

7E4065

Roll No. _____

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7E4065**B. Tech. VII Semester (Main/Back) Examination, Nov-Dec-2011****Mechanical Engineering****7ME6.1 Robotics**

Time : 3 Hours

Maximum Marks : 80

Min. Passing Marks : 24

Instructions to Candidates:

Attempt any **five questions** selecting **one** question from **each unit**. All questions carry **equal marks**. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.

Unit - I

1. Using the notation scheme for defining manipulator configurations draw diagrams of the following robots.

- a) TRT b) VVR c) VROT
d) TRT : R e) TVR : TR f) RR : T

OR

1. Describe the differences in orientation capabilities and work volumes for a : TR and a : RT wrist assembly. Use sketches as needed.

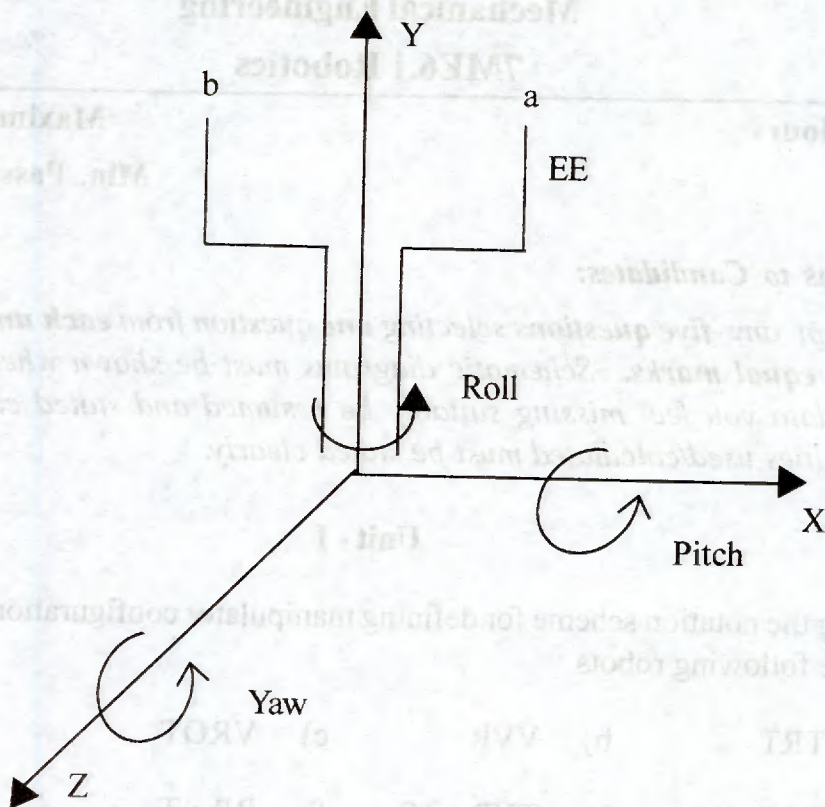
Unit - II

2. A robotic end effector is positioned as shown in Fig - 1. The yaw of the end effector (EE) is $\pi/2$ about Z-axis. The pitch of EE is π about X-axis and roll of the EE is $-\pi/2$ about Y-axis.

- a) Draw the sketch of the EE in sequence often each of yaw, pitch and roll motions
b) The composite transformation matrix T which maps the tip Co-ordinates into the EE's wrist frame.

- c) Find the co-ordinates of a point $p(0, 1.6, 0)$ at tool t.p with respect to wrist co-ordinate frame.

Fig - 1



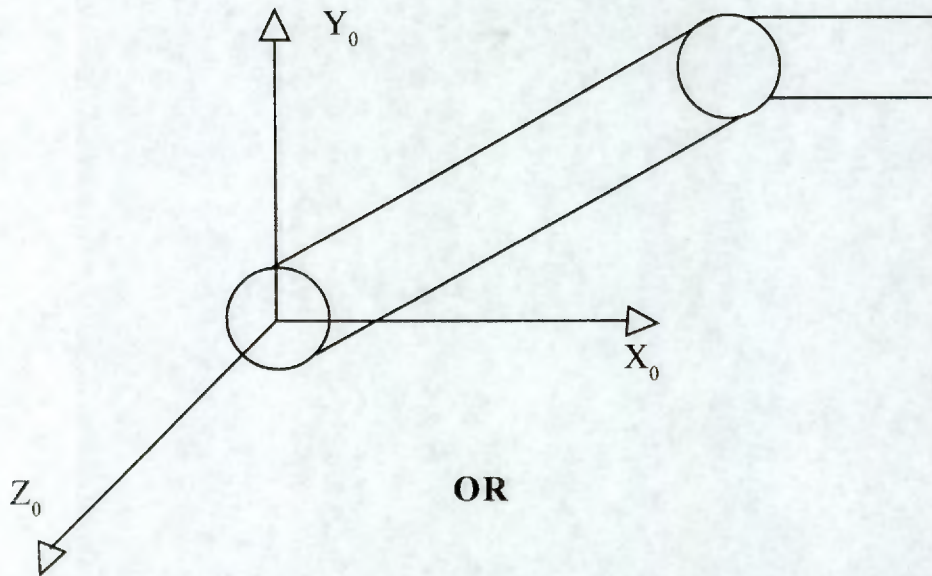
OR

2. Compute the rotation matrix to represent a rotation of 90° about an arbitrary vector $V = (2, 2, 2)^T$.

Unit - III

3. A two degree of freedom robot manipulator is shown in Fig - 2. Given that the length of each link is 1 unit. Establish link co-ordinate frame and the kinematic parameters. Find 0A_1 and 1A_2 .

Fig - 2



OR

3. Explain and derive inverse kinematic solution for the variables of a cylindrical robot.

Unit - IV

4. With the help of a block diagram, Explain the functions of a robotic vision system and devices used in the same.

OR

4. A raster scan system of vision has a frame of face - plate with 256 lines, having $\frac{1}{3}$ Sec as the scanning rate. It may be assumed that the electron beam takes 10% of the scan time to move from one line to other line. If there are 256 pixels per line, determine the sampling rate.

Unit - V

5. a) What are general characteristics of Industrial work situations that tend to promote the substitution of robots for human workers.
b) What are the three categories of robot Industrial applications.

OR

5. a) Explain the cost and revenue analysis of investment on robotic implementation in an Industry.
b) Give a brief overview of Robot safety.

