Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Sixth Semester B.Tech Degree Regular and Supplementary Examination July 2021

Course Code: EC368
Course Name: ROBOTICS

Max. Marks: 100 Duration: 3 Hours

PART A

Answer any two full questions, each carries 15 marks Marks

1 a) Define the term degrees of freedom and explain six degrees of freedom associated with robot. (8)

b) Describe the **TLL robot** configuration with neat sketch. (7)

2 a) Illustrate the working of strain gauge-based force sensor using Wheatstone bridge setup. (8)

b) Compare hydraulic, electric, and pneumatic actuators. (7)

3 a) With the help of torque speed characteristic explain the working of servomotor. (7)

b) Explain different types of joints with the help of neat sketches. (8)

PART B

Answer any two full questions, each carries 15 marks

4 a) Explain the functions of a machine vision system with the help of block diagram (10)

b) Find the new location of point $P(1, 2,3)^T$ relative to the reference frame after a rotation of 30^0 about the z-axis followed by a rotation of 60^0 about the y-axis. (5)

5 a) A frame *B* is rotated 90^0 about the *z*-axis, then translated 3 and 5 units relative to the *n* and *o*-axes respectively, then rotated another 90^0 about the *n*-axis, and finally, 90^0 about the *y*-axis. Find the new location and orientation of the frame (8)

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

b) Explain the steps to be followed for the implementation of Denavit- Hartenberg representation. (7)

6 a) Explain the three phases involved in analog to digital signal conversion. (9)

b) Derive the matrix representing RPY orientation. (6)

PART C

Answer any two full questions, each carries 20 marks

7	a)	Derive the Jacobian operator for linear and angular velocity of end-effector.	(10)
	b)	Explain about Lagrangian mechanics. How will you derive dynamic model of robot?	(5)
	c)	What is PID control? What are the main advantages of PID control?	(5)
8	a)	Explain the robot language structure with a block diagram.	(10)
	b)	Distinguish textual and lead through programming.	(5)
	c)	Mention end-effector and motion commands in VAL programming language.	(5)
9	a)	Explain in detail about different control schemes of robots.	(10)
	b)	Explain the use of robots in industrial applications.	(10)

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