[4860] -101

M.E. (Mechanical Engineering - Design Engineering)
c-ROBOTICS
(2008 Course) (Semester - I) (Elective-II)

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

Instructions to the candidates:

1) *Answer three questions from each section.*
2) *Answer to the each section should be written in separate books.*
3) *Figures to the right indicate full marks.*
4) *Use of electronic pocket calculator is allowed.*
5) *Assume suitable data, if required.*

<u>SECTION - I</u>

Q1) a)   Explain elements of Robotics and its working.   **[6]**

b)   Give classification of robotic systems used in industry and write a note on one of the them.   **[10]**
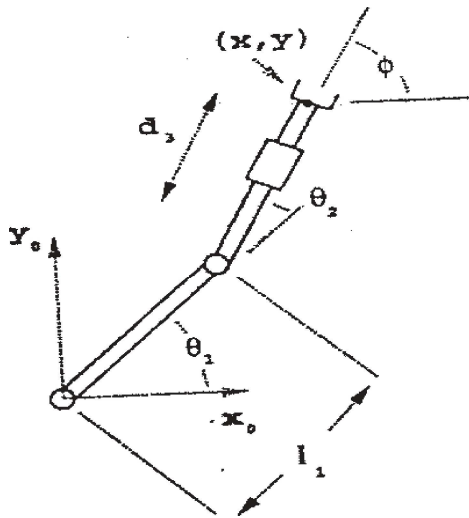
Q2) a)   Explain following terms.   **[10]**

   i)   Point to point control

   ii)   Work volume

   iii)   Spatial resolution

   iv)   Precision and Accuracy

   v)   Continuous path controls.

b)   Explain step by step procedure for forward kinematics and why inverse kinematics produces multiple solutions?   **[6]**

Q3) a) Figure shows a planar three-degrees-of-freedom manipulator. The first two joints are revolute, and the third is prismatic. The end effector position (x, y) is expressed with respect to the (fixed) world coordinate frame $(x0, y0)$, and the orientation of the end effector is defined as the angle of the second link φ measured from the x0 axis as shown. The link length $l1$ is constant. The joint variables are given by the angles θ1 and θ2 and the displacement $d3$, and are defined as shown. The example will be used throughout this section to demonstrate the ideas behind the various kinematic problems of interest.

Derive a relation for gripper position using matrix method. **[10]**

b) Explain following configurations of robotic systems. **[6]**

i) 2R Robot

ii) 3R Robot

iii) 3P Robot

Q4) a) Explain iterative method used in Newton-Euler Dynamic formulation. **[8]**

b) Explain Lagrangian formulation of Manipulator. **[10]**

SECTION - II

Q5) a) Write down the general considerations used in path description and generation. **[10]**

b) Explain cartesian and polar coordinate system in terms of robotic analysis and its formulations using PUMA robot. **[6]**

Q6) a) Explain working of Optical Encoders and write a difference between absolute and incremental encoders. **[8]**

b) Explain working of Touch and Slip Sensors. **[8]**

Q7) a) Write a note on Real-time operating systems used in robotics. **[8]**

b) Explain working of H-Bridge drives used in DC motor controls. **[8]**

Q8) Write note in following (Attempt any three). **[18]**

a) Overload current and stall detection methods.

b) Microprocessor based robot controllers.

c) Hydraulic and Pneumatic actuators in robotics.

d) Proximity Sensors

e) Velocity and Acceleration sensors.

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