

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° about the z-axis followed by a rotation of 60° about the y-axis. (5)
- 5 a) A frame B is rotated 90° about the z-axis, then translated 3 and 5 units relative to the n and o -axes respectively, then rotated another 90° about the n -axis, and finally, 90° 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)
