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Date: 26/11/2015

Student Exam No: \_\_\_\_\_

**GANPAT UNIVERSITY**  
**B.TECH SEM. VII - MECHATRONICS ENGINEERING**  
**REGULAR EXAMINATION NOV/DEC - 2015**  
**2MC-702 ROBOTICS**

**Time: 3 Hours**

**Total Marks: 70**

**Instructions:**

- 1). All questions are **compulsory**.
- 2). Figures to the **right** indicate full marks.
- 3). Answers to the two sections must be written in **separate** answer books.
- 4). Assume all necessary data.

**Section – I**

**Que:-1 Attempt All.**

- (A) Enlist Robotic applications in which end effector is a tool.
- (B) Explain construction & working of vidicon tube camera.
- (C) Which are uses of sensors in robotics?

[12]

**OR**

**Que:-1 Attempt All.**

- (A) Write short note on Touch sensors.
- (B) Explain components required for Robotics/Machine vision.
- (C) What is physical constriction method used in the gripper.

[12]

**Que:-2 Attempt All.**

- (A) List and explain in brief robot co-ordinate systems (Cartesian, Cylindrical, polar, spherical & Revolve system).
- (B) Write a short note on optical encoders.

[06]

[05]

**OR**

**Que:-2 Attempt All.**

- (A) Write a short note on CCD camera.
- (B) Discuss the different factors which are considered for the gripper selection.

[06]

[05]

**Que:-3 Attempt Any three.**

- (A) Explain a vacuum cup gripper.
- (B) Define stability, accuracy, repeatability and compliance of a robot.
- (C) Architecture of Robotic vision system.
- (D) Write the three laws of robotics.

[12]

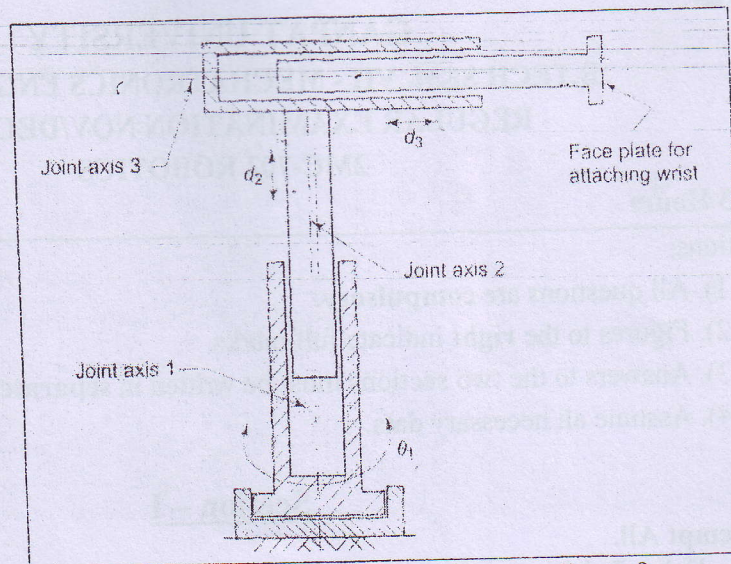


## Section - II

Que:-4 Attempt All.

[12]

- (A) For the 3-DOF manipulator arm shown in figure, assign frames and obtain the joint-link parameter. Also, determine the position of the tool tip with respect to the base frame  $\{0\}$ .



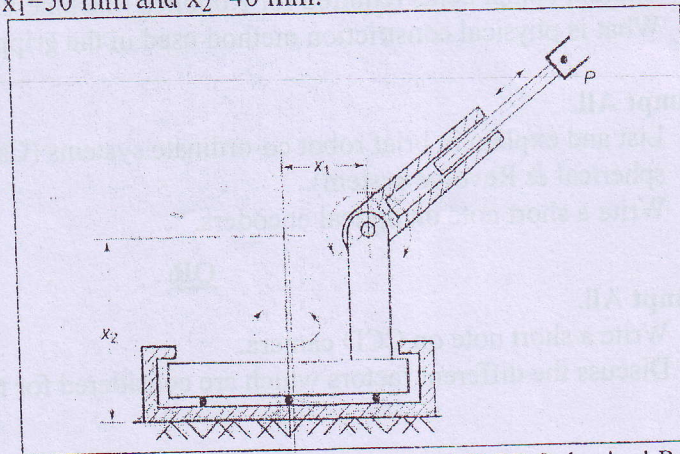
- (B) The coordinates of point P with respect to a moving coordinate frame are given as  $P = [0.5 \ 0.8 \ 1.3 \ 1]^T$ . What are the coordinates of P with respect to fixed coordinate frame, if the moving frame is rotated by  $90^\circ$  about z-axis of the fixed frame?

OR

Que:-4 Attempt All.

[12]

- (A) Derive mathematical formulation of kinematics of a 3 DOF Polar Arm, and obtain the orientation and position of tool point P of the joint variable vector is  $Q = [90^\circ \ -45^\circ \ 100\text{mm}]^T$  with  $x_1 = 50 \text{ mm}$  and  $x_2 = 40 \text{ mm}$ .



- (B) Find general Forward kinematics solutions for the 3 DOF Spherical Robotics Arm.

Que:-5

Find general Inverse kinematics solutions for the 3 DOF Articulated Robotics Arm.

OR

Que:-5

Inverse Kinematics of RPY wrist.

Que:-6 Attempt Any three.

- (A) The end-point of a link of a manipulator is at  $P = [2 \ 2 \ 6 \ 1]^T$ . The link is rotated by  $90^\circ$  about x axis, then by  $-180^\circ$  about its own w-axis, and finally by  $-90^\circ$  about its own v-axis. Find the resulting homogeneous transformation matrix and the final location of end-point.
- (B) What is mapping? State any one case of mapping.
- (C) Explain Inverting A Homogeneous Transform.
- (D) Derive the rotation matrix for rotation about X -Axis.