Reg.No.:												

VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN
[AUTONOMOUS INSTITUTION AFFILIATED TO ANNA UNIVERSITY, CHENNAI]
Elayampalayam – 637 205, Tiruchengode, Namakkal Dt., Tamil Nadu.

Question Paper Code: 80023

B.E. / B.Tech. DEGREE END-SEMESTER EXAMINATIONS – NOV. / DEC. 2025
Fifth Semester
Electrical and Electronics Engineering
U23EEV41 – ROBOTICS AND CONTROL
(Regulation 2023)

Time: Three Hours | Maximum: 100 Marks

Answer ALL the questions

Knowledge Levels (KL)	K1 – Remembering	K3 – Applying	K5 - Evaluating
	K2 – Understanding	K4 – Analyzing	K6 - Creating

PART – A

(10 x 2 = 20 Marks)

Q.No.	Questions	Marks	KL	CO
1.	Define the term Degrees of Freedom (DOF) in a robot and explain its importance in robotic motion.	2	K1	CO1
2.	List any two advantages and disadvantages of using robots in industrial applications.	2	K1	CO1
3.	Compare the usage of grippers and tools as end effectors.	2	K2	CO2
4.	List any two differences between contact sensors and non-contact sensors used in robots.	2	K1	CO2
5.	What is a homogeneous transformation matrix, and why is it used in robotic kinematics?	2	K2	CO3
6.	Infer the concept of a homogeneous transformation matrix.	2	K2	CO3
7.	Compare online and offline robot programming, providing one example for each.	2	K2	CO4
8.	What is the Lead-Through (Lead-Teach) method in robot programming, and how is the robot's path defined in this method?	2	K1	CO4
9.	List any four types of sensors commonly used in robotic systems and provide one application for each.	2	K1	CO5
10.	Interpret the basic characteristics of a sensor used in robotics.	2	K2	CO5

PART – B

(5 x 13 = 65 Marks)

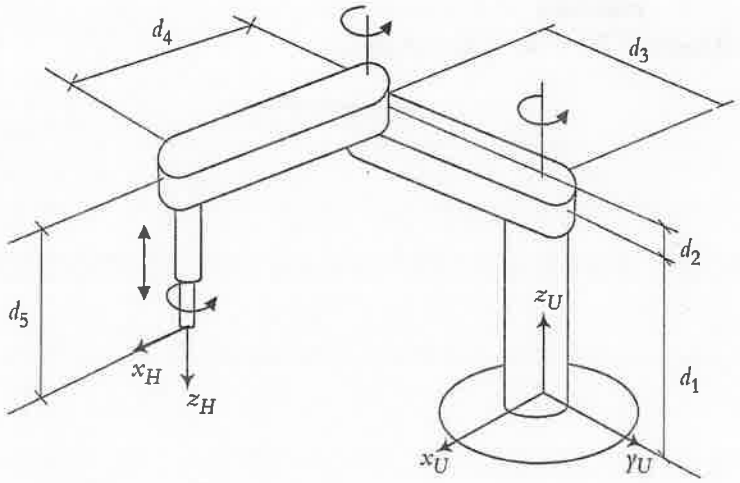
Q.No.		Questions	Marks	KL	CO
11.	a)	Explain the classification of robots based on (a) configuration, (b) control, and (c) application with suitable examples for each category.	13	K2	CO1
		(OR)			
	b)	Infer the main components of a robot and illustrate them with a neat block diagram. Explain the role of joints and coordinate systems in determining robotic motion and positional accuracy.	13	K2	CO1
12.	a)	Explain the different types of joints and linkages used in robotic manipulators. Discuss how they determine the robot's degrees of freedom and influence its workspace.	13	K2	CO2
		(OR)			
	b)	i. Identify the feedback devices and sensor systems used in robots for motion control.	8	K3	CO2
		ii. Explain the working principle of machine vision and its importance in robotic applications.	5	K2	
13.	a)	Explain how the points and vectors are represented using matrices in space. Additionally, derive the expression for a homogeneous transformation matrix and discuss its role in representing the position and orientation of a robot.	13	K2	CO3
		(OR)			
	b)	Infer the Denavit-Hartenberg (D-H) representation for forward kinematics. Using the D-H convention, derive the forward kinematic equations for a 2-link planar manipulator with joint angles θ_1 and θ_2 and link lengths l_1 and l_2.	13	K2	CO3
14.	a)	Explain the different robot programming methods, including online, offline, explicit, and task-level languages. Also, draw a task point diagram, and discuss the characteristics of each programming approach in terms of accuracy, flexibility, and ease of use.	13	K2	CO4
		(OR)			
	b)	i. Compare first-generation and second-generation robot programming languages in terms of structure, motion commands, end-effector control, and sensor integration.	8	K2	CO4
		ii. Explain how motion interpolation and branching enhance the robot's motion planning capabilities and list their advantages and limitations with suitable examples.	5		

15.	a)	i.	Explain the working principles of position, velocity, and acceleration sensors and their applications in robotic control systems.	7	K2	CO5
		ii.	Infer how sensor feedback is used to improve the accuracy and stability of robot motion.	6		
			(OR)			
	b)		Identify the main components and working of a robotic vision system. Explain the stages of image processing and discuss the use of vision-controlled robots in industrial automation applications such as inspection and assembly.	13	K2	CO5

PART – C

(1 x 15 = 15 Marks)

Q.No.		Questions	Marks	KL	CO
16.	a)	For the following SCARA-type robot shown in the figure below,	15	K2	CO3

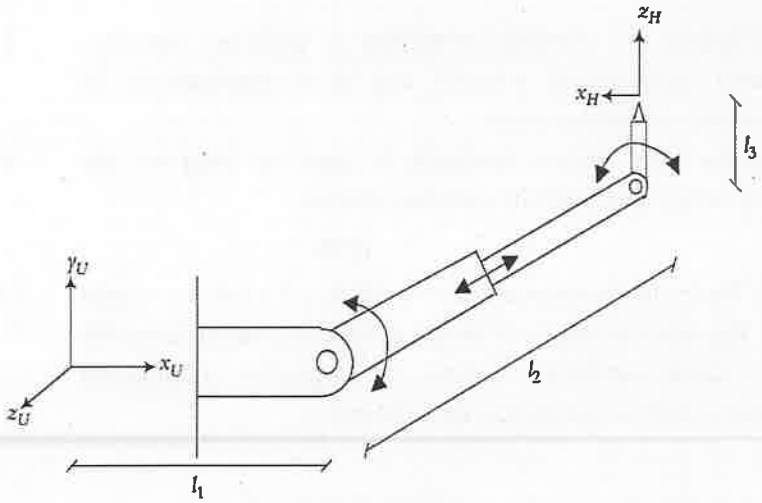


i. Assign the coordinate frames based on the D–H representation.
ii. Fill out the parameters table.
iii. Write all the A matrices.
iv. Write the UTH matrix in terms of the A matrices.

Where, UTH = $A_1 \times A_2 \times A_3 \times ...$

(OR)

b) For the following 3-DOF spraying robot shown in the figure below, 15 K2 CO3



i. Assign the coordinate frames based on the D–H representation.
ii. Fill out the parameters table.
iii. Write all the A matrix.
iv. Write the UTH matrix in terms of the A matrices.

Where, UTH = $A_1 \times A_2 \times A_3 \times ...$