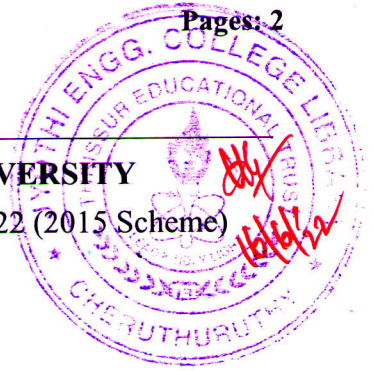


Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
Sixth Semester B.Tech Degree (S,FE) Examination May 2022 (2015 Scheme)



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 following performance parameters of a robot. (6)
- (i) Repeatability
- (ii) Resolution
- (iii) Accuracy
- b) What is meant by work space of a robot? How robots are classified based on work space? (6)
- c) A cartesian robot has a horizontal reach of 550 mm and a horizontal stroke of 350 mm. What is the maximum limit within which the object placed is not reachable? (3)
- 2 a) Provide the typical features of robotic sensors? Explain any five sensors used in robotics and mention areas of application of each? (10)
- b) Compare the various drive systems used in robotics? (5)
- 3 a) Define a robot and with a neat diagram explain the anatomy of a robot? (7)
- b) With a neat sketch explain the following hydraulic actuators. (8)
- (i) Rotary actuator (ii) Linear actuator

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

- 4 a) A mobile body reference frame OABC is rotated 60° about OY – axis of the fixed base reference frame OXYZ. If $p_{xyz} = (4,7,3)^T$ and $q_{xyz} = (2,6,5)^T$ are the co-ordinates with respect to OXYZ plane, what are the corresponding co-ordinates of p and q with respect to OABC frame? (6)
- b) Differentiate between forward and inverse kinematics? (4)
- c) What is rotation matrix? Mention any three properties of rotation matrix? (5)
- 5 a) Describe any four image processing techniques used in robotics? (10)
- b) What is homogeneous transformation matrix? Explain the matrix elements? (5)

- 6 a) What do you mean by link parameter table? How it can be obtained by using Denavit - Hartenberg method? (10)
- b) What is kinematic decoupling? Give the advantage of using kinematic decoupling? (5)

PART C

Answer any two full questions, each carries 20 marks

- 7 a) What is meant by robot singularities? Why are they important? (5)
- b) Explain Lagrangian mechanics? (5)
- c) How can PID controller be useful in robot actuation and control? (10)
- 8 a) Derive the kinetic and potential energies for a planar 2-link manipulator with link lengths d_1, d_2 , joint angles θ_1, θ_2 and masses m_1, m_2 ? (10)
- b) Describe in detail how robots can be used for material handling and assembly? (10)
- 9 a) Give any five recent developments in robotics? (5)
- b) Write down all the motion and speed control commands in VAL and explain the function performed by each of these commands? (5)
- c) Explain the structure of robot programming language? (10)
