

INDUSTRIAL ROBOTICS
(MECH 4127)

Time Allotted : 3 hrs

Full Marks : 70

Figures out of the right margin indicate full marks.

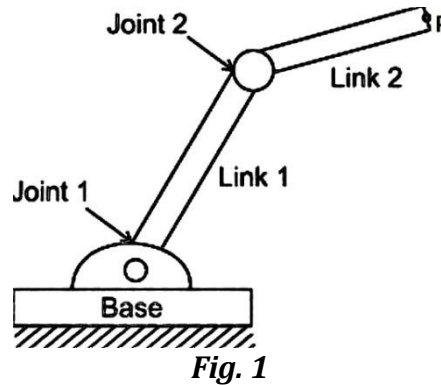
Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

Candidates are required to give answer in their own words as far as practicable.

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**
- (i) Robot is derived from Czech word (CO1)
(a) Rabota (b) Robota (c) Rebota (d) Ribota
- (ii) Match the following (CO3)
- | Robot part | Function |
|--------------------|--|
| a. Manipulator arm | 1. For holding a piece or tool |
| b. Controllers | 2. Move the manipulator arm and end effector |
| c. Drives | 3. Number of degrees of freedom of movement |
| d. Gripper | 4. Delivers commands to the actuators |
- (a) a-1, b-4, c-2, d-3 (b) a-3, b-4, c-2, d-1
(c) a-3, b-2, c-4, d-1 (d) a-4, b-3, c-2, d-1
- (iii) The Robot designed with Polar coordinate systems has (CO1)
(a) Three linear movements
(b) Three rotational movements
(c) Two linear and one rotational movement
(d) Two rotational and one linear movement.
- (iv) Which of the following sensors determines the relationship of the robot and its environment and the objects handled by it (CO3)
(a) Internal State sensors (b) External State sensors
(c) Both (a) and (b) (d) None of the above.
- (v) For a two degree of freedom planar RR manipulator as shown in Fig.1, the length of the links 1 and 2 are 40 cm and 20 cm respectively. If the base joint is

located at the origin, then which of the given points are not possible for point P?
(C02)



- (a) (20, 30) (b) (-30, -20) (c) (0, 10) (d) (50, 0).

- (vi) Physical structure of robot which moves around, is called (C01)
 (a) Manipulator (b) Joints (c) Links (d) End-effector.
- (vii) In which of the following operations Continuous Path System is used? (C01)
 (a) Pick and Place (b) Loading and Unloading
 (c) Continuous welding (d) All of the above.
- (viii) _____ is not a programming language for computer controlled robot. (C05)
 (a) VAL (b) RAIL (c) AML (d) AMU.
- (ix) Which of the following places would be least likely to include operational robot?
(C06)
 (a) Warehouses (b) Factory (c) Hospitals (d) Private Homes.
- (x) The main objective(s) of Industrial robot is to (C06)
 (a) To minimize the labour requirement
 (b) To increase productivity
 (c) To enhance the life of production machines
 (d) All of the above.

Group - B

2. (a) Classify and explain the robots on the bases of control method?
 [(C01) (Understand /LOCQ)]
 (b) Establish the Denavit Hartenberg link coordinate system for a PUMA robot?
 [(C02) (Create /HOCQ)]
- 4 + 8 = 12**
3. (a) Mention laws of robotics. [(C01) (Remember/LOCQ)]
 (b) It is desired to determine the values to which the angles θ_1 and θ_2 must be set in order to achieve a certain point in space for the manipulator shown in fig. 2. The length of joint 1, $L_1 = 12$ cm, the length of joint 2, $L_2 = 10$ cm. The point P_w which the robot must achieve is defined by the coordinates $x = 15.7$ and $y = 12.6$. [(C02)(Evaluate/HOCQ)]

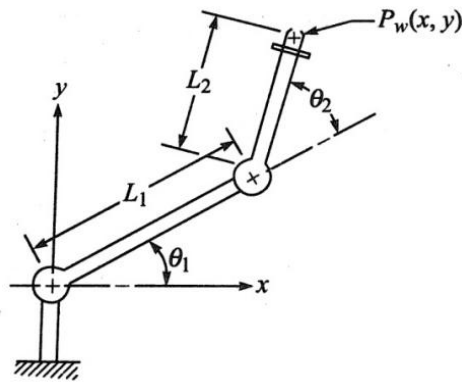


Fig. 2

5 + 7 = 12

Group - C

4. (a) Briefly discuss on magnetostrictive type special actuator. [(CO3) (Remember/LOCQ)]
(b) Demonstrate hydraulic actuators. State the advantages and disadvantages. [(CO3) (Apply /IOCQ)]

6 + 6 = 12

5. (a) Illustrate the working principle of Stepper motor with sketches. [(CO3) (Analyze /IOCQ)]
(b) State the advantages and limitation of adhesive gripper. [(CO4) (Analyze /IOCQ)]

6 + 6 = 12

Group - D

6. (a) Explain the steps in a robot vision system. [(CO3) (Understand /LOCQ)]
(b) Is there any advantage of external sensors over internal types, Explain it? [(CO3) (Analyze /IOCQ)]

8 + 4 = 12

7. (a) Explain absolute and incremental rotary encoder with diagram. [(CO3) (Understand /LOCQ)]
(b) What is Calibration? Define analog and digital sensors with examples. [(CO3) (Remember/LOCQ)]

6 + 6 = 12

Group - E

8. (a) State the advantages of keyboard programming. [(CO5) (Remember/LOCQ)]
(b) Demonstrate the application of robotics in inspection field. [(CO6) (Apply /IOCQ)]

6 + 6 = 12

9. (a) Write the advantages of robot employment in manufacturing industry. [(CO6) (Understand/LOCQ)]

(b) How the robot can be useful in space exploration? [(CO6) (Remember/LOCQ)]

6 + 6= 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	55.21%	29.16%	15.63%

Course Outcome (CO):

After the completion of the course students will be able to

C01	Identify different components of industrial robots and classify based on different criterion
C02	Implement the knowledge of forward kinematics, inverse kinematics to analyze manipulator motions
C03	Use sensors, actuators, drives for various industrial applications
C04	Select suitable end effectors for specific industrial applications
C05	Develop program for controlling robot for a given application
C06	Describe the various applications of robots in industry

*LOCQ: Lower Order Cognitive Question; IOCQ: Intermediate Order Cognitive Question;
HOCQ: Higher Order Cognitive Question

Department & Section	Submission link:
ME	https://classroom.google.com/c/NDA1MjExMjY0ODY0/a/NDY0NDg5MjY5Njc4/details