

Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S8 (R,S) Exam April 2025 (2019 Scheme)

Course Code: ECT476**Course Name: ROBOTICS****Max. Marks: 100****Duration: 3 Hours****PART A***Answer all questions, each carries 3 marks.*

Marks

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|----|--|-----|
| 1 | Explain the specifications of robot- (a) Reach (b) Precision (c) Repeatability | (3) |
| 2 | Write the function of a gripper in robotics. | (3) |
| 3 | Explain three characteristics of the sensors used in robotics. | (3) |
| 4 | Write the advantages and disadvantages of pneumatic actuation systems. | (3) |
| 5 | Differentiate between Forward and Inverse Kinematics. | (3) |
| 6 | What is Kinematic decoupling? | (3) |
| 7 | How P, PI and PID control can be employed in Robotics? | (3) |
| 8 | Mention the different robot programming methods. | (3) |
| 9 | Examine the significance of imitation learning in humanoid robots. | (3) |
| 10 | Mention any three non industrial applications of Robot. | (3) |

PART B*Answer any one full question from each module, each carries 14 marks.***Module I**

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| 11 | a) Define Degree of freedom of a robot manipulator. How will you specify position and orientation of an object in a 3-dimensional space? | (8) |
| | b) Discuss about the advantages and disadvantages of using robots. | (6) |

OR

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| 12 | a) What is the difference between links and joints of a robot. Describe different types of joints with neat diagram. | (6) |
| | b) Describe the basic components of robotic systems and its functions. | (8) |

Module II

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|----|---|------|
| 13 | a) Explain construction and working of a Stepper motor. | (10) |
| | b) What are the functions of actuators and sensors used in a robot? | (4) |

OR

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| 14 | a) How is speed control of an electric motor attained by pulse width modulation | (4) |
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using a microprocessor?

- b) Explain the components and working of hydraulic actuation system. (10)

Module III

- 15 a) Assume a point P $[1,5,4]^T$ is translated along Y axis by 3 units and then rotated along Z axis by 180 degrees. Derive the homogeneous transformation matrix and find the new coordinates of P. (6)
- b) What is the relevance of Jacobian operator in velocity kinematics? What is meant by manipulator Jacobian? (8)

OR

- 16 a) Write the homogeneous transformation matrix for a 2 link planar manipulator. (8)
- b) What is meant by Singularities? Mention the importance of identifying manipulator singularities. (6)

Module IV

- 17 a) Explain the process of control of position and force of manipulators in robots. (8)
- b) Give 2 examples each for motion, end effectors, and sensor commands in VAL programming language and explain its function. (6)

OR

- 18 a) What are the different control schemes used in robotics? (6)
- b) With the help of a block diagram explain robot language structure. (8)

Module V

- 19 a) What are mobile robots? What are the different classes of mobile robots? (6)
- b) What do you mean by collaborative robots? Briefly explain the collaborative operation put into practice for robots. (8)

OR

- 20 a) Analyse the role that artificial intelligence plays in robotics. (6)
- b) Explain the different approaches assuring safe cooperation of human workers and industrial robots. (8)