Code No: R5421002

B.Tech.IV Year II Semester(R05) Regular & Supplementary Examinations, April/May 2010
ROBOTICS AND AUTOMATION
(Electronics & Instrumentation Engineering)

Time: 3 hours   **Max Marks: 80**

Answer any FIVE questions
All questions carry equal marks
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1. (a) What is a Robot? Describe the function of the basic components of a robot.
   (b) Discuss the reasons for using a robot instead of a human being to perform a specific task.

2. (a) How do you specify a robot? Is robotics an automation? Discuss the different classification systems of robots.
   (b) Discuss the differences between servo controlled and non-servo controlled robots. Sketch and explain the servo control system for point to point positioning.

3. (a) Distinguish between shunt wound motor and series wound motor. Sketch and explain the principle of operation of stepper motor.
   (b) Distinguish between tactile and non-tactile sensors. Sketch and explain the working of an acoustic sensor.

4. (a) Distinguish between two-point and three-point centering of robot gripper. Explain any two types of grippers used for robots.
   (b) What is the function of a manipulator? Sketch and explain a robotic manipulator arm.

5. (a) Write the homogenous transform matrix for a rotation of 90^0 about the z axis followed by a rotation of -90^0 about the axis, followed by a translation of (3,7,9).
   (b) What are the various inputs to an inverse kinematics algorithm? Explain functioning of an inverse kinematic algorithm.

6. (a) Explain the geometric based direct kinematic analysis of articulated robot.
   (b) Distinguish between first generation and second generation robot languages. Discuss the various instructions used in programming.

7. (a) What is meant by robot cell? Explain the different robotic cell layouts.
   (b) What is spot welding? Describe briefly the operations involved in robotic spot welding. What are the advantages of robotic welding over manual welding?

8. (a) Write short notes on any THREE of the following.
      i. Degrees of freedom.
      ii. Machine Vision.
      iii. Vaccum Grippers.
      iv. Robot cell design.

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Answer any FIVE questions
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1. (a) Define Automation. Distinguish between fixed automation and programmable automation.
   (b) Give the classification of industrial robots based on their control systems. Discuss in detail the play back robots with continuous path control and intelligent robots.

2. Discuss in detail about photo detector tactile sensors with neat sketches.

3. Explain the variable structure systems for the control of manipulators.

4. (a) How is a robot end-effector specified? Discuss the design considerations in the robot end-of-the-arm tooling.
   (b) What is the function of a manipulator. Discuss the working of a robotic manipulator arm with a sketch.

5. (a) What is robot vision? Describe a vision sensor used to take the image of an object.
   (b) Discuss response, accuracy and sensitivity in relation to robot sensors. Explain the working of proximity and range sensors.

6. (a) What are the different types of actuators used for robots? Explain the working of a hydraulic actuator system.
   (b) Classify the robot end-effector from the view point of control. Sketch and explain a cam actuated gripper used for robots.

7. (a) Discuss the different inputs to an inverse kinematics algorithm. Explain the solution of a simple inverse kinematic algorithm.
   (b) What is homogenous transformation of coordinates? Write the homogenous transformation matrix for translation in 3D.

8. Write short notes on any THREE of the following:

   (a) Asimov's laws of robotics.
   (b) Hydraulic drives.
   (c) Magnetic grippers.
   (d) Robot applications in manufacturing.

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1. (a) Compare the various attributes of robot with those of human being. Explain a robot structure with a sketch.
   (b) What are the various types of joints used in robots? Sketch the following robots indicating the joints and degree of freedom.
       i. SCARA robot.
       ii. Gantry robot.

2. Discuss in detail about photo detector tactile sensors with neat sketches.

3. Explain the variable structures systems for the control of manipulators.

4. (a) How is a robot end-effector specified? Discuss the design considerations in the robot end-of- the-arm tooling.
   (b) What is the function of a manipulator. Discuss the working of a robotic manipulator arm with a sketch.

5. (a) What is robot vision? Describe a vision sensor used to take the image of an object.
   (b) Discuss response, accuracy and sensitivity in relation to robot sensors. Explain the working of proximity and range sensors.

6. (a) What is homogenous transformation of coordinates? Write homogenous transformation matrices for rotation in 3D.
   (b) Determine a T matrix that represents a rotation through an angle about OX axis followed by a rotation of about the OY axis.

7. (a) What is Jacobian work envelope? Explain in brief.
   (b) Explain the different hill climbing techniques.

8. (a) What are the various applications of robots in hazardous areas? Discuss them in detail.
   (b) Explain the concept of tracking window in in-line robot work cell.

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1. Discuss the anatomy of Robot and explain the important parts of a robot with a neat sketch.

2. (a) Enumerate the advantages and limitations of Lead through method robot languages and Textual robot languages.

   (b) What is meant by dynamic stabilization of robot? Discuss briefly.

3. What are the advantages of using pneumatic drives in the robots? Discuss the different types of pneumatic drives used in the robots with the help of neat sketches.

4. Sketch and explain the following type of sensors used in the robots (a) Laser sensors and (b) Magnetic sensors.

5. Explain various force control methods in robot manipulators.

6. What are the different types of grippers used in industrial robots? Describe any four of them.

7. How does direct kinematics differ from inverse kinematics? Discuss Euler angle representation for orientation.

8. (a) What are the various applications of robots in hazardous areas? Discuss them in detail.

   (b) Explain the concept of tracking window in In-line robot work cell.

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