1. Department, Course Number, and Course Title:

MECHANICAL ENGINEERING

ME 408 FLUID MECHANICS II

2. Designation:

Required	☐	Elective	☑
Lower Division	☐	Upper Division	☑

3. Course Description: Compressible and incompressible fluid dynamics; continuity, momentum and energy equations for viscous fluids; circulation and vorticity, Navier-Stokes equation, boundary layer theory, turbulence, two-dimensional flow, three-dimensional flow.

4. Prerequisites: CE/ME 303 (Fluid Mechanics I), MATH 215 (Differential Equations)

5. Text and Materials: A Brief Introduction to Fluid Mechanics, Second Edition, Munson, Young & Okiishi, John Wiley & Sons, 2001.

6. Course Objectives: To introduce the governing equations of viscous, inviscid and compressible fluid flow, some basic solutions to these equations, and methods of solving engineering problems involving fluid dynamics.

Course Outcomes

- a knowledge of the governing equations for potential flow and basic flow solutions
- a knowledge of the Navier-Stokes equations for viscous flow and basic flow solutions
- a knowledge of the compressible flow theory for perfect gas
- a knowledge of Computational Fluid Dynamics (CFD) software and on-line fluid mechanics software
- an ability to predict the boundary layer thickness and skin friction drag on a surface
- an ability to predict the lift and drag on a body moving in a fluid
- an ability to solve problems involving 1-D isentropic flow, normal shock and oblique shock
- an ability to utilize various computer software for problems and design projects involving fluid flow

7. Topics Covered: (in Order of Presentation)

- Review of Control Volume Analysis
- Potential Flow Theory
- Basic Potential Flow Solutions
- Superposed Solutions
- Navier-Stokes Equ. for Viscous Flow
- Simple Solutions of Viscous Flow
- Laminar Boundary Layer Theory
- Integral Momentum Method
- Turbulent Boundary Layers
- Drag Prediction
- Lift Prediction
- Ideal Gas Properties
- 1-D Isentropic Flow
- Normal Shock

8. Class Schedule:

Number of Sessions per week:	2
Duration of each session:	1 hour 40 minutes

9. Contribution of course to meeting the professional component:

This course is part of the 24 units of technical electives required for the mechanical engineering program.

Engineering Science	2 units
Engineering Design	2 units

10. Relationship of course to program objectives:

This course relates to the program objectives by contributing to the following measurable outcomes at the level indicated for all engineering graduates:

Knowledge outcomes:

- an ability to apply knowledge of mathematics, science, and engineering (abet a)
- a knowledge of computer aided design and simulation software

Skill outcomes:

- an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability (abet c)
- an ability to communicate effectively (abet g)
- an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice (abet k)
- an ability to think in a logical sequential process

Attitudes Outcome:

- an understanding of professional and ethical responsibility (abet f)
- a recognition of the need for an ability to engage in lifelong learning (abet i)

11. Prepared by: Darrell Guillaume 05/2005