

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST-2 EXAMINATIONS-2022

B.Tech-VII Semester (Open elective course) (CSE, IT, ECE, CE)

COURSE CODE (CREDITS): 20B1WEC731 (3)

MAX. MARKS: 25

COURSE NAME: Automation and Robotics

COURSE INSTRUCTOR: Dr. Pardeep Garg

MAX. TIME: 1.5 hours

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*Note: All questions are compulsory. Marks are indicated against each question in square brackets. Symbols have the same meaning as taught in class.*

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Q1. What is rigid body? Derive the necessary condition for a body to be rigid.

CO-3

[1+2=3 marks]

Q2. What is robot? How can robots be classified? Discuss the various areas of application of robots.

CO-3

[1+2+2=5 marks]

Q3. Derive 3D rotation matrix about any axis. (*Hint* – Derive for 2D rotation and then extrapolate it to 3D)

CO-3

[5 marks]

Q4. Derive the formula for obstacle distance calculation using LiDAR sensor. Draw schematic diagram of a feedback control system.

CO-4

[3+2=5 marks]

Q5. Prove if frame A and B are coincident, then rotation matrix about all the axes is identity.

CO-3

[3 marks]

Q6. A frame is rotated by  $30^\circ$  around Z-axis, then rotated by  $60^\circ$  around Y-axis and then finally rotated by  $90^\circ$  around X-axis. Find the resultant rotation matrix. Draw figures at each step showing the rotations.

CO-3

[3+1=4 marks]