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Course Code: MCT308
Semester: VII

AUTONOMOUS MOBILE ROBOTS

Course Objectives:
The course aims at enabling the learner to
- *Choose Autonomous Mobile Robots*
- *Select Sensors for Mobile Robotic Systems*
- *Perform Localization and Mapping through Mobile Robots*
- *Design and Plan Path for Autonomous Mobile Robots*

UNIT – I   **10 Periods**
INTRODUCTION : History of Mobile Robotics – Locomotion – Legged Locomotion, Wheeled Locomotion – Maneauverability, Workspace, Motion Control.
Applications of Mobile Robots: Industry, Space, Military, Home and Healthcare.

UNIT – II   **10 Periods**
SENSORS FOR MOBILE ROBOTS: Sensor classification- Characterizing sensor performance, Wheel/motor sensors, Heading sensors, Ground-based beacons, Active ranging, Motion/speed sensors, Vision-based sensors - Representing Uncertainty, Statistical representation, Error propagation: combining uncertain measurements - Feature Extraction - based on range data and Visual appearance.

UNIT – III   **12 Periods**
LOCALIZATION AND MAPPING: Introduction - Bayes filter – Kalman Filter - Extended Kalman Filter - Information Filter - Histogram Filter - Particle Filter – Challenges of Localization- Map Representation- Probabilistic Map based Localization-Monte carlo localization- Landmark based navigation-Globally unique localization- Positioning beacon systems- Route based localization – Mapping - Metrical maps - Grid maps - Sector maps – Hybrid Maps – SLAM.

UNIT – IV   **13 Periods**
PLANNING AND NAVIGATION: Introduction-Path planning overview- Global path planning – A* Algorithm - local path planning - Road map path planning- Cell decomposition path planning-Potential field path planning-Obstacle avoidance – Path control.

TEXT BOOKS:
1. Roland Siegwart, Illah Reza Nourbakhsh, Davide Scaramuzza, Introduction to Autonomous Mobile Robots, Bradford Company Scituate, USA, 2011.

REFERENCES:
1. Sebastian Thrun, Wolfram Burgard, Dieter Fox, ―Probabilistic Robotics, MIT Press, 2005.
2. KarstenBerns, Ewald Von Puttkamer, ―Autonomous Land Vehicles Steps towards Service Robots, Vieweg Teubner Springer, 2009.
3. Howie Choset, Kevin LynchSeth Hutchinson, George Kantor, Wolfram Burgard, Lydia Kavraki, and Sebastian Thrun, ―Principles of Robot Motion-Theory, Algorithms, and Implementation, MIT Press, Cambridge, 2005.
4. Bruno Siciliano, Oussama Khatib, Springer Hand book of Robotics, Springer, 2008.

ONLINE MATERIAL:
1. https://www.coursera.org/learn/modernrobotics-course5#syllabus

LEARNING OUTCOMES

Upon successful completion, the learner will be able to:

Unit- I	Classify and choose different mobile robot configurations as per the need.
Unit – II	Select and implement appropriate sensors for mobile robots.
Unit - III	Implement localization and mapping algorithms using mobile robotic platforms.
Unit – IV	Perform path planning and navigation of mobile robots.