

B. Tech Degree VII Semester Examination in Instrumentation, November 2009

IN 705 ROBOTICS AND EXPERT SYSTEMS

Time: 3 Hours

Maximum Marks: 100

PART A

(Answer **ANY FIVE** questions)

(5 x 5 =25)

- I. a. How do you define a robot? What do you understand by degrees of freedom?
 b. What are the different types of joints used in a robot? Describe briefly with the aid of sketches.
 c. Explain how robots are classified.
 d. Explain the terms 'Reach' and 'Stroke' of a robot.
 e. What are the different types of actuators used in robots? Compare them.
 f. With the help of sketches explain various designs of grippers used in robots.
 g. State Asimov's laws of robotics. Explain the various industrial applications of robots.

PART B

(5 x 15 =75)

- II. What are sensors? Explain the range finding sensors used in robotic applications.
OR
 III. With the help of neat sketches elaborate on Machine vision systems.
- IV. Explain DC servo motor as a drive for robotic systems.
OR
 V. Derive an equation for the drive motor torque required to move a single joint manipulator.
- VI. What do you understand by robot arm kinematics? What are the two fundamental approaches in this study? Derive the three basic 3 x 3 rotation matrices, which are used to describe the rotational operations of the body frame with respect to the reference frame.
OR
 VII. a. Explain Yaw, Pitch and Roll operations.
 b. What are composite rotation matrices and explain how they can be obtained from basic rotation matrices?
 c. Derive a composite rotation matrix for Yaw-Pitch and Roll operation in that order.
- VIII. Explain the inverse kinematics problem in robotics.
OR
 IX. a. What are homogeneous coordinates? What is the importance of that in robotics?
 b. What is a homogeneous transformation matrix?
 c. For a vector $v=25i + 10j+20k$ perform a translation by a distance 8 cm in the X - direction, 7 cm in the Y - direction and 0 in the Z - direction. Find the translated vector.
- X. a. What do you understand by Intelligence and Artificial Intelligence?
 b. Write a note on "Predicate Calculus".
OR
 XI. Write short notes on **three**
 (i) Future trends in robots
 (ii) Hill climbing technique
 (iii) Expert system
 (iv) Force sensing wrist and its uses in robots.
 (v) Tactile array sensors in robots.