GANPAT UNIVERSITY
M.Tech Sem. II nd (AMT)
Regular External Examination May 2014
3ME- 205 Robotics & Artificial Intelligence

Time: 3 Hrs   Marks: 70

Instructions:
(i) All questions are compulsory.
(ii) Answers to two sections must be written in separate answer sheets.
(iii)Assume suitable data wherever necessary.
(iv)Figure to right indicates marks.

SECTION – I

Q1   Answer the following questions.   12
(a)   What are the basic learning laws in ANN? Explain hebbian learning law.
(b)   Explain the logic functions (using truth tables) performed by the following networks with MP neurons given in Figure. 1

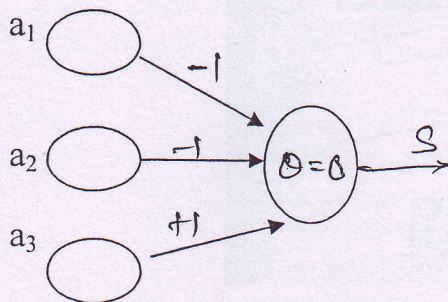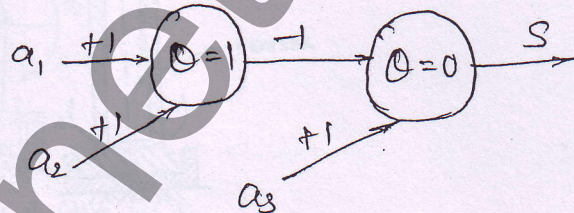Fig. 1 (a)   Que. 1(b)   Fig. 1 (b)

(c)   What is the difficulty in solving a real world problem like metal cutting even by an artificial neural network model?

OR

Q1   Answer the following questions.   12
(a)   What are the issues at the architectural level of artificial neural networks?
(b)   Application of ANN in controlling parameter in grinding operation for predicting surface roughness.
(c)   Short note on Expert system & Decision support system.

Q2   Answer the following questions.
(a)   Explain how AI techniques help for making Intelligent robot.   2
(b)   Explain different fuzzification method with examples.   5
(c)   Name and describe the main Component of Genetic Algorithms.   5

OR

Q2   Answer the following questions.   12
(a)   Write short note on defuzzificaion process.
(b)   AI is a knowledge area with a strong inters disciplinary nature- Justify the statement.
(c)   Explain how fuzzy controller works with examples of center less grinding.

Q3   Answer any three of following Questions.   11
(a)   Write Rule base for fuzzy controller for robot gripping force.
(b)   Compare biological neural network with Artificial Neural network.
(c)   Explain one application of genetic Algorithm as a case study.

(d) Two jugs of capacity of 16 and 7 liters are given. You are required to obtain 8 liters of water in 16 liters of jug. There are no measuring markers on jugs. Obtain only through exchange. Draw the state space diagram.

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SECTION – II

Q4 Answer the following questions.
(a) What is basic different between fixed angle representation and Euler angle representation frame rotation.   2
(b) Explain with sketches and show work envelop for different kind of robot configuration.   4
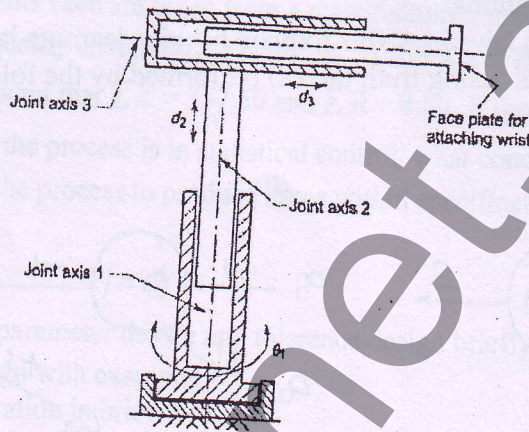**(c)** Obtain end-effectors position and orientation shown in fig.2   5

Fig. 2 Que. 4 (c)

OR

Q4 Answer the following questions.
(a) Explain Robot Capabilities.   2
(b) Explain with block diagram: Forward kinematics and Inverse kinematics. Give name of parameters are input in inverse and forward kinematics.   4
(c) For the 3 –DOF robotics manipulator arm shown in the below figure assign frame to each of the link and determine the joints –link parameter and therefore obtain the direct kinematic model.   5
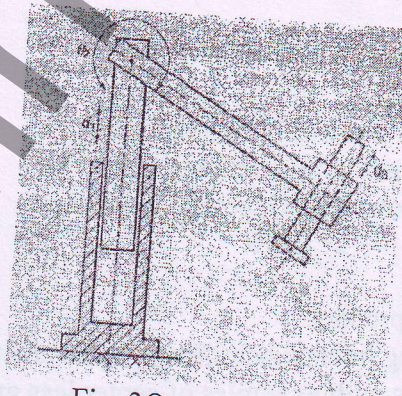

Fig. 3Que. 4(c) OR

Q5 Answer the following questions.   **12**

(a) A robot is to be selected for loading and unloading what technical and non-technical issues or factors you will consider?

(b) State guide lines to obtain close form solutions for an inverse kinematics problem.

(c) For the 3-DOF (RRP) configuration manipulator, shown in fig.4 the position and orientation of point P in Cartesian space is given by

$$T = \begin{bmatrix} 0.354 & 0.866 & 0.354 & 0.106 \\ -0.612 & 0.500 & -0.612 & -0.184 \\ 0.707 & 0 & 0.707 & 0.212 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

Determine all values of all joint variables that is all solutions to the inverse kinematic problem. The joint displacement allowed (joint limits) for three joints are $-100^0 < \Theta_1 < 100^0$,$-30^0 < \Theta_2 < 70^0$ and $0.05m < d_3 < 0.5m$ Identify the feasible solutions.
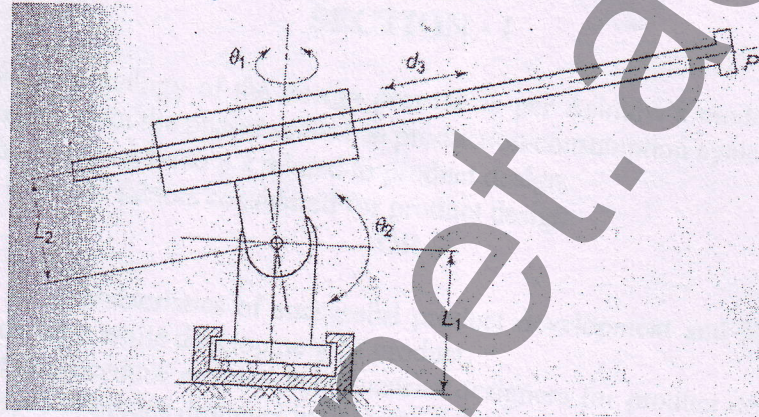

Fig. 4 Que. 5(C)

OR

Q5 Answer the following questions.   **12**

(a) Define link parameters and joint parameters with sketch.

(b) Explain with a neat sketch and example, Denavit-Hartenberg Algorithm.

(c) Frame {2} is rotated with respect to frame {1} about the X-axis by an angle of 60^0. The position of the origin of frame{2} as seen from frame{1} is $^1D_2 = [7.0\ 5.0\ 7.0]^T$. Obtain the transformation matrix $^1T_2$, which describes frame {2} relative to frame{1}. Also, find the description of point P in frame{1} if $^2P = [2.0\ 4.0\ 6.0]^T$.

Q6 Answer any **Three** form the following Questions: **12**

(a) Compare a robot manipulator with human hand for their capabilities.

(b) State and explain in detail the terms:
      (i)Degree of freedom (ii) wrist configuration

(c) A 3 DOF articulated configuration arm of manipulator has all three revolute Joints. In a typical articulated arm the joints design determines the joint range the design of joint provides almost 360^0 joint range but has joint offset / joint distance $d_1=d_2$ For link 2& d_3 for link 3, Using the algorithm for link frame assignments, tabulate the joint link parameters and obtain forward kinematic model of the arm.

(d) Determine the manipulator jacobian for a 3-DOF articulated arm.

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