Printed Page:- 04 Subject Code:- AEC0515

Roll. No:

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech

SEM: V - THEORY EXAMINATION (2024 - 2025)

Subject: Introduction to Robotics and it's Applications

Time: 3 Hours Max. Marks: 100

General Instructions:

IMP: *Verify that you have received the question paper with the correct course, code, branch etc.*

1. This Question paper comprises of three Sections -A, B, & C. It consists of Multiple Choice Questions (MCQ's) & Subjective type questions.

2. Maximum marks for each question are indicated on right -hand side of each question.

3. Illustrate your answers with neat sketches wherever necessary.

4. Assume suitable data if necessary.

5. Preferably, write the answers in sequential order.

6. No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.

SECTION-A 20

1. Attempt all parts:-

1-a. An automatic apparatus or device that performs functions ordinarily ascribed to humans or operate with what appears to be almost human intelligence is called _____. (CO1, K2) 1

(a) Robot
(b) Human
(c) Animals
(d) Reptiles

1-b. The basic components of robot are_____: (CO1, K2) 1

(a) The mechanical linkage
(b) Sensors and controllers
(c) User interface and power conversion unit
(d) All of the mentioned

1-c. What is "kinematic chain" in a robot mechanism? (CO2, K2) 1

(a) The software controlling the robot
(b) A series of rigid links connected by joints
(c) The power transmission system of the robot
(d) A chain used for lifting

1-d. A robot manipulator is typically a_____: (CO2, K2) 1

(a) Parallel mechanism

(b) Serial mechanism

(c) Planar mechanism

(d) Linear mechanism

1-i. Which type of robot is commonly used for material handling tasks in manufacturing? (CO5, K3) 1

(a) Articulated robots

(b) Cartesian robots

(c) SCARA robots

(d) Delta robots

1-e. What is the primary difference between a DC motor and a stepper motor? (CO3, K6) 1

(a) Stepper motors can control position in discrete steps, while DC motors provide continuous motion.

(b) DC motors use sensors for position feedback, while stepper motors do not.

(c) DC motors require no external power supply, unlike stepper motors.

(d) Stepper motors are more efficient than DC motors in all applications.

1-j. What is the role of robot in inspection automation? (CO5, K3) 1

(a) To handle and assemble parts

(b) To visually inspect products for defects and ensure quality

(c) To weld and paint parts

(d) To perform customer service functions

1-f. How does a microprocessor control the speed of a DC motor? (CO3, K6) 1

(a) By adjusting the rotor size

(b) By modifying the PWM duty cycle

(c) By changing the motor's physical structure

(d) By increasing the current frequency

1-g. Which sensor is used in robotics to measure the angular velocity? (CO4, K5) 1

(a) Accelerometer

(b) Gyroscope

(c) Ultrasonic sensor

(d) Strain gauge

1-h. Accelerometers are often used in robotics for: (CO4, K5) 1

(a) Detecting collisions and sudden movements

(b) Measuring rotational speed

(c) Monitoring motor torque

(d) Measuring position directly

2. Attempt all parts:-

2.a. What is the degree of freedom of a robot wrist configuration and draw its 2

	symbolic diagram? (CO1, K2)	
2.b.	Write down all the transformation matrices of a robotic arm based on fundamental rotations. (CO2, K2)	2
2.c.	Define hydraulic actuator for robotics application.(CO3, K6)	2
2.d.	What is the need of force and pressure sensors in robot? (CO4, K5)	2
2.e.	Why robot is used in pick-and-place operations ? (CO5, K3)	2
SECTION-B		30
3. Answer any five of the following:-		
3-a.	Define the various types of robotic joints and also draw its approximate diagram. (CO1, K2)	6
3-b.	Define robotics and its significance in modern technology. (CO1, K2)	6
3-c.	Explain the need of homogeneous transformation matrix. (CO2, K2)	6
3-d.	How do you find the location of a robotic manipulator. (CO2, K2)	6
3.e.	Explain the role of controlling unit in a electric drive system. (CO3, K6)	6
3.f.	Define velocity sensors and explain its role in robotic systems. (CO4, K5)	6
3.g.	What factors influence the selection of robots for specific assembly tasks? (CO5, K3)	6
SECTION-C		50
4. Answer any one of the following:-		
4-a.	Draw the robotic system and explain the various components of robot. (CO1, K2)	10
4-b.	What do you mean by robot workspace? Draw the workspace of some commonly used robots. (CO1, K2)	10
5. Answer any one of the following:-		
5-a.	Explain the concept of kinematics chain of a robotic manipulator using any one relevant example. (CO2, K2)	10
5-b.	Write a short notes on inverse kinematics. (CO2, K2)	10
6. Answer any one of the following:-		
6-a.	Discuss the principle of operations and parts of DC motor. (CO3, K6)	10
6-b.	Explain the role of Power modulator, Controlling unit, and sensing unit of an electric drive system? (CO3, K6)	10
7. Answer any one of the following:-		
7-a.	Compare the potentiometric and optical encoders used for robotic position sensing. Which one is more suitable for high-precision tasks and Why? (CO4, K5)	10
7-b.	Describe the working principle of an IR proximity sensor. How can ambient light affect its performance? (CO4, K5)	10
8. Answer any one of the following:-		
8-a.	Explain the importance of robots in material transfer operations within manufacturing industries. (CO5, K3)	10

8-b. Explain the process of robotic spray painting. How do robots achieve consistent paint application? (CO5, K3) 10