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MINI-043

M.Tech. IN ADVANCED INFORMATION TECHNOLOGY – INTELLIGENT SYSTEMS AND ROBOTICS (MTECHSR)

Term-End Examination

00014

December, 2014

MINI-043 : MOBILE AUTONOMOUS ROBOTS

Time : 3 hours *Maximum Marks : 100*

Note :

(i) *Section I is* ***compulsory****.*

(ii) *In Section II, answer any* ***five*** *questions.*

(iii) *Assume suitable data wherever required.*

(iv) *Draw suitable circuits wherever required.*

(v) *Italicized figures to the right indicate maximum marks.*

(vi) *Use of calculator is allowed.*

SECTION I

1. An autonomous bot named 'xShooter' has the ability to move around in stealth mode and fire at targets. It also has the following functionalities :

(a) Use 2-D vision to find and identify and track the target.

(b) Find safe and unsafe places to hide.

(c) Computing optimal paths across the safe area towards the desired destination.

(d) Driving along the calculated route.

(e) Avoiding all obstacles on path.

(f) Shoot at the target once the target is locked and approved by the base station.

Give the design details for xShooter based on the following :

(i) Hardware Design *7*

(ii) Locomotion *7*

(iii) Sensors on board *8*

(iv) Algorithm and flow chart of a fully functional xShooter *8*

Justify each of the design considerations with appropriate reason.

SECTION II

2. What are the different encoding mechanisms available to determine the position of a motor shaft or wheel ? Explain any two of them with circuit diagram. *14*

3. Write in brief about the following : *2×7=14*

   (a) Swarm Robotics v/s Modular Robotics

   (b) How will you estimate ADC size for an application ?

4. Compare the following with appropriate circuit, diagram and equations : *14*

   (a) P

   (b) PI

   (c) PID

5. Explain the following : *2×7=14*

   (a) Dead Reckoning

   (b) Localization

6. Maze solving robots follow Maze Exploration Techniques to reach the centre of the maze from the starting point. Explain two different Maze Exploration Techniques. *2×7=14*

7. Explain the working principle of the following motors. Give a suitable use for each of these motors with suitable examples. $4 \times 3\frac{1}{2} = 14$

(a) DC Motor

(b) Stepper Motor

(c) Servo Motor

(d) Brush-less DC Motor

8. Discuss about Balancing Robots. Explain any one technique of balancing with proper schematic. Give details of sensors used and different actions taken depending on sensor reading. *14*