

Code No: 56084

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD****B. Tech III Year II Semester Examinations, April - 2018****ROBOTICS****(Automobile Engineering)****Time: 3 hours****Max. Marks: 75****Answer any five questions  
All questions carry equal marks**

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- 1.a) Distinguish an automation and a robot.  
b) Classification of robot by control system and coordinate system. [7+8]
- 2.a) Explain about homogeneous transformation.  
b) For the point  $a_{uvw} = (6, 2, 4)^T$  perform following operations.  
i) Rotate  $30^\circ$  about the x-axis followed by translation of 6 units along y-axis.  
ii) Translate 6 units along y-axis, followed by rotation of  $30^\circ$  about x-axis.  
iii) Rotate  $60^\circ$  about z-axis followed by translation of 10 units along the rotated u-axis. [5+10]
3. Write and explain the algorithm for deriving the forward kinematics for any manipulator based on D-H convention. [15]
- 4.a) What is robot arm dynamics?  
b) Find the joint space singularities of the cylindrical coordinate robot. Describe the self-motion of the manipulator out singularities if present. [7+8]
5. Establish the dynamic model of a one-axis robot (Inverted Pendulum) with Lagrangian-Euler formulation. [15]
- 6.a) Differentiate between path planning and trajectory planning.  
b) The trajectory of a particular joint is specified as follows, path points in degrees 10, 35, 25 and 10. The duration of these three segments should be 2, 1, 3 seconds respectively. The magnitude of the default acceleration to use at all blend points is  $50 \text{ degrees/sec}^2$ . Calculate all segment velocities, blend times and linear times. [7+8]
- 7.a) Explain the term Robot actuation and feedback components.  
b) Differentiate the following:  
i) Open loop and closed loop  
ii) Resolvers and encoders. [7+8]
- 8.a) What are the considerations in robot material handling?  
b) Explain simple pick and place operation of the robot. [7+8]