Exam No: _____

GANPAT UNIVERSITY

M.Tech.[ME-(AMS)] Sem-II CBCS (New)

REGULAR EXAMINATION– APRIL-JUNE 2017

3ME114: Robotics & Artificial Intelligence

TIME: 3 HRS **TOTAL MARKS: 60**

Instructions: (1) This Question paper has two sections. Attempt each section in separate answer book.
(2) Figures on right indicate marks.
(3) Be precise and to the point in answering the descriptive questions.

SECTION: I

Q.1 (a) For 2-3-2 feedforward neural network, write steps to implement backpropagation algorithm. **(05)**

(b) Name any four membership functions used in Fuzzy logic. Explain how to determine membership of any arbitrary input for triangular membership function. **(05)**

OR

Q. 1 (a) Write down differences between supervised neural network and unsupervised neural network. Also discuss their applications in real life. **(05)**

(b) For given membership functions, determine fuzzy union, intersection and compliment. **(05)**

$$\tilde{A}=\left\{\frac{0}{1}\ \frac{0.2}{2}\ \frac{0.5}{3}\ \frac{0.85}{4}\ \frac{1}{5}\right\} \text{ and } \tilde{B}=\left\{\frac{0.2}{1}\ \frac{0.35}{2}\ \frac{0.45}{3}\ \frac{0.8}{4}\ \frac{0.95}{5}\right\}$$

Q.2 (a) Discuss about Water Jug Problem using state space search. **(05)**
You are given two jugs, a 4-litre one and a 3-litre one. Neither have any measuring markers on it. There is a pump that can be used to fill the jugs with water. How can you get exactly 2 litre of water into 4-litre jug?

(b) For following sets of fuzzy relations, determine $\tilde{R}_1 o \tilde{R}_2$ using max-min composition rule. **(05)**

$$\tilde{R}_1(x,y)=\begin{bmatrix}0.5 & 0.1 & 0.8\\ 1 & 0.6 & 0.4\\ 0.3 & 0.8 & 0.1\end{bmatrix} \text{ and } \tilde{R}_2(y,z)=\begin{bmatrix}0.4 & 0.2 & 0.5\\ 0.6 & 0.42 & 0.6\\ 0.7 & 0.9 & 0.45\end{bmatrix}$$

OR

Q.2 (a) For 2-2-3 feedforward neural network, determine outputs if **(05)**

$$i=\{1\ \ 1\};\quad v=\begin{bmatrix}1 & 1\\ 1 & 0.5\end{bmatrix};\quad w=\begin{bmatrix}0.1 & 0.1\\ 0.1 & 0.1\\ 0.1 & 0.1\end{bmatrix}.$$

Where, i, v and w are inputs, input layer to hidden layer weights and hidden layer to output layer weight matrix. Assume linear activation function wherever needed.

(b) Explain the different problems addressed by AI. **(05)**

Q.3 (a) Draw fuzzy control system block diagram and explain its working. **(05)**

(b) Explain advantages and disadvantages of BFS and DFS algorithm. **(05)**

SECTION: II

Q.4 (a) Name different types of robotic grippers and explain working of vacuum gripper. **(05)**

(b) For three co-ordinate frames {1},{2} and {3}, find matrix R_3^2 if given matrices are **(05)**

$$R_3^1=\begin{bmatrix}0 & 0 & -1\\ 0 & 1 & 0\\ 1 & 0 & 0\end{bmatrix} \quad R_2^1=\begin{bmatrix}1 & 0 & 0\\ 0 & 0.5 & -0.86\\ 0 & 0.86 & 0.5\end{bmatrix}$$

OR

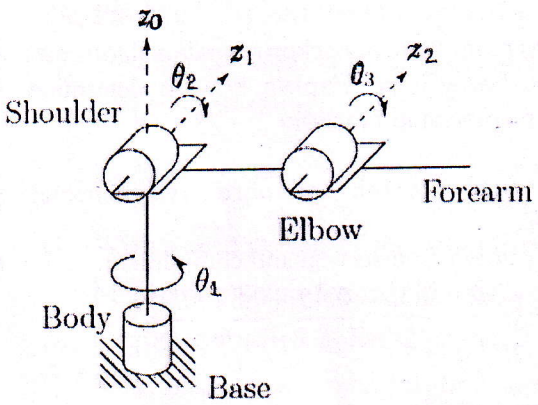
Q.4 (a) What does a redundant manipulator mean? Write configuration space of redundant manipulator. Which are the applications of redundant manipulator? (05)

(b) There are two frames {0} and {1}. Frame {1} is obtained by rotating frame {0} by 90° w.r.to Y-axis. If a point ${}^0P = \{5 \quad 0 \quad 0\}^T$ is rotated by 90° w.r.to Z-axis of frame {0}, what will be its co-ordinates in frame {1}? (05)

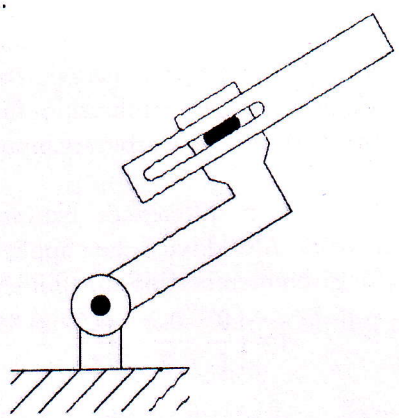
Q.5 Consider RRR robot shown in Fig.1 to derive forward kinematic model. Assume link lengths to be l_1, l_2 and l_3 starting from 1st link. Derive forward kinematic model to determine position and orientation of point located at the end of forearm with respect to base frame. Do not multiply matrices to obtain final model. (10)

OR

Q.5 Assuming suitable link parameters for following 2D planar RP robotic configuration shown in Fig. 2 derive forward and inverse kinematics model. (10)



[Fig. 1]



[Fig. 2]

Q.6 (a) Define robot and explain features of robots in detail. (05)

(b) Explain velocity propagation from link to link in serial manipulator. (05)

----------END OF PAPER----------