3. RAI 812 Mobile Robotics (3)

Textbook: Introduction to Autonomous Mobile Robots. By Roland Siegwart and Illah R. Nourbakhsh, The MIT Press, 2004.
ISBN-10: 0-262-19502-X, ISBN-13: 978-0-262-19502-7

Reference Books: Robot Motion Planning, By Jean-Claude Latombe, Kluwer Academic Publishers, 1991.
ISBN-10: 079239206X, ISBN-13: 978-0792392064
Handouts and research articles may also be used by the instructor.

Objective:

This course focuses on providing the student with an in-depth knowledge of the functional architecture of a mobile robot as well as issues relating to its navigation and control. The course is organized with the robot functional architecture as an outline, and each its component is explained one by one. The course intends to furnish the student with a clear idea of how a robot can be endowed with mobility and how to resolve some of the fundamental issues concerning its navigation and control.

Pre-Requisite:

EM 800 Robotics – I (or equivalent)

Course Outcome:

This course will furnish the students with a comprehensive insight into mobile robotics both in terms of their design architecture as well as their navigation and control. The course also features laboratory experiments which will enhance the students' practical experience of working hands on with mobile robots. It will enable students to undertake research projects and theses falling within the subject area of mobile robotics.

Course Outline:

The course covers the techniques and technology that enable mobility in a series of interacting modules. Various topics cover different aspects of mobility, moving from low-level to high-level details. These include low-level locomotive ability, examining robots' wheels and legs and the principles of kinematics, an in-depth view of perception, including descriptions of many "off-the-shelf" sensors and an analysis of the interpretation of sensed data. The course also considers the higher-level challenges of localization and cognition, discussing successful localization strategies, autonomous mapping, and navigation competence.

Topics	Allocated Periods
Wheeled Mobile Robots Legged Mobile Robots Mobile Robot Forward Kinematics models Wheel Kinematic Constraints Robot Kinematic Constraints Degree of Mobility and Degree of Steerability Mobile Robot Degrees of Freedom Holonomic Robots Path and Trajectory Considerations Open Loop Trajectory Following Control	45

Feedback Control Sensors for Mobile Robots Wheel / Motor Sensors, Heading Sensors, Ground Based Sensors, Motion / Speed Sensors, Laser, Ultrasonic, Vision-based Ranging Odometric Position Estimation Map Representation Probabilistic Map Based Localization Landmark based Navigation Positioning Beacon Systems Route Based Localization Autonomous Map Building Navigation: Planning and Reacting Obstacle Avoidance **Lab** Practical operation of mobile robots Use of sensors mounted on mobile robots Hands on experience of vision with mobile robots	