Date: 01/06/2016.

Exam No: _____

GANPAT UNIVERSITY

M. TECH SEM- II AMT REGULAR EXAMINATION APRIL-JUNE 2016

3ME205 ROBOTICS & ARTIFICIAL INTELLIGENCE

MAX. TIME: 3 HRS **MAX. 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 Attempt ALL.

(a) Find Rotational transformation matrix representing roll of π followed by pitch of $\pi/2$ and yaw of $\pi/2$. (10)

(b) Two frames {0} and {1} are related by homogeneous transformation matrix

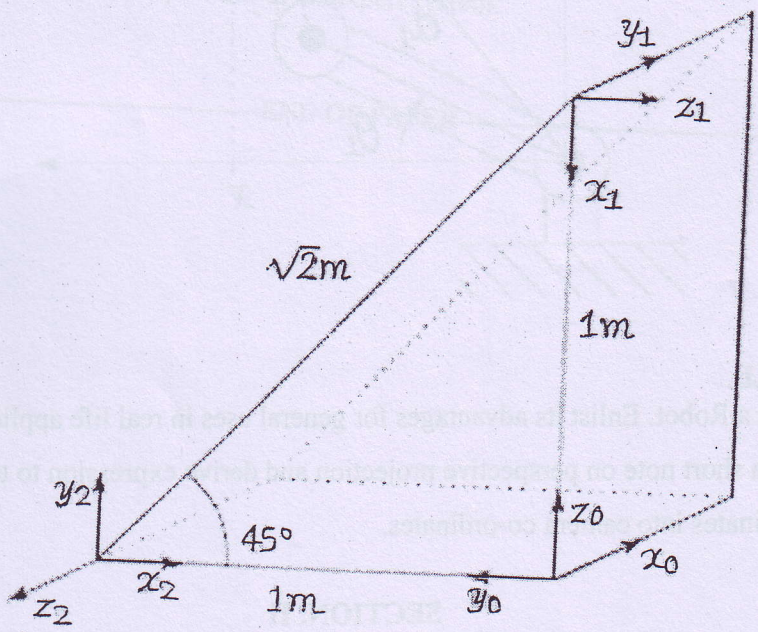
$$H_1^0 = \begin{bmatrix} 0 & -1 & 0 & 1 \\ 1 & 0 & 0 & -1 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

A particle has velocity $v_1(t) = [3,1,0]^T$ in frame {1}. What is its velocity in frame {0}?

OR

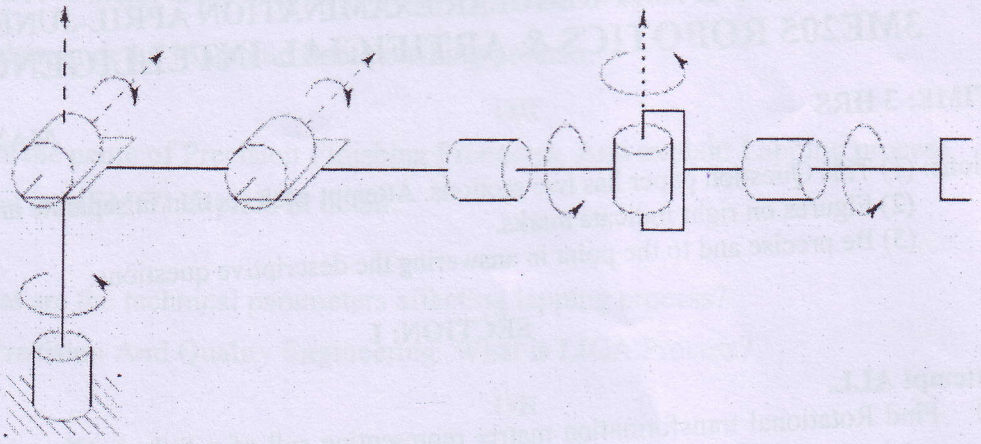
Q. 1 Attempt ALL.

(a) Write homogeneous transformation matrices H_1^0 and H_2^0 for following figure. (10)



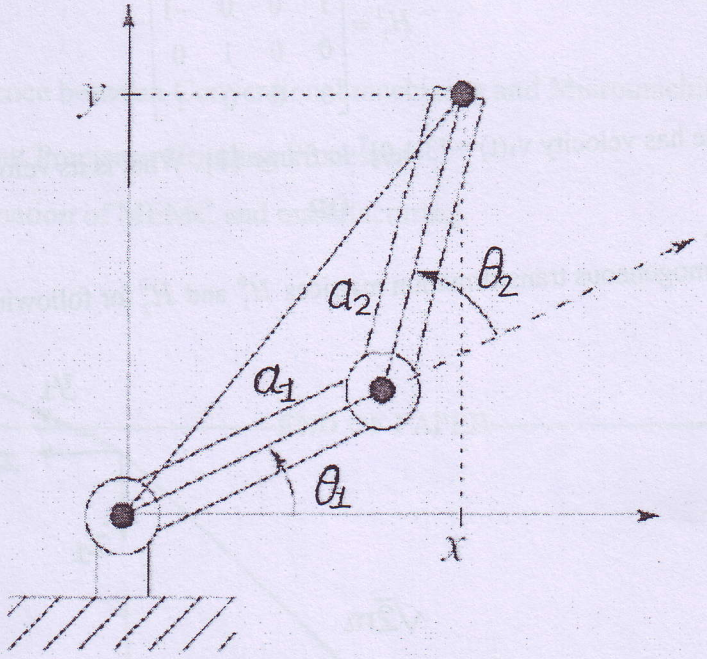
(b) Determine projection of object center co-ordinate (50, 70, 100) on camera plane if focal length is 5 unit.

Q.2 Assuming link length a1, a2, a3, a4, a5 and a6, derive forward kinematics model for following robot using DH convention. Do not multiply matrices. (10)



OR

Q.2 Derive forward kinematics model for following 2D planar robot. Using this forward kinematics model, derive inverse kinematics model to determine joint angles for given pose and position of end-effector. (10)



Q.3 **Attempt ALL.** (10)

(a) Define a Robot. Enlist its advantages for general uses in real life applications.

(b) Write a short note on perspective projection and derive expression to transform world co-ordinates into camera co-ordinates.

SECTION: II

Q.4 **Attempt ALL.** (10)

(a) Describe the chess problem in context of AI.

(b) Draw and explain architecture of artificial neural network.

Q.4 **Attempt ALL.** **OR**

(a) Explain with block diagram the working of a fuzzy controller. (10)

(b) Define heuristic search? Explain the best first search technique with help of an algorithm.

Q.5 **Attempt ALL.**

(a) Discuss about Water Jug Problem using state space search. (10)

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 litres of water into 4-litre jug.

(b) Solve the following cryptographic problem: **S E N D + M O R E = M O N E Y**

Q.5 **Attempt ALL.** **OR**

(a) Explain the simple hill climbing algorithm. (10)

(b) Discuss in detail about breadth first search with its merits and demerits.

Q.6 **Attempt ALL.**

(a) Write in brief: (10)

(A) Turing test, (B) Architecture of expert system. (03)

(b) Define artificial intelligence. "Marcus is intelligent student", justify the statement in context of intelligence. (03)

(c) Discuss about the task domains of Artificial Intelligence. (02)

(d) Explain the various components of an expert system. (02)

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