

Code No: 56084

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**B. Tech III Year II Semester Examinations, December - 2017****ROBOTICS****(Automobile Engineering)****Time: 3 hours****Max. Marks: 75****Answer any five questions
All questions carry equal marks**

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- 1.a) Classify the robot by coordinate system.
b) What general aspects are considered for gripper selection and design? [8+7]
- 2.a) One end A of the line AB, is at origin. It is translated by +3 units in X direction, followed by +3 units in Y direction, followed by 30^0 rotation about X axis. Determine the final position of the point.
b) What are Euler angles? Discuss one of its applications. [8+7]
- 3.a) What is manipulator workspace?
b) What procedure is followed for a SCARA manipulator for inverse kinematics for finding the position of the end of the manipulator? [7+8]
- 4.a) Why the study of manipulator singularity is of great importance.
b) A moving frame [1] is represented by the following rotation matrix R, where α is the angle of rotation of the frame [1] with respect to base frame. If α is a function of time, find the angular velocity of frame [1]. [7+8]
- $${}^0R_1 = \begin{bmatrix} C\alpha & -S\alpha & 0 \\ S\alpha & C\alpha & 0 \\ 0 & 0 & 1 \end{bmatrix}$$
5. Establish the dynamic modeling of 2 DOF manipulator with 2 rotary joints. [15]
- 6.a) What are the various constraints applied to a joint for joint interpolated trajectory planning.
b) Differentiate joint space and Cartesian space trajectory planning. [8+7]
- 7.a) Describe the principle of hydraulic actuators.
b) What are the tactile sensors? Describe the types and range of each of them. [7+8]
8. How the assembly operation is automated? [15]