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Question Paper Code: U9402

B.E. / B.Tech. DEGREE EXAMINATION, APRIL /MAY 2025

Professional Elective

Electronics and Communication Engineering

21UEC902- ROBOTICS AND APPLICATION

(Regulations 2021)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (5 x 1 = 5 Marks)

1. What is the primary function of sensors in a robot? CO1-U
(a) Data collection (b) Signal transmission (c) Movement (d) Orientation
2. Degrees of freedom in robotics describe: CO2-App
(a) Movement capability (b) Programming difficulty (c) Weight handling (d) Speed
3. Force balance is important for: CO1-U
(a) Static analysis (b) Dynamic movement (c) Signal processing (d) Orientation
4. The term 'p-degree polynomial' refers to: CO4- App
(a) Path generation (b) Sensor alignment (c) Velocity calculation (d) Torque balance
5. Which command is used for delays in robot motion? CO1-U
(a) Delay command (b) Stop command (c) Wait command (d) Pause command

PART – B (5 x 3= 15 Marks)

6. What is the role of tactile sensors? CO1-U
7. What are the various types of joints? CO1-U
8. List the interior singularities. CO1-U
9. Write the Lagrangian-Euler formula for a dynamic model. CO1-U
10. Mention the different methods of robot programming. CO1-U

PART – C (5 x 16= 80 Marks)

11. (a) Explain the brief history of robots, and how have they evolved over time from early myths and conceptual designs to modern industrial and personal applications? CO1-U (16)
- Or
- (b) Detail about common design and control issues faced in robotics, particularly in terms of system integration, reliability, and safety? CO1-U (16)
12. (a) How can mathematically derive the relationship between two rotated frames, and what role does the rotation matrix play in mapping coordinates from one frame to another in robotic systems? CO1-U (16)
- Or
- (b) Derive the Mathematical representation of Robots CO1-U (16)
13. (a) Inspect the significance of the Denavit-Hartenberg (D-H) convention in robotic kinematics? CO4-Ana (16)
- Or
- (b) Survey the Proportion integral Derivative control scheme improve accuracy and eliminate steady-state error in a robotic manipulator? CO4-Ana (16)
14. (a) A one degree of freedom manipulator with a rotary joint is to move from 113 degrees to 210 degrees in 7 seconds. Find the coefficient of the cubic polynomial to interpolate a smooth trajectory. Identify the position velocity and acceleration variation as a function of time. CO2-App (16)
- Or
- (b) A six-axis robot's first joint moves from 350° to 700° within 6 seconds. Using a cubic polynomial trajectory, determine the joint angle at 1, 2, and 3 seconds. CO2-App (16)
15. (a) Summarize the lead-through programming methods used in robotics. Explain the steps involved in teaching a robot using these methods with relevant examples. CO1-U (16)
- Or
- (b) Extend robot program as a "path in space"? Explain how this concept is implemented in robot programming and its significance in real-world applications. CO1-U (16)

