Question Paper Code:UB706

B.E./B.Tech. DEGREE EXAMINATION, NOV 2025

Professional Elective

21BMV706–ROBOTICS IN MEDICINE

Biomedical Engineering

(Regulations 2021)

Duration: Three hours   Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 2 = 20 Marks)

1.	Differentiate between joint coordinates and Cartesian coordinates.	CO1-U
2.	Name any two types of robotic joints.	CO1-U
3.	List any two physical characteristics of parallel robots.	CO1-U
4.	State the need for transformation of forces and moments between coordinate frames.	CO1-U
5.	Draw the basic block diagram of a control system.	CO1-U
6.	Give one example of a multiple-input multiple-output (MIMO) system.	CO1-U
7.	Mention one application of visible sensors in robotics.	CO1-U
8.	State one application of the Hough transform.	CO1-U
9.	Define fuzzification.	CO1-U
10.	What is the function of tele-operated robots in cardiac surgery?	CO1-U

PART – B (5 x 16= 80 Marks)

11. (a) Apply the concept of reference frames and coordinate transformations to show how a robot end-effector position is described. CO2 - App (16)

Or

(b) Using the Denavit–Hartenberg (DH) convention, derive the transformation matrices for a two-link planar manipulator. CO2 - App (16)

12. (a) Apply the forward kinematic approach to a simple 2-DOF planar   CO1 - U   (16)
   parallel robot and derive the end-effector position.

<div align="center">Or</div>

    (b) Compare differential operator methods with Lagrangian   CO1 - U   (16)
   mechanics for deriving dynamic equations of multi-DOF robots.

13. (a) Explain the differences between path planning and trajectory   CO1 - U   (16)
   planning in robotic motion.

<div align="center">Or</div>

    (b) Explain the role of Laplace transforms, transfer functions, and   CO1 - U   (16)
   block diagram algebra in robotic motion control systems.

14. (a) Analyze the advantages and limitations of using visible vs.   CO5 - Ana   (16)
   infrared sensors in robotic applications.

<div align="center">Or</div>

    (b) Examine a case study of an industrial vision system and discuss   CO5 - Ana   (16)
   how heuristics improve object detection and decision-making.

15. (a) Analyze a case study of fuzzy logic application in clinical   CO5 - Ana   (16)
   diagnosis, highlighting strengths and limitations.

<div align="center">Or</div>

    (b) Compare the effectiveness of fuzzy control applications in   CO5- Ana   (16)
   rehabilitation vs. surgical robotics, with justified conclusions.

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