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
   Introduction to Autonomous Mobile Robots, Siegwart, R., Nourbakhsh, I. R., and Scaramuzza, D., 2011
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