1. Course number and name
   EML 4800 Introduction to 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. Carl Moore, Coordinator: Dr. Jonathan Clark
4. Text book, title, author, and year
   Robot Modeling and Control, Spong, M. W., Hutchinson, S., and Vidyasaga, M., 2005
5. Specific course information
   a. *brief description of the content of the course (catalog description)*
      This course explores the basic elements of a robot, robot actuators, and servo control; sensors, senses, vision, and voice; microprocessor system design and computers; kinematic equations; motion trajectories.
   b. *prerequisites or corequisites*
      Prerequisite: EML 3014C
   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 recognize different types of robots and their intended applications [1]
      2. Be able to develop a transformation matrix that relates the end effector of a robot with the base coordinate frame [2, 3]
      3. Be able to determine the position and orientation of a robot end effector given its joint positions [3, 4, 8]
      4. Be able to determine the linear and angular velocity of a robot end effector given the position and velocities of its joints [3, 4. 8]
      5. Be able to create the equations of motion for a manipulator using the Lagrangian formulation [5, 8]
      6. Be able to calculate a set of robot joint positions, velocities, and accelerations that will achieve a desired end effector trajectory
      7. Be able to develop and simulate robot control using the computed torque method [5, 7, 9]
      8. Understand the fundamentals of robot control [5, 7, 8]
      9. Be able to create computer code necessary to drive a robot system [2, 3, 4, 5, 7]
      10. Be able to present technical material through writing [8]

      Numbers refer to Course Objectives below, e.g. for course outcome 9, [2, 3, 4, 5, 7] refers to course objectives 2, 3, 4, 5, and 7.
   b. *Course Objectives and Relation to Student Outcomes*
      1. To provide an overview of the state of the art in robot technology
      2. To teach formation of homogeneous transformations for relating positions and orientation between frames
      3. To teach the relationship between manipulator joint space positions and task space positions
      4. To teach the relationship between manipulator joint space velocities and task space velocities

5. To teach the Lagrangian (energy-based) approach to dynamics
6. To teach how to compute a manipulator trajectory through multidimensional space
7. To teach computed torque and position/force control methods
8. To teach comprehension and application of material from technical journal articles
9. To teach the ability to write computer programs that calculate robot mathematics

7. Brief list of topics to be covered
    - Introduction and History of robots
    - Translations, rotations, and transformations
    - Manipulator kinematics
    - Inverse manipulator kinematics
    - Jacobians: velocities and static forces
    - Manipulator dynamics
    - Trajectory generation
    - Linear manipulator control
    - Nonlinear control of manipulators