

BE (B10M) sem VIII (Rev)
 Robotics in Medicine
 (REVISED COURSE)

4 2nd half 11-AM(g)
 Con. 6974-11.

MP-5239

(3 Hours)

[Total Marks : 100

- N.B. : (1) Question No. 1 is **compulsory**.
 (2) Attempt any **four** questions from the **remaining** questions.
 (3) Assume any data if **necessary** specify **clearly**.

1. (a) Distinguish between Repeatability, Precision and Accuracy of a Robot. 4
 (b) Define Kinematic Parameters. 4
 * (c) What is meant by inverse Kinematic Problem? Enumerate different methods to solve. 4
 (d) Write a short note on Work Space Fixtures. 4
 (e) Explain line descriptors and area descriptors. 4
2. (a) Compare Hard and Soft Automation. 4
 (b) Clarify robots based on :— 4
 (i) Drive Technology
 (ii) Motion Control Methods.
 (c) Consider the following co-ordinate transformation matrix, which represents a fundamental rotation. What is the axis of rotation (1, 2 or 3) and find out the angle of rotation — 5

$$R = \begin{bmatrix} 0.5 & 0 & -0.866 \\ 0.0 & 1 & 0.0 \\ 0.866 & 0 & 0.5 \end{bmatrix}$$

- (d) Suppose the homogeneous co-ordinate of point is $[q]^M = [0, 0, 10, 1]^T$. Let $F = \{f^1, f^2, f^3\}$ and $M = \{m^1, m^2, m^3\}$ be initially coincident fixed and mobile co-ordinate frames respectively. If we perform a screw transformation along f^2 axis, translating by a distance of 3 units and rotating by an angle of $\pi/3$, find the co-ordinate of (q) with respect to the fixed frame of reference after the screw transformation. Determine also the pitch of the screw. 7

3. (a) Explain D. H. algorithm. 10
 (b) Draw the link co-ordinate diagram of SCARA robot and derive the total arm matrix. 10
4. (a) Develop inverse kinematic analysis of Rhino XR-3 Robotic arm. 15
 (b) Explain tool configuration vector. 5
5. (a) Explain the total work envelope, joint space work envelope, dexterous work envelope. 10
 (b) Explain how straight line motion can be obtained using an articulated robot. 10
6. (a) Explain the pick and place motion trajectory in detail. 10
 (b) Explain linear interpolation with parabolic blends. 5
 (c) What is meant by perspective transformation? 5
7. (a) Explain any one application of robotics in Biomedical Engineering. 5
 (b) Explain shrink and swell operation. 10
 (c) Discuss edge detection techniques. 5

Bounded deviation

B10M

(4)