Course Description (catalog): 3 sem. hrs. (3:0). Fluid properties, fluid statics, dynamics, and kinematics, conservation of energy and momentum, incompressible, laminar and turbulent flow. Similitude and dimensional analysis, and viscous flow. Prerequisites: ENGR 2326 - Dynamics

Course Description (narrative): This is a first course in fluid mechanics and fluid power. The course introduces students to basic concepts in fluid statics, kinematics and dynamics. Control-volume, differential equation and dimensional analysis methods are used. Applications of basic concepts and analysis methods to simple internal and external flows are emphasized in this course to determine flow variables of interest, such as pressure, forces, shear stresses, flow rates, energy losses, and power requirements.

Course Learning Objectives: Upon completing this course, students will

1. Have a basic understanding of fluid statics, kinematics and dynamics
2. Be able to perform engineering calculations of forces in hydrostatic systems
3. Be able to perform engineering calculations of momentum and energy changes using control-volume methods
4. Be able to perform engineering calculations of volumetric flow rates and friction losses of pipe flow
5. Be able to perform engineering calculation of drag of external flows
6. Have a basic understanding of pump and turbine characteristics and perform power calculations
7. Have a basic understanding of analysis and interpretation of data or results obtained from experiments or CFD (computational fluid dynamics) calculations

Course Outline/Schedule (tentative, subject to change):

7 lectures: Introduction: dimensions, fluid properties
Fluid statics: pressure, hydrostatic force, rigid body motion
(Textbook sections 1.1-1.10, 2.1-2.12)

Test #1 \textbf{On or about 2 Oct 2013}

8 lectures: Elementary fluid dynamics; Bernoulli equation
Fluid kinematics, velocity field
Reynolds transport theorem
Finite control volume analysis; equations of continuity, momentum, and energy
(Textbook sections 3.1-3.6, 4.4-4.4; 5.1-5.3)

Test #2 \textbf{On or about 31 Oct 2013}

7 lectures: Dimensional analysis and similitude
Fully-developed pipe flows
(Textbook sections 7.1-7.7, 8.1-8.6)

Test #3 \textbf{On or about 5 Dec 2013}

2 lectures: External flows, boundary layers
Calculations of drag
Pump performance (as time allows)

Final \textbf{8:00 am, Thursday, 12 Dec 2013 (using 8:00 TTH exam slot)}
Homework Quizzes: Suggested homework problems will be assigned in class, but no homework problems will be collected and graded. A 15-minute quiz will be given once per week during each week that does not have an hour test (which means approximately 11 quizzes). The lowest two quiz scores will be dropped; no make-up quizzes will be given. These will be based on the homework problems assigned for that week. A weekly hour-long problem session will be scheduled; attendance will be optional and the instructor will work problems about which there are questions.

Preparatory assignments for control volume problems: A significant portion of the class will be spent covering the control volume method for solving certain fluid mechanics problems. This method relies upon a number of concepts you have covered in previous classes, particularly integration from calculus and vector analysis from statics. Three assignments that review basic concepts of calculus, unit vectors, and dot products will be posted on Blackboard. Each student must complete all three prior to the discussion of the control volume method in class. The exercises must be submitted by the due date given on each assignment, and they will be graded for completion (but not correctness; solution sets will be posted on Blackboard). The completion of all three exercises by the corresponding due dates will count as two quiz grades (i.e., only 9 quizzes will actually be given in class; the completed exercises will count as the additional two quizzes, which will not be dropped).

Labs (tentative, subject to change)

1. Viscosity measurement
2. Pressure measurements
3. Forces on submerged planes
4. Center of pressure
5. Verification of Bernoulli’s equation
6. Laminar and turbulent flow
7. Pressure drop measurement using a venturi meter
8. Pipe network
9. Pump performance map and cavitation

Lab procedures and reports: Labs will take approximately one week each to complete. Generally the labs are short enough that the data may be acquired in one lab period, with a second lab period available to complete data acquisition if not enough time was available during the first period. Students will work as a single team to acquire data, then each student should write his or her own report (report format details to be provided separately). Students will have to complete a lab safety course provided by the MEEN lab coordinators at the beginning of the class.

Grading: Three one-hour tests will be given on dates announced at least two class periods in advance. These tests will make up 50% of the final course grade. Weekly homework quizzes will make up 10% of the final course grade, the lab reports will make up 20% of the final course grade, and a three-hour comprehensive final will make up 20% of the course grade. Grades will be assigned on a 10-point scale: 90-100=A, 80-89=B, 70-79=C, 60-69=D, below 60=F.

Absences: Tests missed as a result of unexcused absences will result in a score of zero. Under most circumstances, the final exam grade will be substituted for tests missed due to excused absences. The absence must be excused in advance except in case of extreme emergency. No makeup exams will be given, except under unusual circumstances and entirely at the discretion of the instructor.

Communications: All outside-of-class communications will be conducted through the message and e-mail functions of the Blackboard site for the class. Announcements will be posted to Blackboard and e-mailed to your Islander account. Homework assignments, solutions, handouts, and other course materials will be posted to Blackboard. Grades will not be posted to Blackboard. For any e-mails from students to instructor, please enter ENGR 3315 in the email’s subject field. Each student should make sure his or her preferred e-mail address is the one in the Blackboard system, and each student should check e-mail and the Blackboard message site regularly.

Academic Honesty: Academic honesty is expected at all times. Occurrences of cheating will be dealt with according to university regulations regarding academic misconduct.