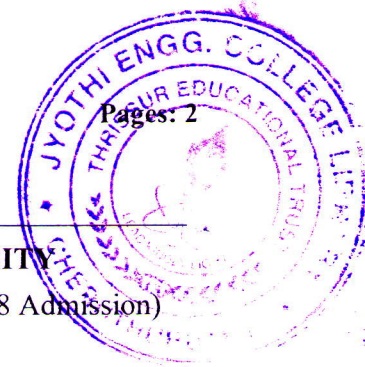


Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Sixth Semester B.Tech (Hons) Degree Examination July 2021 (2018 Admission)



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) Explain cylindrical and spherical robot configurations. (6)
- b) Explain the terms reach, precision, and repeatability of a robot. (9)
- 2 a) With neat diagram, explain working of LVDT. (5)
- b) How torque is measured using strain gauge? (5)
- c) How a variable reluctance type stepper motor is constructed? On what parameters step angle of a stepper motor is dependent on? (5)
- 3 a) What is a hydraulic actuator? List any 3 advantages and 3 disadvantages of hydraulic actuator. (5)
- b) Explain working of a DC servo motor. (5)
- c) How will you control speed and direction of DC motors? (5)

PART B*Answer any two full questions, each carries 15 marks*

- 4 a) What are the main functions of robot vision system? (5)
- b) With a neat block diagram, explain the components of a machine vision system (10)
- 5 a) A robot with 2 revolute joints (J1, J2) has 2 links (L1, L2) with length 1m each. Assume origin is at joint J1. Determine the end-effector coordinates if the joint rotations are 30 degrees at J1 and J2. (5)
- b) Find a homogeneous transformation matrix T that represents a rotation of α angle about OX axis, followed by a translation of a units along the OX axis, followed by a translation of d units along the OZ axis, followed by a rotation of θ units along the OZ axis. (10)
- 6 a) Explain clearly the rules in DH representation. Define each parameter used. (6)
- b) Derive the rotation matrix for a sequence of rotations: Ψ about OX axis, θ about OY axis, ϕ about OZ axis. (9)

PART C

Answer any two full questions, each carries 20 marks

- 7 a) Derive manipulator Jacobian for a 2D planar 2 link manipulator. (10)
b) What are the consequences of singularities in inverse kinematics? (5)
c) What is PID control? What are the main advantages of PID control? (5)
- 8 a) Name the main categories of robot programming languages (5)
b) List 3 typical commands in VAL II and explain the function performed by each of these commands (10)
c) What is task level programming? (5)
- 9 a) Derive the kinetic and potential energies of a planar 2 link manipulator with link lengths l_1 , l_2 , joint angles θ_1 , θ_2 and masses m_1 , m_2 . (10)
b) Explain the use of robots in medical applications. (5)
c) Explain the recent developments in robotics (5)
