Ex. Seat No. _____

GANPAT UNIVERSITY

M.Tech Sem. II[nd] Mechanical(Advance Manufacturing Techniques)

External Examination June 2012

3ME205 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) 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. Suggest which strategy BFS/DFS will be better? Justify your answer.

(b) Give Heuristics for following problem.
(i) 8 Puzzle (ii) Tic- Tac- Toe(Zero-cross) (iii) Missionaries- Cannibals

(c) Explain turing test?

OR

Q1(a) Discuss Breadth first search procedure with an example. **12**

(b) Discuss the following terms.
(i) Machine Intelligence (ii) Knowledge (iii) Backtracking

(c) Differentiate between fuzzy set and crisp set.

Q2(a) How real world problem is presented in state space? Explain with example. **12**

(b) Explain the different levels of intelligence from primitive to latest intelligence AI level used for robots.

(c) Write short note on Expert system & Decision support system.

OR

Q2(a) Explain knowledge triangle in detail. **12**

(b) Explain briefly the operation of biological neural network.

(c) What is AI and discuss current trends of AI used in robotics in brief.

Q3 Answer any **Three** form the following Questions: **11**

(a) Suggest Application for AI techniques for following cases:
(i) Prediction (ii) process control (iii) medical diagnosis systems.
Define fuzzyfication rules, rules for knowledge base and method for defuzzification for **any** one robot gripper.

(b) Explain term Fuzzy logic. And how fuzzy controller works.

(c) Explain any two Defuzzyfication methods with examples.

(d) Explain application of ANN in performance predication in hard turning with minimal quantities of cooling lubricants.

SECTION – II

Q4 Answer the following Questions : **12**

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

(b) Classify basic robot manipulator configuration with their specific

characteristic, merits & demerits.

(c) Define degree of freedom related to Robotics. Define kinematics pair of robot and possible motion with notation and effect of motion in robot work space.

OR

Q4 Answer the following Questions : **12**

(a) Explain inverse and forward kinematics. Give name of parameters are input in inverse and forward kinematics.

(b) Explain following Robot Capabilities

(i) Repeatability's (ii) Accuracy, error

(iii) Trajectory planning (iv) Reproducibility

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

Q5(a) Obtain forward kinematic model for configuration shown in fig.1. **12**

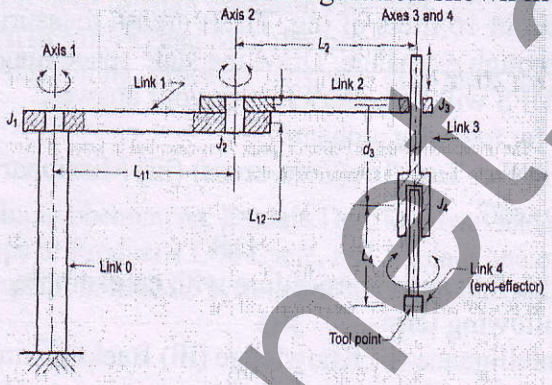

Fig.1 Que 5(a)

(b) Explain with sketch Denavit-Hartenberg notation for kinematics parameters, define each parameter.

OR

Q5(a) List the various representation methods for fundamental rotation and explain any one. **12**

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

Q6 Answer any **Three** form the following Questions: **11**

(a) Explain importance of duel gripper over single gripper in machine loading /unloading application.

(b) Design and selection considerations for robot grippers.

(c) Explain the terms

(i) Joint & Cartesian space

(ii) Manipulatability

(iii) Dexterous workspace

(d) Determine the singularities of the 3-DOF articulated arm you used in laboratory for analysis exercise.