*Total No of Questions: [12]* *SEAT NO. :* [ ]

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# *B.E. 2008 (Mechanical Engineering)*

## *ROBOTICS (402049C)*

## *(Semester - II)*

*Time: 3 Hours* *Max. Marks : 100*

***Instructions to the candidates:***

1) ***Answers to the two sections should be written in separate answer books.***
2) ***Answer any three questions from each section.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right side indicate full marks.***
5) ***Use of Calculator is allowed.***
6) ***Assume Suitable data if necessary***

## SECTION I

Q1) a) Explain the five basic robot configurations according to the work envelope and applications. [10]

b) Define Repeatability, Precision and Accuracy of Robot? Why repeatability is important design characteristics? [6]

OR

Q2) a) How does the SCARA arm geometry differ from the vertical articulated arm? [4]

b) Why is the SCARA arm more ideal for assembly applications? [4]

c) Explain the term "Compliance" in terms of a robot? Explain types of Compliance. [8]

Q3) a) Discuss various types of grippers used in robotics. What is the meaning of the term "end effector"? [8]

b) Which sensor can be used along with the gripper to sense whether the object is falling? Explain the working principle. [8]

OR

Q4) a) Explain the Design considerations of gripper selection. [8]

b) Compile a list of sensors that might be used in robotic systems. For each sensor, give an application. [8]

Q5) a) Explain the advantages/disadvantages of using pneumatics vis a vis hydraulics as power source for drives in Robotics. [8]

b) A joint in a PTP robot, Which rotates from an initial angle of 5°to a final angle of 65°in 5 sec with a constant velocity. Determine the position of the joint in 1,2,3,4 secs and plot the results. [10]

OR

Q6) a) Enlist the different Components used in transmission systems of a robot. Write advantages & disadvantages of each in perspective of accuracy of robot. [8]

b) Explain different types of controllers used in robots [10]

## SECTION II

Q7) a) A planar 3R manipulator has link lengths $l_1$=100 mm, $l_2$=80 mm and $l_3$=60 mm. Determine its reachable workspace and state whether point (200,100) is reached with $\theta_1$=40°. If yes, what are the values of $\theta_2$ and $\theta_3$? If no, then what should be the minimum value of $\theta_1$ so that the point will be reached by the manipulator? [8]

b) Explain the Newton- Euler Dynamic formulation. [10]

OR

Q8) a) Explain the two approaches to inverse kinematic solutions. [8]

b) Find whether the following matrix is a rotation matrix or not. If not, then identify an element which may be modified to convert the matrix into rotation matrix. [10]

$$\begin{pmatrix} 0.5687 & 0.7141 & 0.4082 \\ 0.7462 & 0.6567 & 0.1094 \\ 0.3462 & 0.2424 & 0.7063 \end{pmatrix}$$

Q9) a) Describe the functions of a machine vision system. [8]

b) Explain WAIT, DELAY and SIGNAL commands. [8]

OR

Q10) a) Write short notes on: [8]

i) Manual mode of programming ii) Offline programming

b) What are the different image pre-processing techniques? [8]

Q11) a) Describe the three primary descriptors applied to simulation that serves as the characteristics of the simulation. [8]

b) Explain the term Robot Safety. [8]

OR

Q12) a) Give the need and applications of artificial intelligence. [8]

Discuss the new trends and recent updates in Robotics. [8]