

IV B.Tech. II Semester Supplementary Examinations, July -2005
ROBOTICS & AUTOMATION
(Common to Bio-Medical Engineering and Electronics and Instrumentation Engineering)

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks

1. (a) Classify the robots based on their different configurations and discuss their applications, limitation.
(b) Define Degree of Freedom and discuss the various degrees of freedom associated with the Polar coordinate robot arm and body.
2. Explain the principle of pneumatic actuator used in Robots. Draw a neat sketch and describe the working of Pneumatic actuator. Also explain the advantages and limitations of using pneumatic actuators in robots.
3. Explain the principle, working and advantages of the following sensors used in robots:
 - (a) Range sensor
 - (b) Proximity sensor
4. (a) Enumerate the advantages and disadvantages of hydraulic drives over electric drives and pneumatic drives.
(b) Describe the important considerations in Gripper Selection and Gripper Design.
5. What is end effector? Define and discuss 'yaw', 'roll' and 'pitch' with respect to end effector. Sketch and explain a cam actuated gripper used for robots.
6. (a) Explain in detail inverse solution of solving kinematics problem.
(b) What is robot software and explain common software elements of a robot.
7. What is meant by robot cell? What are the different robot cell layouts? Explain the different robot cell layouts with the help of neat sketches.
8. Discuss the various applications of robots in manufacturing system.

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1. (a) Discuss the relative advantages and limitation of various generations of robots.
(b) Describe the functions of the four basic types of a robot.
2. What are the different types of Electric drives used in the Robots? With a line diagram explain the operation of Stepper motor drive and mention their advantages and limitations.
3. (a) What are the different types of sensors used in robots? Explain the suitable sensor to measure the position of the gripper accurately.
(b) Explain the various functions of machine vision system.
4. (a) What are the different types of actuators? Discuss any two types of actuators.
(b) With the help of neat sketch, explain the pneumatic manipulator control circuit in industrial Robots.
5. What is the function of the Gripper? What are the different types of Grippers used in Robots? Discuss any two types of Grippers with the help of neat diagrams.
6. (a) Discuss Jacobian work envelope for any one type of Robot.
(b) Enumerate the advantages and limitations of various robot languages.
7. Describe the following search techniques:
 - (a) Depth-first search
 - (b) Breadth-first search
 - (c) Best-first search.
8. (a) Explain the application of industrial robots in the non-manufacturing areas.
(b) What is robot work cell? Explain the design considerations of a robot cell.

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1. (a) Define 'accuracy', 'resolution' and 'repeatability'. Discuss their importance in the field of robots.
(b) Enumerate the advantages of Robots over other forms of automation.
2. What are the applications of sensors used in robots? Discuss various types of ranging sensors used for Robots. Describe their advantages and disadvantages.
3. Discuss principle of tactile sensors used in Robots? What are the different types of tactile sensors? Explain any one type with suitable sketch. Discuss the applications, limitations and advantages tactile sensors.
4. (a) What are the different forces acting on the end effectors? Explain any one method to control the force acting on the end effectors.
(b) Explain the necessity of construction of Robot dynamic model for effective control of Robot arm manipulator.
5. Describe the following types robot grippers with the help of neat sketches:
 - (a) Cam operated gripper
 - (b) Gear operated gripper
 - (c) Lever operated gripper.
6. Discuss the different inputs to an inverse kinematics algorithm? Explain the solution of a simple inverse kinematics algorithm.
7. State characteristics of work which promote application of robots. Discuss robot application for assembly and inspection.
8. (a) What is robot software? Discuss the software elements of robot and different teaching methods of robot.
(b) List the advantages and disadvantages of off-line programming? Explain the different robot cell layouts.

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1. (a) Discuss various generations of Robot indicating their modifications at each stage.
(b) With the help of line diagram explain basic components of a Robot system.
2. (a) Discuss various types of tactile sensors highlighting their specific applications.
(b) Distinguish constructional details of Scara and Gantry robots. Mention their specific applications.
3. (a) Enumerate the differences between hydraulic and pneumatic actuators highlighting merits and limitations of each type.
(b) With a line diagram explain the operation of pneumatic actuators for Robots. What are its limitations?
4. (a) What is robot vision? Explain the various types of vision sensors used to take the image of an object.
(b) Explain the principle of working of the following sensors used in robots:
 - i. Range sensor
 - ii. Tactile sensor.
5. (a) Define the following terms and compare their characteristics:
 - i. End effectors
 - ii. Gripper.
(b) Compare mechanical grippers with other types of grippers used in robots.
6. (a) Distinguish between the forward solution and inverse solution of solving kinematics problems and Forward solution method in detail.
(b) Write the necessary steps required for solution of inverse kinematics problem using hill climbing technique.
7. (a) What is robot software? Explain the important points to be considered for robot software.
(b) What is robotic work cell? Explain the design considerations of a robotic cell.
8. Write a short note on the following:
 - (a) Dynamic stability of Robot

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Set No.4

- (b) Encoders
- (c) Robots in manufacturing applications.
