1. Course number and name
   **EML 4830 Introduction to Mobile Robotics**

2. Credits and contact hours
   3 cr, 2.5 contact hours (2 hrs. 30 min. lecture)

3. Instructor’s or course coordinator’s name
   Instructor: Dr. Emmanuel Collins, Coordinator: Dr. Jonathan Clark

4. Text book, title, author, and year

5. Specific course information
   a. brief description of the content of the course (catalog description)
      This course covers the following topics: analytical dynamic modeling and dynamic simulation of mobile robots; mobile robot sensors; basic computer vision methods; Kalman filtering and mobile robot localization; basic mapping concepts; path planning and obstacle avoidance; intelligent control architectures.
   
   b. prerequisites or corequisites
      Prerequisite: Instructor permission.
   
   c. indicate whether a required, elective, or selected elective course in the program
      Selected Technical Elective course

6. Specific goals for the course
   a. Course Outcomes
      1. Be able to describe a wide variety of autonomous vehicles and their industrial or military applications [1]
      2. Be able to describe the major physical subsystems associated with mobile robots [1]
      3. Be able to discuss the different levels of autonomy for mobile robots [1]
      4. Be able to describe the basic types of mobile robot sensors and the principle of operation of a given sensor type [2]
      5. Be able to discuss the way sensors are characterized and the precise meaning of a given sensor characteristic [2]
      6. Be able to design and simulate a Kalman filter for simple navigation problems [3]
      7. Be able to describe the basic issues in computer vision for mobile robot applications [4]
      8. Be able to describe and program the A* algorithm for path planning [5]
      9. Be able to describe potential field path planning [5]
     10. Be able to describe several obstacle avoidance algorithms [5]
     11. Be able to describe the major topics in human-robot interaction [6]
     12. Be able to design and build a simple mobile robot [7]
     13. Be able to construct and calibrate the kinematics of a differentially-steered vehicle [7]

      Numbers refer to Course Objectives below, e.g. for course outcome 7, [4] refers to course objective 4.

   b. Course Objectives and Relation to Student Outcomes
      1. To provide an overview of the key concepts related to designing and implementing mobile robots in practical applications [1, 3, 4, 5, 8, 9, 10]
2. To provide an overview of the basic sensors used in mobile robots and the ways that these sensors are characterized [1, 2, 10, 11]
3. To introduce the concept of Kalman filtering and mobile robot localization [1, 2, 10, 11]
4. To introduce basic issues in computer vision for mobile robotics [1, 2, 10, 11]
5. To present standard path planning and obstacle avoidance algorithms [1, 2, 10, 11]
6. To provide a broad overview of topics in human-robot interaction [3, 4, 6, 8, 10]
7. To provide hands-on experience in designing and modeling a simple mobile robot [2, 5, 10, 11]

Numbers refer to Departmental Student Outcomes, e.g. for course objective 7, [2, 5, 10, 11] refers to student outcomes 2, 5, 10, and 11.

7. Brief list of topics to be covered
   - Introduction to mobile robotics
   - Robot locomotion and kinematics
   - Sensors and sensor fusion
   - Localization
   - Path planning
   - Obstacle avoidance
   - Control architectures
   - Human-robot interaction