# K. K. Wagh Institute of Engineering Education & Research, Nashik

(An Autonomous Institute From A.Y. 2022-23)

| WINTER-2025 | |
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| Exam Seat No.: | |
| Academic Year:2025-2026 | Semester:IV |
| Class:SY | Program:B.Tech |
| Branch Code:ROB | Pattern:2023 |
| Name of Course:Robot Operating Systems | Course Code:2312211 |
| Max. Marks:60 | Duration:2.30 Hrs. |

**Instructions:** Candidates should read carefully the instructions printed on the Question Paper and on the cover page of the Answer Book, which is provided for their use.

1. This question paper contains 02 page(s).
2. Answer to each new question is to be started on a new page.
3. Assume suitable data wherever required, but justify it.
4. Draw the neat labelled diagrams, wherever necessary.
5. The last columns indicates the Course Outcome and level of Blooms Taxonomy of the Question/sub-question.

| | | Marks | CO |
|---|---|---|---|
| **Question No. 1** | | | |
| 1a) | Explain the objectives of ROS and discuss how ROS supports modular robotic system development. | (6) | CO1, CO5 |
| **Question No. 2** | | | |
| 2a) | What is RViz? Explain its major features and how it helps in robot visualization. | (6) | CO2, CO5 |
| **Question No. 3** | | | |
| 3a) | Describe in detail the architecture and working of the OpenCR board. | (8) | CO3, CO5 |
| | **OR** | | |
| 3b) | Explain the working principle of rosserial communication. | (8) | CO3, CO5 |
| 3c) | Discuss the TurtleBot3 development environment. | (8) | CO3, CO5 |
| | **OR** | | |
| 3d) | Explain remote control operation in TurtleBot3. | (8) | CO3, CO5 |
| **Question No. 4** | | | |
| 4a) | Explain the role of sensing and pose estimation in robot navigation. | (8) | CO4, CO5 |
| | **OR** | | |
| 4b) | Describe SLAM applications and how SLAM is applied to service robots. | (8) | CO4, CO5 |

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|---|---|---|---|
| 4c) | Discuss map generation and types of maps in ROS. | (8) | CO4, CO5 |

**OR**

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|---|---|---|---|
| 4d) | Explain hardware constraints affecting SLAM. | (8) | CO4, CO5 |

**Question No. 5**

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|---|---|---|---|
| 5a) | Explain key features of ROS 2 for industrial & real-time applications. | (8) | CO6 |

**OR**

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|---|---|---|---|
| 5b) | Discuss ROS 2 communication middleware DDS and its advantages. | (8) | CO6 |
| 5c) | Explain the purpose and structure of ROS 2 packages. | (8) | CO6 |

**OR**

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|---|---|---|---|
| 5d) | Describe the ROS 2 node lifecycle. | (8) | CO6 |

**····· End of question paper·····**