuration robot along with its workspace.
2. How robot vision works and mention the processes involved?
3. Explain Hydraulic drive used in a robot describing its components. Compare Hydraulic drive with pneumatic drive.
4. (a) Explain the differences between proximity and tactile sensors.
(b) Describe the working of an acoustic sensor.
5. Obtain dynamic equations for a two link (RR) planar manipulator using Lagrangian formulation.
6. Explain the design consideration for the design of grippers.
7. Mention the programming language used and explain specific features of two programming languages.
8. (a) How do you select a robot? Explain.
(b) Explain the features of robot used for arc welding applications.
