

Roll No. ....

Total No. of Questions : 08]

[Total No. of Pages : 01

## Paper ID [PE520]

(Please fill this Paper ID in OMR Sheet)

M.Tech (Sem. - 1<sup>st</sup>)

ROBOTICS AND INDUSTRIAL AUTOMATION (PE - 520)

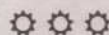
Time : 03 Hours

Maximum Marks : 100

### Instruction to Candidates:

- 1) Attempt any **Five** questions.
- 2) All questions carry equal marks.

- Q1)** (a) What are the major components of a robotic manipulator? Discuss.  
(b) Differentiate between servo and non-servo manipulators.
- Q2)** (a) What are the basic characteristics of a robot-level language? Discuss with the help of an example.  
(b) Differentiate between VAL and RAIL robot programming language.
- Q3)** (a) What is Denavit-Hartenberg notation for assigning frames to links and identifying joint link parameters? Discuss.  
(b) Discuss the direct and inverse kinematic models.
- Q4)** Compute the linear as well as angular velocity of tool tip with respect to the base 3 frame for a two link planar manipulator. Assume the two joints as rotary joints.
- Q5)** Derive expressions for joint torque for single link planar robotic manipulator having rotary joint using Newton-Euler dynamics formulations.
- Q6)** Write short note on the following :  
(a) Force Control of robotic manipulator.  
(b) Optical encoder.
- Q7)** Discuss the following :  
(a) Electrical Actuator.  
(b) Automation systems.  
(c) Pressure Control valves.
- Q8)** (a) What do you understand by Automated Guided Vehicle systems? Discuss.  
(b) Discuss the quantitative analysis of single direction and continuous loop conveyor systems.



R-1062 [2058]