Code No: D5506 **R09**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.TECH II - SEMESTER EXAMINATIONS, APRIL/MAY-2012
ROBOTICS
(EMBEDDED SYSTEMS)

Time: 3hours **Max. Marks: 60**

Answer any five questions
All questions carry equal marks
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1.a) What are the basic components of a robotic system? Explain the functions of each of the components with a diagram.
b) What are the different types of electric drives used in the robots? Describe them with the help of neat sketches.

2.a) A one - degree of freedom manipulator with rotary joint is to move from 1130 to 2100 in 7 seconds. Find the coefficients of the cubic polynomial to interpolate a smooth trajectory.
b) What are the different types of sensors used in robots? Explain the suitable sensor to measure the position of the gripper accurately.

3.a) What do you mean by linear stepper motor? Explain.
b) A Hydraulic rotary vane actuator is to be used for a twist joint. The power source can generate up to 8 Mpa of pressure for delivery to the cylinder at a rate of 25 cm^3/sec. The outer and inner radii of vane are 62 mm and 19 mm respectively. The thickness of each vane is 5 mm. Determine the angular velocity and the torque that can be generated by the actuator.

4.a) Find the joint space singularities of the cylindrical -coordinate robot. Describe the Self motions of the manipulator at singularities if present.
b) Derive the forward kinematics equation using the DH convention for the two link Cartesian Manipulator.

5.a) An automated guided vehicle has to be designed to aid visually disadvantageous people. What Strategy would you adopt to avoid obstacles and path planning?
b) Explain the difference between Cartesian coordinate representation and Homogeneous Coordinate representation with an example

6.a) Differentiate between incremental and absolute encoders?
b) A resolver is to indicate angular position at a rotational wrist joint. The excitation voltage to the resolver is 24 V. The resolver is connected to the wrist joint so that a given rotation of the output link corresponds to an equal rotation of the resolver. At a certain moment in time, the movement of the wrist joint results in voltage across the two pairs of stator terminals to be 10 V and -21.82 V. Determine the angle of the rotational joint.

7.a) What is robot software? Discuss the software elements of robot and different teaching methods of robot.
b) Explain the safety considerations to be followed while programming robots.

8.a) Explain YPR notation and its significance in robotics.
b) For an absolute optical encoder with 10 tracks, determine the value of the number of pulses per radian and the encoder constant. If the shaft angle of the encoders were 0.73 rad, determine its output value.

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