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JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST–1 EXAMINATION – 2026

B.Tech–VIII Semester (Open Elective)

COURSE CODE (CREDITS): 25B1WEC832 (3) **MAX. MARKS:** 15

COURSENAME: Intelligent Robotics and Autonomous Systems

COURSE INSTRUCTORS: Dr. Vikas Baghel **MAX. TIME:** 1 Hour

Note: (a) All questions are compulsory.

(b) The candidate is allowed to make suitable numeric assumptions wherever required for solving problems.

(c) Use of calculators is allowed.

Q.No	Question	CO	Marks
Q1	a. Differentiate between wheeled, legged, and humanoid robots in terms of terrain capability, control complexity, and energy efficiency.	CO1	[1]
	b. Explain the system architecture of a mobile robot. Describe the major components involved and explain how sensing, perception, decision-making, and actuation are integrated in the overall architecture.		[2]
	c. Explain the limitation of Euler angles with respect to gimbal lock. A robot performs a 90° yaw rotation about the Z-axis. Compute the corresponding quaternion representation.		[2]
Q2	a. Explain the layered architecture of ROS 2 with the help of a neat diagram. Discuss the role of DDS and the middleware abstraction layer.	CO1	[2]
	b. Compare Topics, Services, and Actions in ROS 2 with respect to their communication model and typical usage. For each mechanism, provide one real-world robotic application where it is most appropriately used.		[2]
	c. Describe the role of tf2 in a multi-sensor robotic system. Explain why tf2 is essential for sensor fusion, localization, and robot navigation..		[1]

(34)

Q.No	Question	CO	Marks
Q3	a. Write the command to publish a static transform between `base_link` and `base_laser` with translation $(0.1, 0, 0.2)$ and no rotation. b. Describe how to view the fields and data types of a custom message (`.msg`) from an interfaces package in ROS 2. c. Consider the ROS 2 package creation command: ros2 pkg create <package_name> --build-type <build_type> --dependencies <dependency_1> <dependency_2> Explain the function of each component of the command.	CO1	[2] [2] [1]