GANPAT UNIVERSITY
M. Tech. Semester IInd CAD-CAM
Regular Examination May – June 2014
3ME214 Robotics and Intelligent Manufacturing

Time: 3 Hours / ~~Paper Scheme~~   **Total Marks: 70**

Instruction: 1 Start a new question from new page.
2 Draw the figure with right indication.
3 Answer to the two sections must be written in separate answer sheet.
4 Assume necessary data and mention your assumption.

Section - I

Q. 1 Answer the following questions.

(a) Explain Knowledge triangle.   (02)
(b) Suggest which strategy BFS/DFS will be better for water jag problem? Justify your answer.   (05)
(c) Discuss following terms.   (05)
   1) Backward chaining
   2) Heuristic function
   3) Inference
   4) Facts and predicate
   5) Cognitive

OR

Q. 1 Answer the following questions.

(a) Explain Turing test for checking intelligence of system.   (02)
(b) Describe about short term memory and long term memory of human information system. (04)
(c) Explain domains of Artificial Intelligence.   (06)

Q. 2 Answer the following questions.

(a) How ANN works? Explain Robertson perception Model of ANN.   (03)
(b) Discuss different activation functions used in ANN.   (04)
(c) Discuss application of ANN in prediction of surface roughness of metal cutting process on lathe. (04)

OR

Q. 2 Answer the following questions.

(a) Discuss term fuzzy logic. Write down rules for fuzzy controlled automobile welding robot. (06)
(b) Explain architecture of Expert system for manufacturing processes.   (05)

Q.3 Answer any three of the following questions.   (12)

(a) Write short note on fuzzy controller with block diagram.
(b) Differentiate between expert system and decision support system.
(c) Discuss Breadth first search procedure with an example.
(d) Name and describe the main features of Genetic Algorithms.

Section – II

Q. 4 Answer the following questions.

(a) Find rotation matrix for a frame which rotate with $\frac{\pi}{4}$ along X-axis. Then $\frac{\pi}{2}$ along Y-axis, then $\frac{\pi}{2}$ along Z-axis. Consider Euler angle representation.   (04)

(b) A frame {B} rotate with respect to frame {A}, the transformation given by ^A_BT. Now appoint has position $[-1.598 \quad 0.7009 \quad 3.482]^T$ in fixed frame {A}. What is the position of that with respect to frame {B}. (04)

$$^A_BT = \begin{bmatrix} 0 & \dfrac{-\sqrt{3}}{2} & \dfrac{1}{2} & 1 \\ \dfrac{1}{2} & \dfrac{-\sqrt{3}}{4} & \dfrac{-3}{4} & 1 \\ \dfrac{\sqrt{3}}{2} & \dfrac{1}{4} & \dfrac{\sqrt{3}}{4} & 1 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

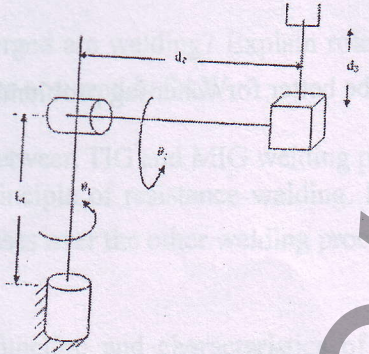(c) Find the DH table for the manipulator shown in Figure 1. (04)

Figure 1 Que. 4(c)

OR

Q. 4 Answer the following questions.

(a) Derive the rotation matrix about X-axis with an angle Φ (04)

$$R_{(x, \phi)} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos\phi & -\sin\phi \\ 0 & \sin\phi & \cos\phi \end{bmatrix}$$

(b) A frame {B} rotate with respect to frame {A} the transformation given by ^A_BT. Now a point has position $[3.866 \quad 5.323 \quad 0]^T$ in fixed frame {A}. What is the position of that with respect to frame {B}. (04)

$$^A_BT = \begin{bmatrix} 0.866 & -0.5 & 0 & 4 \\ 0.5 & 0.866 & 0 & 3 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

(c) A frame {B} rotate 30° about X-axis with respect to frame {A}. Then it rotate with 90° about Z-axis. Derive final rotation matrix according to fixed angle rotation and Euler angle rotation theory. (04)

Q. 5   Give the algebraic solution for the link planner manipulator. Shown in figure 2.   (11)
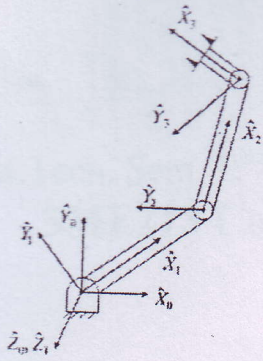
(a) Find DH parameter table

(b) Find kinematic equation for forward transformation

(c) Find all θs for matrix

$$^B_W T = \begin{bmatrix} \cos\varnothing & -\sin\varnothing & 0 & x \\ \sin\varnothing & \cos\varnothing & 0 & y \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

Figure 2. Que. 5

OR

Q. 5   Answer the following questions.

(a)   A two link manipulator with rotational joints is shown in figure 3. Calculate the velocity of the   (07)
tip of the arm as a function of joint rates. Give the answer in two frame in terms of frame{3}
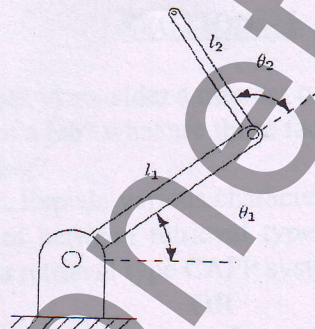and in terms of frame{0}.

Figure 3 Que. 5(a) OR

(b)   Discuss Singularities, explain different types of singularities.   (04)

Q. 6   Answer the following questions.   [12]

(a)   A single link robot with a rotary joint is motionless at $\theta = 15°$. It is desired to move the joint
in a smooth manner to $\theta = 75°$ in 3 seconds. Find the coefficients of the cubic that
accomplishes this motion and bring the manipulator to rest at the goal.

(b)   Explain different types of workspaces. Consider two link manipulator, define workspace if both
links have same length or different.

(c)   Explain compound transformation.

END OF PAPER