Fluid Mechanics ENGR 3315.002
School of Engineering and Computing Sciences
Spring 2018

A. COURSE INFORMATION

Course number/section: ENGR 3315.002
Class meeting time: MWF 8:00-8:50 am
Class location: EN 107
Course Website: bb9.tamucc.edu

B. INSTRUCTOR INFORMATION

Instructor: Andrew White PhD
Office location: EN 111
Office hours: Tu: 3 pm – 5 pm; Th: 10 am – 12 pm; and by appointment
Telephone: 361-825-6212
e-mail: andrew.white@tamucc.edu
Appointments: Talk to me before/after class or by email

C. COURSE DESCRIPTION

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 and differential equation and dimensional analysis methods are derived. Applications of basic concepts and analysis methods to simple internal and external flows are emphasized in this course that determine flow variables of interest, such as pressure, forces, shear stresses, flow rates, energy losses, and power requirements.

D. PREREQUISITES

MATH 3315 - Differential Equations
ENGR 2326 – Dynamics
MATH 3470 - Calculus III

E. REQUIRED TEXTBOOK(S), READINGS AND SUPPLIES

Required Textbook

Optional Textbook
F. **STUDENT LEARNING OUTCOMES AND ASSESSMENT**

Assessment is a process used by instructors to help improve learning. Assessment is essential for effective learning because it provides feedback to both students and instructors. A critical step in this process is making clear the course’s student learning outcomes that describe what students are expected to learn to be successful in the course. The student learning outcomes for this course are listed below. By collecting data and sharing it with students on how well they are accomplishing these learning outcomes students can more efficiently and effectively focus their learning efforts. This information can also help instructors identify challenging areas for students and adjust their teaching approach to facilitate learning.

By the end of this course, students should be able to:

1. Understand and apply basic concepts of fluid statics, kinematics and dynamics.
2. Perform engineering calculations and force balances in hydrostatic systems.
3. Perform engineering calculations and balances of momentum and energy using integral and differential forms of governing equations.
4. Apply Buckingham \( \pi \) theorem and concepts of similitude to model and analyze systems.
5. Analyze a variety of internal flows including friction losses in pipes.
6. Analyze a variety of external flows including concepts such as boundary layers and drag.
7. Analyze turbomachinery including pump performance and similarity laws.

G. **INSTRUCTIONAL METHODS AND ACTIVITIES**

This course will be based primarily on lectures, tests and the final exam. Weekly homework assignments will be used to review progress and understanding of the material.

H. **MAJOR COURSE REQUIREMENTS AND GRADING**

Homework problems will be assigned weekly to judge progress, and these will be worth 10% of the final course grade. Three in-class tests will be given and these will count 60% of the final course grade. The comprehensive final exam will count for 30% of the final course grade.

<table>
<thead>
<tr>
<th>ACTIVITY</th>
<th>% of FINAL GRADE</th>
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<tbody>
<tr>
<td>Exams (3)</td>
<td>60% (20% each)</td>
</tr>
<tr>
<td>Homework</td>
<td>10%</td>
</tr>
<tr>
<td>Final exam</td>
<td>30%</td>
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</tbody>
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I. **COURSE CONTENT/SCHEDULE**

<table>
<thead>
<tr>
<th>DATES</th>
<th>Ch.</th>
<th>TOPICS</th>
<th>ASSESSMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan 17, 19</td>
<td>Ch 1</td>
<td>Intro: fluid properties, dimensions &amp; units</td>
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<tr>
<td>Jan 22, 24, 26</td>
<td>Ch 2</td>
<td>Fluid statics: pressure, manometers, hydrostatic forces</td>
<td>HW 1</td>
</tr>
<tr>
<td>Jan 29, 31, Feb 2</td>
<td>Ch 3</td>
<td>Bernoulli equation: streamlines, Newton’s 2nd law</td>
<td>HW 2</td>
</tr>
<tr>
<td>Feb 5, 7, 9</td>
<td>Ch 4</td>
<td>Fluid kinematics, control volumes, Reynolds Trans. Thm.</td>
<td>EXAM 1, Feb 5</td>
</tr>
<tr>
<td>Feb 12, 14, 16</td>
<td>Ch 5</td>
<td>Control volumes: conservation of mass and momentum</td>
<td>HW 3</td>
</tr>
<tr>
<td>Feb 19, 21, 23</td>
<td>Ch 5</td>
<td>Control volumes: conservation of energy, 2nd law</td>
<td>HW 4</td>
</tr>
<tr>
<td>Feb 26, 28, Mar 2</td>
<td>Ch 6</td>
<td>Differential analysis: continuity, momentum, inviscid flow</td>
<td>HW 5</td>
</tr>
<tr>
<td>Mar 5, 7, 9</td>
<td>Ch 6</td>
<td>Differential analysis: Navier-Stokes</td>
<td>EXAM 2, Mar 9</td>
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<td>Mar 12-16: Spring Break</td>
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<tr>
<td>Mar 19, 21, 23</td>
<td>Ch 7</td>
<td>Dimensional analysis: Buckingham $\pi$, similitude, modeling</td>
<td>HW 6</td>
</tr>
<tr>
<td>Mar 26, 28, 30</td>
<td>Ch 8</td>
<td>Viscous pipe flow: laminar &amp; turbulent flow</td>
<td>HW 7</td>
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<tr>
<td>Apr 2, 4, 6</td>
<td>Ch 8</td>
<td>Viscous pipe flow: losses, flow measurement</td>
<td>HW 8</td>
</tr>
<tr>
<td>Apr 9, 11, 13</td>
<td>Ch 9</td>
<td>Immersed bodies: boundary layers</td>
<td>HW 9</td>
</tr>
<tr>
<td>Apr 16, 18, 20</td>
<td>Ch 9</td>
<td>Immersed bodies: drag, lift</td>
<td>HW 10</td>
</tr>
<tr>
<td>Apr 23, 25, 27</td>
<td>Ch 8, 12</td>
<td>Flow system design: pipe networks, turbomachinery</td>
<td>EXAM 3, Apr 23</td>
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<tr>
<td>Apr 30, May 2</td>
<td>Ch 12</td>
<td>Flow system design: pump performance and selection</td>
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*Target dates may be adjusted depending on material covered.

Note: Changes in this course schedule may be necessary and will be announced to the class by the Instructor. The assignments and exams shown are directly related to the Student Learning Outcomes described in Section F.

J. **COURSE POLICIES**

**Attendance:** Students are expected to arrive on time for the beginning of class. Each student is responsible for what takes place in class each day whether or not the student is present.

**Homework:** Homework will be due one week after the assignment date. Homework must be turned in at the beginning of class for full credit – **no exceptions.** Homework submitted late will incur a 10% penalty for each day it is late up to a maximum of a 50% penalty.

**Make-up Exams:** Exams 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 semester exams missed due to excused absences. The absence must be excused at least two weeks in advance.
except in case of extreme emergency. Typically, no make-up exams will be given except under unusual circumstances and entirely at the discretion of the instructor.

Cell Phone Use: Cell phones should be turned off and put away during class.

Laptop Use: Laptops should be turned off and put away during class unless given permission by the instructor.

Email: Use your tamucc.edu email for all email correspondence.

K. COLLEGE AND UNIVERSITY POLICIES

- **Academic Integrity (University)**
  University students are expected to conduct themselves in accordance with the highest standards of academic honesty. Academic misconduct for which a student is subject to penalty includes all forms of cheating, such as illicit possession of examinations or examination materials, falsification, forgery, complicity or plagiarism. (Plagiarism is the presentation of the work of another as one’s own work.) In this class, academic misconduct or complicity in an act of academic misconduct on an assignment or test will result in a failing grade.

- **Classroom/Professional Behavior**
  Texas A&M University-Corpus Christi, as an academic community, requires that each individual respect the needs of others to study and learn in a peaceful atmosphere. Under Article III of the Student Code of Conduct, classroom behavior that interferes with either (a) the instructor’s ability to conduct the class or (b) the ability of other students to profit from the instructional program may be considered a breach of the peace and is subject to disciplinary sanction outlined in article VII of the Student Code of Conduct. Students engaging in unacceptable behavior may be instructed to leave the classroom. This prohibition applies to all instructional forums, including classrooms, electronic classrooms, labs, discussion groups, field trips, etc.

- **Statement of Civility**
  Texas A&M University-Corpus Christi has a diverse student population that represents the population of the state. Our goal is to provide you with a high quality educational experience that is free from repression. You are responsible for following the rules of the University, city, state and federal government. We expect that you will behave in a manner that is dignified, respectful and courteous to all people, regardless of sex, ethnic/racial origin, religious background, sexual orientation or disability. Behaviors that infringe on the rights of another individual will not be tolerated.

- **Deadline for Dropping a Course with a Grade of W (University)**
  I hope that you never find it necessary to drop this or any other class. However, events can sometimes occur that make dropping a course necessary or wise. Please consult with your academic advisor, the Financial Aid Office, and me, before you decide to
drop this course. Should dropping the course be the best course of action, you must initiate the process to drop the course by going to the Student Services Center and filling out a course drop form. Just stopping attendance and participation WILL NOT automatically result in your being dropped from the class. Please consult the Academic Calendar (http://www.tamucc.edu/academics/calendar/) for the last day to drop a course.

- **Grade Appeals (College of Science and Engineering)**
  As stated in University Procedure 13.02.99.C2.01, Student Grade Appeal Procedures, a student who believes that he or she has not been held to appropriate academic standards as outlined in the class syllabus, equitable evaluation procedures, or appropriate grading, may appeal the final grade given in the course. The burden of proof is upon the student to demonstrate the appropriateness of the appeal. A student with a complaint about a grade is encouraged to first discuss the matter with the instructor. For complete details, including the responsibilities of the parties involved in the process and the number of days allowed for completing the steps in the process, see University Procedure 13.02.99.C2.01, Student Grade Appeal Procedures. These documents are accessible through the University Rules website at http://www.tamucc.edu/provost/university_rules/index.html, and the College of Science and Engineering Grade Appeals webpage at http://sci.tamucc.edu/students/GradeAppeal.html. For assistance and/or guidance in the grade appeal process, students may contact the chair or director of the appropriate department or school, the Office of the College of Science and Engineering Dean, or the Office of the Provost.

- **Disability Services**
  The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please call (361) 825-5816 or visit Disability Services in Corpus Christi Hall 116.

  If you are a returning veteran and are experiencing cognitive and/or physical access issues in the classroom or on campus, please contact the Disability Services office for assistance at (361) 825-5816.

  http://disabilityservices.tamucc.edu/

- **Statement of Academic Continuity**
  In the event of an unforeseen adverse event, such as a major hurricane and classes could not be held on the campus of Texas A&M University–Corpus Christi; this course would continue through the use of Blackboard and/or email. In addition, the syllabus and class activities may be modified to allow continuation of the course. Ideally, University facilities (i.e., emails, web sites, and Blackboard) will be
operational within two days of the closing of the physical campus. However, students need to make certain that the course instructor has a primary and a secondary means of contacting each student.

L. OTHER INFORMATION

- Academic Advising
  The College of Science & Engineering requires that students meet with an Academic Advisor as soon as they are ready to declare a major. The Academic Advisor will set up a degree plan, which must be signed by the student, a faculty mentor, and the department chair. Meetings are by appointment only; advisors do not take walk-ins. Please call or stop by the Advising Center to check availability and schedule an appointment. The College’s Academic Advising Center is located in Center for Instruction 350 or can be reached at (361) 825-3928.

GENERAL DISCLAIMER

I reserve the right to modify the information, schedule, assignments, deadlines, and course policies in this syllabus if and when necessary. I will announce such changes in a timely manner during regularly scheduled lecture periods.