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**SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)**

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

**SIXTH SEMESTER B.TECH DEGREE EXAMINATION (R), MAY 2023****(2020 SCHEME)****Course Code : 20RBT382****Course Name: Introduction to Mobile Robotics****Max. Marks : 100****Duration: 3 Hours****PART A*****(Answer all questions. Each question carries 3 marks)***

1. Differentiate between wheeled mobile robots and legged mobile robots.
2. Describe the critical issues associated with locomotion.
3. Explain the properties of a non-holonomic robot.
4. Differentiate between the degree of freedom and the degree of steerability.
5. Classify the types of sensors used in mobile robots.
6. List the characteristics of a sensor.
7. With the help of an example, explain the execution of reactive navigation in mobile robots.
8. Illustrate the working of the D\* algorithm.
9. Examine whether the bug algorithm provides the shortest path to the goal position.
10. List the applications where collaborative robots are used.

**PART B*****(Answer one full question from each module, each question carries 14 marks)*****MODULE I**

11. a) Compare the characteristics of steered wheels and castor wheels with the help of equations. (10)
- b) Summarize the advantages of using wheeled locomotion in planetary rovers. (4)

**OR**

12. a) Compare and contrast underwater robots and surface water robots. (10)
- b) Differentiate static and dynamic stability in legged mobile robots. (4)

**MODULE II**

13. a) Identify the classification of wheel configurations in rolling vehicles. (10)
- b) Differentiate between differential degree of freedom (DDOF) and degrees of freedom (DOF). (4)

**OR**

14. a) Examine the unicycle model of a differential drive robot. (7)  
b) Explain the dynamic model of a mobile robot using the Lagrange method. (7)

**MODULE III**

15. a) Classify the types of image preprocessing techniques in vision systems. (8)  
b) Outline the role of feature extraction in vision systems. (6)

**OR**

16. a) Explain the working principle of the IMU sensor module. (7)  
b) With the help of an example, illustrate the role of heading sensors in robots. (7)

**MODULE IV**

17. a) Determine the challenges involved in robot localization. (6)  
b) Explain the probabilistic map-based localization. (8)

**OR**

18. a) Differentiate between local and global path planning in robot navigation. (8)  
b) Describe the steps involved in implementing the SLAM technique for autonomous navigation. (6)

**MODULE V**

19. a) Illustrate how a mobile robot can be programmed to move to a goal position by controlling its linear and angular velocities. (10)  
b) List the approaches in robot navigation that can avoid obstacles to reach the goal position. (4)

**OR**

20. a) With the help of an example, explain the working of the vector field histogram algorithm. (8)  
b) Differentiate between vector field algorithm and dynamic window approach. (6)

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