

B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2024

Seventh Semester

Electrical and Electronics Engineering**20EEL715 - ROBOTICS AND CONTROL**

Regulations - 2020

Duration: 3 Hours

Max. Marks: 100

PART - A (MCQ) (20 × 1 = 20 Marks)

Answer ALL Questions

Marks *K-
Level* CO

1. Who coined the word "Robotics"? 1 K1 CO1
(a) Karel Capek (b) Issac Asimov (c) Isaac Newton (d) Elon Musk
2. _____ is a machine that has functions similar to human upper limbs, and moves the objects spatially. 1 K1 CO1
(a) Manipulator (b) Playback Robot (c) Intelligent Robot (d) Smart Device
3. What is external to the manipulator? 1 K1 CO1
(a) End-effector (b) Wrist (c) Manipulator arm (d) Hand
4. How many degrees of freedom does a human shoulder have? 1 K1 CO1
(a) 1 (b) 2 (c) 3 (d) 4
5. Drives are also known as 1 K1 CO2
(a) Actuators (b) Controller (c) Sensor (d) manipulator
6. The number of moveable joints in the base, the arm, and the end effectors of the robot determines _____. 1 K1 CO2
(a) degrees of freedom (b) payload capacity (c) operational limits (d) flexibility
7. Identify from the following short range sensor 1 K1 CO2
(a) ultrasonic sensor (b) GPS (c) Radar (d) Camera systems
8. One of the following term refers to the rotational motion of a robot. 1 K1 CO2
(a) Swivel (b) Axle (c) Retrograde (d) Roll
9. The type of joint allows a robotic manipulator to rotate about a single axis. 1 K1 CO3
(a) Prismatic joint (b) Revolute joint (c) Spherical joint (d) Translational joint
10. In an assembly line, which type of sensor would be most suitable for detecting the presence of small components near the robot's end effectors? 1 K1 CO3
(a) Proximity sensors (b) Force/torque sensors (c) Cameras (d) Range sensors
11. Identify the end effectors used in robotics? 1 K1 CO3
(a) Proximity sensors (b) Welding gun (c) Grippers (d) All the above
12. The type of gripper is known for its high strength and is used in applications requiring a significant amount of force? 1 K1 CO3
(a) Vacuum gripper (b) Pneumatic gripper (c) Electric gripper (d) Hydraulic gripper
13. Which of the following defines the motion of robots without considering the forces causing the motion. 1 K1 CO4
(a) Kinematics (b) Dynamics (c) Robotics (d) none of the above
14. The following is the common application of robotics 1 K1 CO4
(a) Path planning (b) navigation planning (c) Object recognition (d) direction
15. The common approach for solving forward kinematics problem 1 K1 CO4
(a) Closed form solution (b) numerical optimization (c) trial and error (d) all the above
16. The common approach for solving inverse kinematics problem 1 K1 CO4
(a) Closed form solution (b) numerical optimization (c) trial and error (d) all the above
17. Dynamic model of a robotic arm can be studied by..... 1 K1 CO5
(a) Newtonian laws (b) Lagrangian laws (c) Eulerian Laws (d) all the above

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|---|---|----|-----|
| 18. High stiffness and high accuracy are the characteristics ofactuator system. | 1 | K1 | CO5 |
| (a) Hydraulic (b) pneumatic (c) manipulator (d) system | | | |
| 19. Robot can be easily programmed to performoperation | 1 | K1 | CO5 |
| (a) Palletizing (b) bomb detection (c) drilling (d) painting | | | |
| 20. An N joint manipulator will have ... number of trajectory segments. | 1 | K1 | CO5 |
| (a) N (b) N+1 (c) N-1 (d) N+2 | | | |

PART - B (10 × 2 = 20 Marks)

Answer ALL Questions

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|---|---|----|-----|
| 21. Recall the term robot. | 2 | K1 | CO1 |
| 22. What is meant by Workspace? | 2 | K1 | CO1 |
| 23. Write the characteristics of actuating systems. | 2 | K1 | CO2 |
| 24. Point out the uses of sensors in robotics. | 2 | K1 | CO2 |
| 25. List any four important factors to be considered in the selection and design of grippers. | 2 | K1 | CO3 |
| 26. Summarize the need of control circuits. | 2 | K2 | CO3 |
| 27. Define statics. | 2 | K1 | CO4 |
| 28. Write the basic mechanism of legged robots. | 2 | K1 | CO4 |
| 29. List the types of robot cell layout. | 2 | K1 | CO5 |
| 30. What is Palletizing? | 2 | K1 | CO5 |

PART - C (6 × 10 = 60 Marks)

Answer ALL Questions

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|---|----|----|-----|
| 31. a) Sketch and explain the four basic robot configurations classified according to the coordinate system. | 10 | K2 | CO1 |
| OR | | | |
| b) Discuss the four types of robot controls. | 10 | K2 | CO1 |
| 32. a) What is robot vision? Describe a vision sensor used to take the image of an object. | 10 | K2 | CO2 |
| OR | | | |
| b) What are the different types of sensors? Classify them. Sketch and explain the use of a proximity sensor. | 10 | K2 | CO2 |
| 33. a) Describe with neat sketches the features, merits, limitations and applications of following grippers.
(i) Magnetic Gripper. (ii) Vacuum Gripper | 10 | K2 | CO3 |
| OR | | | |
| b) Sketch and explain a pneumatic manipulator control circuits used for robots. | 10 | K2 | CO3 |
| 34. a) What is robot software? Discuss the software elements of robot and different teaching methods of robot. | 10 | K2 | CO4 |
| OR | | | |
| b) Discuss the teach pendant for robot system. | 10 | K2 | CO4 |
| 35. a) Explain the Safety sensors and safety monitoring of Robots in detail. | 10 | K2 | CO5 |
| OR | | | |
| b) Discuss about closed loop control of a manipulator. | 10 | K2 | CO5 |
| 36. a) i) Discuss the software elements of robot. | 5 | K2 | CO4 |
| ii) Write short notes on any about the selection of robot. | 5 | K2 | CO5 |
| OR | | | |
| b) i) What is homogenous transformation of coordinates? | 5 | K2 | CO4 |
| ii) Discuss robot application for assembly and inspection. | 5 | K2 | CO5 |