1. Course number and name

   EML 4711 Introduction to Gas Dynamics
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. Farrukh Alvi, Coordinator: Dr. Juan Ordonez
4. Text book, title, author, and year

   Gas Dynamics, John, J. E. A., Keith, T. G., 2006
5. Specific course information
   a. *brief description of the content of the course (catalog description)*

      This course is a thorough one-dimensional treatment of compressible flows and applications to nozzle, diffuser, sound waves, tunnel, and shock tube flows.
   b. *prerequisites or corequisites*

      Prerequisite: EML 3016C
   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 literate about at least some of the most important historical developments in gas dynamics [1]
      2. Understand the physical meaning of key thermodynamic state variables of simple gasses, including pressure, density, specific volume, temperature, internal energy, enthalpy, and entropy [1]
      3. Understand the relationship between thermodynamic pressure and density or specific volume and mechanical properties, and be able to compute basic mechanical properties from the thermodynamic ones and vice-versa [1]
      4. Understand the requirements for the thermodynamic state of a typical gas to be completely determined [1]
      5. Understand the relationship between inviscid and isentropic flows for typical compressible flows, the major limitations of isentropic and inviscid flows, and the effect of irreversibility and viscous effects on entropy [2]
      6. Be able to recognize where the equation of state may be used to find additional variables, and be able to do so [1, 2]
      7. Understand the concept of Mach number, and how it relates to compressibility effects, typical flow properties, and wave propagation [3]
      8. Understand the physical origin of the equations of compressible one-dimensional flows [1]
      9. Be able to analyze one-dimensional flows including shock waves, heat addition, and friction [1]
      10. Understand the relationship between Mach number and stagnation and pitot properties and be able to compute their relationship in typical applications [1, 2, 3]
      11. Be able to analyze converging and converging-diverging ducts in typical applications such as wind tunnels, turbines, and rocket exit nozzles [4]
      12. Be able to analyze the starting problem in supersonic wind tunnels [4]

13. Be able to analyze unsteady one-dimensional wave motion, including moving and reflected shock waves, expansion waves, for typical applications such as shock tubes and flow measurements [4]
14. Be able to graphically describe and analyze one-dimensional wave motions [4]

Numbers refer to Course Objectives below, e.g. for course outcome 10, [1, 2, 3] refers to course objectives 1, 2, 3.

b. *Course Objectives and Relation to Student Outcomes*

1. Provide students with a minimum literacy into the origins, purposes, and methods of gas dynamics [1, 5 ,8]
2. To teach students how thermodynamical concepts apply to gas dynamics [1, 5]
3. To familiarize students with the features of inviscid compressible flows, including shock waves, expansion fans, and contact surfaces [1, 5]
4. To teach students to analyze or compute one-dimensional and quasi-one-dimensional flows in typical applications such as supersonic windtunnels, rocket nozzles, and shock tubes [1, 3, 5, 10]

Numbers refer to Departmental Student Outcomes, e.g. for course objective 1, [1, 5, 8] refers to student outcomes 1, 5, 8.

7. Brief list of topics to be covered
   - Some historical and introductory notes.
   - One-dimensional flow.
   - Quasi one-dimensional flow.
   - Unsteady wave motion.
   - Additional topics as time permits.