2018

ROBOTICS

Paper : CS 812

Full Marks : 100

Time : Three hours

The figures in the margin indicate
full marks for the questions.

Answer **any five** questions.

1. (a) Explain reinforcement learning with a
     diagram.   6

   (b) Describe the powered and manual lead-
       through programming with an example.
                                                 8

   (c) Write down the manipulators joints
       with their notations and diagrams.
                                                 6

2. (a) Evaluate two new points a_{xyz} and b_{xyz} using homogeneous transformation matrix. The given two points a_{uvw} and b_{uvw} are $(9, 5, 4)^T$ and $(8, 6, 3)^T$ respectively.

(hint : Apply forward transformation i.e. to find x and y co-ordinates.)   6

(b) Explain two degree of freedom (2-DOF) robot manipulator (R-R).

Define the position of end-arm in the world space using the links L_A and L_B (apply forward transformation).

Calculate the reverse transformation (θ_A and θ_B) of this 2-DOF in the figure given below.   14
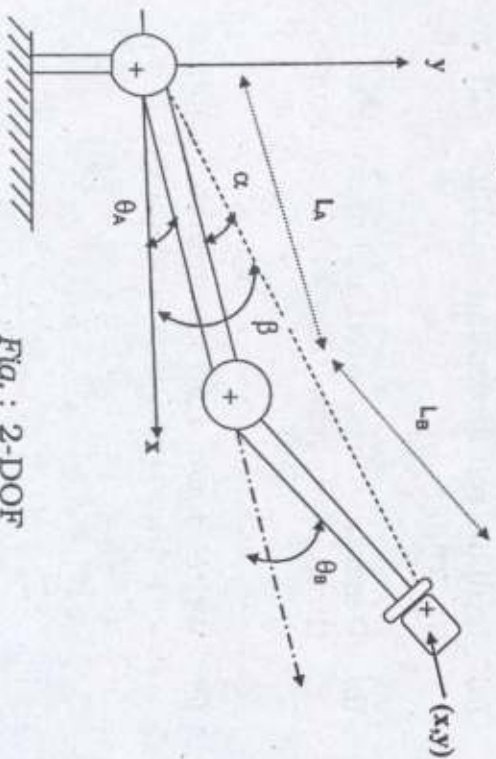
Fig. : 2-DOF

3. (a) Draw a diagram of 3-DOF and define every parameters (links and joints) of this two-dimensional space.   8

(b) Write down the three kinds of joint drive systems.   6

(c) Write down the subtasks for controlling an autonomous robot.   6

4. (a) Evaluate the rotation transformation of a vector $V = 20i + 10j + 5k$, which is rotated with an angle of $60°$ about the x-axis.   8

(b) Explain prismatic and revolute joints with diagram.   8

(c) Describe link length and link twist.   4

5. (a) Explain the kinematics function of link and also D-H transformation with all parameters.   8

(b) Calculate the T-matrix for the given parameters in table using D-H transformation.

Joint i	α_i	a_i	D_i	θ_i
1	0	a_0	0	θ_0
2	-30	a_1	d_1	θ_1
3	0	0	d_1	θ_2
4	60	0	d_2	θ_3

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6. Write short notes on : *(any four)*

4×5=20

(a) Entropy

(b) Industrial robot

(c) Sensor fashion

(d) Sensor fusion – false positive/false negative

(e) Geons

(f) Attributes of a sensor.

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