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| **COURSE NUMBER:** ME 5332, 3 cr. | **COURSE TITLE:** Intermediate Fluid Mechanics |
| **TERMS OFFERED:** Once a year (Fall or Spring) | **PREREQUISITES:** ME 3331 Thermal Sciences II or equivalent first course in fluid mechanics, CSE upper division or Grad student. |
| **TEXTBOOKS/REQUIRED MATERIAL:**<br>Suggested texts or equivalents<br>*Viscous Fluid Flow* by Frank M. White<br>Introductory text in Fluid Mechanics such as *Fundamentals of Fluid Mechanics* by Munson, Young, Okiishi and Huebsch | **PREPARED BY:** Jane H. Davidson<br><br>**DATE OF PREPARATION:** March 1, 2015 |
| **COURSE LEADER(S):** Jane Davidson, Cari Dutcher, Sean Garrick, Jiarong Hong, Lian Shen, Paul Strykowski | **CLASS/LABORATORY SCHEDULE:**<br>Three 50 minute lectures per week<br><br>**CONTRIBUTION OF COURSE TO MEETING PROFESSIONAL OBJECTIVES:**<br>100% Engineering topics |
| **CATALOG DESCRIPTION:** This course is a bridge between an introductory undergraduate course on fluid mechanics and advanced graduate level courses in fluid mechanics and thermal sciences. Topics include the principles of incompressible and compressible flows, boundary layer theory, and analysis using differential formulations of the governing conservation equations. Analysis of phenomena relevant to the practice of engineering is emphasized through problem solving. | **COURSE TOPICS:**<br>1. Properties of fluids and kinematics of fluid motion<br>2. Derivation and physical interpretation of the differential equations of incompressible and compressible flows including transport of mass, momentum, and energy<br>3. Potential flow theory and solution techniques<br>4. Viscous-flow equations and solution techniques with applications to engineering phenomena<br>5. Theory and analysis of laminar and turbulent boundary layers<br>6. Introduction to stability and turbulent flows |

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| **COURSE OBJECTIVES** | Students learn:<br>1. A deeper understanding of the basic thermodynamic, kinematic, and transport properties of fluids than usually taught in introductory undergraduate courses on fluid mechanics<br>2. An understanding of kinematics of fluid motion, streamline coordinates, vorticity<br>3. A physical and mathematical description of the differential governing conservation equations of mass, momentum and energy<br>4. Physical and mathematical application of boundary conditions on velocity and stress at material interfaces<br>5. Application and interpretation of the physical significance of non-dimensional parameters for free and confined flows<br>6. Solutions of viscous flow equations with engineering applications<br>7. Boundary layer theory and solution techniques<br>8. Introduction to the concepts of stability and turbulence<br>9. The application of fluid mechanics principles to engineering design. |
| **COURSE OUTCOMES** | **(Numbers shown in brackets are linked to program outcomes 1-9.)**<br>1. An ability to describe and apply the fundamental fluid properties and the governing differential equations of fluids motion to engineering problems [a, e, g, k ]<br>2. An ability to describe the physical significance and apply dimensionless parameters and analysis to fluid flow [ a, e, g , k]<br>3. An understanding of the classical analytical techniques to solve Newtonian viscous flows [ a, e, k ]<br>4. Knowledge of the physical importance of boundary layers and application of boundary layer theory to engineering problems [a, e, k ]<br>5. Demonstrate a basic understanding of stability and transition to turbulent flows [ a, e , g<br>6. Ability to apply laws and relations of fluid mechanics to analyze engineering equipment and systems [ a, c, e, k ] |
| **ASSESSMENT TOOLS:** | 1. Midterm and final exams<br>2. In class problems & discussion<br>3. Homework problem sets |