Total No. of Questions : 12]

SEAT No. :

P1944

[Total No. of Pages : 3

[5254]-45
B.E. (Mechanical)
ROBOTICS
(2008 Pattern)

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

Instructions to the candidates:

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

SECTION - I

Q1) a) Explain the terms : **[6]**

i) Repeatability

ii) Compliance

iii) Spatial resolution

b) State three laws of Robotics & discuss the significance of any one of them. **[6]**

c) Discuss various advantages of robotsation. **[6]**

Q2) a) Sketch & explain the working of Cartesian gantry type robot. State it's applications. **[6]**

b) Sketch and explain the motions a 3 DOF wrist can perform. **[6]**

c) Sketch and explain types of joints in robot. **[6]**

Q3) a) What are different factors to be considered in design of gripper? **[7]**

b) Explain with neat sketch (any three) : **[9]**

i) A rotory position sensor

ii) A microswitch

iii) A force sensor

iv) A proximity sensor

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Q4) a) Explain with neat sketch the working of stepper motor. State it's advantages. **[8]**

b) Compare close loop control with open loop control system. **[8]**

Q5) a) Compare Pneumatic & Hydraulic actuators w.r.t. their merits & demerits. **[8]**

b) Explain briefly **[8]**

i) Proportional Control

ii) Proportional + Integral Control

Q6) a) What are the different types of actuators? Explain any two briefly. **[6]**

b) Explain the control law of partitioning. **[6]**

c) State the comparison of robot drive systems. **[4]**

SECTION - II

Q7) a) A planar 3R manipulator has link lengths l_1 = 100 mm, l_2= 80mm 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 θ_2 and θ_3? If no, what should be the minimum value of θ_1 so that the point will be reached by the manipulator? **[8]**

b) Explain Newton's - Eural's dynamics formulation. **[8]**

Q8) a) Explain the following terms (Any 2) : **[8]**

i) Fixed Angle Representation

ii) Euler Angle Representation

iii) Forward Kinematics

b) Derive the dynamic model of a 2 DOF Planer RR Manipulator. **[8]**

Q9) a) Explain the image processing techniques. **[6]**

b) Explain the following (Any 2) : **[6]**

i) Image acquisition

ii) Sampling

iii) Edge detection

c) Explain basic modes of robot language operating system. **[6]**

Q10)a) Explain typical vision system for a robot. **[6]**

b) Explain the various methods to enter programming command into the controller memory. **[8]**

c) Discuss various motion interpolation schemes. **[4]**

Q11)a) Describe various search techniques used with respect to Artificial Intelligence in robots. **[8]**

b) Discuss tool and techniques of the simulation. **[8]**

Q12)a) Explain maintenance and safety aspects of robots. **[6]**

b) Explain the following : **[10]**

i) Genetic algorithm

ii) Artificial neural network