|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Roll No. |  |  |  |  |  |  |  |  |  |  |  |  |



**PRESIDENCY UNIVERSITY**

**Bengaluru**

|  |
| --- |
| **End - Term Examinations – JANUARY 2025** |
| Date: 07 – 01- 2025 Time: 09:30 am – 12:30 pm |

|  |  |  |
| --- | --- | --- |
| **School:** School of Engineering | **Program:** B. Tech – Mechanical Engineering | |
| **Course Code:** MEC3099 | **Course Name:** AUTONOMOUS MOBILE ROBOTS | |
| **Semester**: VII | **Max Marks**: 100 | **Weightage**: 50% |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CO - Levels** | **CO1** | **CO2** | **CO3** | **CO4** | **CO5** |
| **Marks** | **44** | **42** | **46** | **48** | **-** |

**Instructions:**

1. *Read all questions carefully and answer accordingly.*
2. *Do not write anything on the question paper other than roll number.*

**Part A**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Answer ALL the Questions. Each question carries 2marks. 10Q x 2M=20M** | | | | |
| **1** | Define stability in the context of legged robots. | **2 Marks** | **L2** | **CO1** |
| **2** | What are holonomic constraints in mobile robots? | **2 Marks** | **L2** | **CO1** |
| **3** | List two applications of vision-based sensors in autonomous robots. | **2 Marks** | **L1** | **CO2** |
| **4** | Mention two advantages of Bayesian localization in mobile robots. | **2 Marks** | **L1** | **CO3** |
| **5** | What is the purpose of Kalman filters in robot localization? | **2 Marks** | **L2** | **CO3** |
| **6** | Briefly explain the concept of probabilistic mapping. | **2 Marks** | **L2** | **CO3** |
| **7** | Define Voronoi diagrams and their role in robot navigation. | **2 Marks** | **L2** | **CO4** |
| **8** | What are Markov Decision Processes (MDP)? | **2 Marks** | **L2** | **CO4** |
| **9** | Differentiate between PRM and RRT in path planning. | **2 Marks** | **L1** | **CO4** |
| **10** | What is the function of stochastic dynamic programming (SDP) in robot planning? | **2 Marks** | **L2** | **CO4** |

**Part B**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Answer the Questions Total 80 Marks.** | | | | | |
| **11.** | **a.** | Explain the types and challenges of locomotion in autonomous robots | **10 Marks** | **L2** | **CO1** |
|  | **b.** | Describe the construction and working of GPS in mobile robot navigation | **10 Marks** | **L2** | **CO1** |
| **or** | | | | | |
| **12.** | **a.** | Discuss the limitations of odometric position estimation and how they can be mitigated. | **20 Marks** | **L3** | **CO1** |
|  |  |  |  |  |  |
| **13.** | **a.** | Compare Kalman localization with Bayesian localization in mobile robots. | **20 Marks** | **L2** | **CO3** |
| **or** | | | | | |
| **14.** | **a.** | Explain the principles of probabilistic mapping in localization. | **10 Marks** | **L2** | **CO3** |
|  | **b.** | Discuss the use of positioning beacon systems in autonomous robots. | **10**  **Marks** | **L3** | **CO3** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **15.** | **a.** | Explain the A-star path planning algorithm with a suitable example. | **20 Marks** | **L** | **CO4** |
| **Or** | | | | | |
| **16.** | **a.** | Describe the role of probabilistic mapping in improving robot localization | **20 Marks** | **L3** | **CO4** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **17.** | **a.** | Describe the filtering techniques used to mitigate uncertainty in robot sensors. | **20 Marks** | **L3** | **CO2** |
| **Or** | | | | | |
| **18.** | **a.** | Explain the performance measures of active and passive sensors in robot perception | **10 Marks** | **L2** | **CO2** |
|  | **b.** | Describe the uncertainty in sensing and its impact on mobile robots. | **10 Marks** | **L2** | **CO2** |

**\*\*\*\*\* BEST WISHES \*\*\*\*\***