

## ME 407: Computational Fluid Dynamics

<i>Course description:</i>	Basic concepts and applications of computational fluid dynamics to the analysis and design of fluid systems and components.
<i>Number of credits:</i>	3
<i>Course Coordinator:</i>	P. Dutta
<i>Prerequisites by course:</i>	ME 303
<i>Prerequisites by topic:</i>	<ol style="list-style-type: none"><li>1. Conservation of mass, momentum, and energy</li><li>2. Fluid statics</li><li>3. Dimensional analysis</li><li>4. Flow in conduits</li><li>5. Applied numerical methods</li><li>6. Finite difference methods</li></ol>
<i>Postrequisites:</i>	None
<i>Textbooks/other required materials:</i>	<ol style="list-style-type: none"><li>1. Versteeg. <i>Introduction to Computational Fluid Dynamics</i>. Pearson Prentice Hall, 2007, 2/e.</li></ol>
<i>Course objectives:</i>	<ol style="list-style-type: none"><li>1. To develop skills in computational fluid dynamics to address engineering problems.</li><li>2. To understand the basic structure and capabilities of current commercial CFD codes.</li><li>3. To apply CFD codes in the design of fluid systems and components.</li></ol>
<i>Topics covered:</i>	<ol style="list-style-type: none"><li>1. Review of control volume formulation of fluid flow analysis.</li><li>2. Finite difference formulation of flow system equations.</li><li>3. Numerical methods to solve systems of algebraic equations.</li><li>4. Upwind differencing and staggered grids for stability and introduction of numerical viscosity.</li><li>5. Pressure formulation of continuity equation.</li><li>6. Flow diagrams for code structure.</li><li>7. Features of currently available commercial codes.</li><li>8. Design and theory and methodology.</li><li>9. Design optimization.</li><li>10. Application of a commercial code to the design of a fluid system or component.</li></ol>
<i>Expected student outcomes:</i>	<ol style="list-style-type: none"><li>1. Be familiar with the general principles of computational fluid mechanics and the capabilities of commercial software for design of engineering fluid systems.</li></ol>
<i>Class schedule:</i>	Three 50-minute lecture sessions per week, for one semester.
<i>Laboratory schedule:</i>	None.
<i>Contribution to meeting the professional component:</i>	Engineering Topics
<i>Relationship of course to program objectives:</i>	Meets: <ol style="list-style-type: none"><li>1. School of MME ME educational objectives: 1</li><li>2. School of MME ME program outcomes: (a), (i), (k)</li><li>3. ABET EC2000, Criterion 3 program outcomes: (a), (i), (k)</li></ol>
<i>Prepared by:</i>	P. Dutta
<i>Date:</i>	March 20, 2013

### POLICIES

#### A. Reasonable Accommodation (the nature of the particular course determines which one applies):

- **Pullman Campus.** Reasonable accommodations are available for students with a documented disability. If you have a disability and need accommodations to fully participate in this class, please either visit or call the Access Center (Washington Building 217; 509-335-3417) to schedule an appointment with an Access Advisor. All accommodations MUST be approved through the Access Center.
- **WSU Online Course.** Reasonable accommodations are available in online classes for students with a documented disability. All accommodations must be approved through your WSU Disability Services office. If you have a disability and need accommodations, we recommend you begin the

process as soon as possible. For more information contact a Disability Specialist on your home campus: Pullman or WSU Online (<http://accesscenter.wsu.edu>), Spokane (<http://spokane.wsu.edu/students/current/studentaffairs/disability/>), Tri-Cities (<http://www.tricity.wsu.edu/disability>), Vancouver (<http://studentaffairs.vancouver.wsu.edu/student-resource-center/disability-services>).

#### **B. Academic Integrity**

WSU expects all students to behave in a manner consistent with its high standards of scholarship and conduct. Students are expected to uphold these standards both on and off campus and acknowledge the university's authority to take disciplinary action. The Standards of Conduct for Students can be found at <http://conduct.wsu.edu>.

#### **C. WSU Safety**

WSU is committed to maintaining a safe environment for its faculty, staff, and students. Safety is the responsibility of every member of the campus community and individuals should know the appropriate actions to take when an emergency arises. In support of our commitment to the safety of the campus community the University has developed a Campus Safety Plan, <http://safetyplan.wsu.edu>. It is highly recommended that you visit this web site as well as the University emergency management web site at <http://oem.wsu.edu/> to become familiar with the information provided.