Thermodynamics ENTC 3320  
Department of Mechanical Engineering  
Spring 2020 (1st 7-week term)

A. COURSE INFORMATION

Course number/section: ENTC 3320.W01  
Class meeting time: Online  
Class location: Online  
Course Website: https://bb9.tamucc.edu/webapps/login/

B. INSTRUCTOR INFORMATION

Instructor: Dr. Rajeev Kumar  
Office location: RFEB 210  
Office hours: Mon-Thurs 2:30 PM - 4:00 PM, or by appointment  
Telephone: 361-825-2559  
e-mail: rajeev.kumar@tamucc.edu  
Appointments: Correspond using ISLANDER email or drop-in

C. COURSE DESCRIPTION

Catalog Course Description
Theory and application of energy methods in engineering; conservation of mass and energy; energy transfer by heat, work and mass; thermodynamic properties; analysis of open and closed systems; the second law of thermodynamics and entropy; gas, vapor and refrigeration cycles.

Extended Course Description
Introduction to the basic concepts of thermodynamics and laws governing the conservation of mass and energy in open and closed systems. Emphasis on thermodynamic properties of steam vapor and ideal gas. Theory and application of the first and second laws of thermodynamics into the analysis of basic power and refrigeration cycles.

D. PREREQUISITES AND COREQUISITES

Prerequisites
PHYS 2425 – University Physics I and MATH 2414 – Calculus II

Corequisites
None
E. **REQUIRED TEXTBOOK(S), READINGS AND SUPPLIES**

Required Textbook(s)

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. Be able to identify the unique vocabulary associated with thermodynamics through the precise definition of basic concepts to form a sound foundation for the development of the principles of thermodynamics.

2. Be able to determine the unknown thermodynamic property values of pure substances (water, steam, and refrigerant R134-a) from the property tables and illustrate the phase-change processes in the property diagrams.

3. Be able to expand our understanding of energy and to develop the first law of thermodynamics as a general statement of energy conservation.

4. Be able to develop the mass and energy conservation equations for general systems and conduct energy analysis for a variety of closed systems and open systems (or control volume) in which the working fluid can be water, steam, ideal gases, and incompressible substances.

5. Be able to identify valid processes as those that satisfy both the first and second laws of thermodynamics and quantify the second-law effects by the increase of entropy principle.

6. Be able to apply the second law and entropy equations to the calculation of various thermodynamic processes in both open and closed systems.

7. Be able to select and apply knowledge of Thermodynamics (first and second laws equations, concepts of open/closed systems, entropy, properties of steam and ideal gas, etc.) to various gas and steam power cycles used to model internal combustion engines and power plans.
**G. INSTRUCTIONAL METHODS AND ACTIVITIES**

This course is structured along the lines of competency-based education (CBE) model. The seven student learning outcomes listed above have been developed into four competencies. The student must demonstrate all four competencies to at least “C” level (grade of 70) to pass the course.

**H. MAJOR COURSE REQUIREMENTS AND GRADING**

Students must pass each competency with at least 70% grades

<table>
<thead>
<tr>
<th>ACTIVITY</th>
<th>% of FINAL GRADE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Competency 1 - Basic Concepts of Thermodynamics and Properties of Pure Substance</td>
<td>20</td>
</tr>
<tr>
<td>Competency 2 - First Law of Thermodynamics and Its Applications in Closed and Open Systems</td>
<td>20</td>
</tr>
<tr>
<td>Competency 3 - Second Law of Thermodynamics and Entropy</td>
<td>20</td>
</tr>
<tr>
<td>Competency 4 - Gas and Vapor Power Cycles Analysis</td>
<td>20</td>
</tr>
<tr>
<td>Final Exam</td>
<td>20</td>
</tr>
</tbody>
</table>

*Grades will be assigned on a scale: 90 \( \leq \) A \( \leq \) 100, 80 \( \leq \) B < 90, 70 \( \leq \) C < 80, 0 \( \leq \) F < 70.

This is a 7-week, short-format course. There will be no graded homework in the course, as there will not be sufficient time to collect, grade, and return homework prior to tests. There will be example problems posted on the Blackboard site, along with solutions. Students should attempt the problems first and then review the solutions, and address questions to the instructor when necessary. The tests will be shorter than typical tests since there will be one test for each of the five competencies in the course. The final exam will have at least one problem related to each competency. A grade of 70 is required to pass each competency, and this must be achieved on either the competency pre-test, the competency test, or the final exam, for all four competencies, in order to pass the course. If a sufficient score is achieved on a pre-test or the competency test for a particular competency for at least two of the four competencies, it will not be necessary to work the problem for that competency on the final exam. If the required score is not obtained on at least two of the competencies, the entire final exam must be completed. The final exam may be completed to raise your grade in the class if you wish to have a grade higher than a “C.” The competency tests and the final exam will be weighted according to the values given in the table above.
Note that it is not required that you take the pre-tests; they are optional. If you plan to take any pre-test, you must contact the instructor in advance.

I. COURSE CONTENT/SCHEDULE

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.

<table>
<thead>
<tr>
<th>DATE (BY DAY OR WEEK)</th>
<th>TOPIC</th>
<th>CHAPTER(S)</th>
</tr>
</thead>
<tbody>
<tr>
<td>21 Jan 2020</td>
<td>The first day of class</td>
<td></td>
</tr>
<tr>
<td>22 Jan 2020</td>
<td>Competency 1 Pre-Test</td>
<td>1,3</td>
</tr>
<tr>
<td><strong>28 Jan 2020</strong></td>
<td><strong>Last Day to Add a Class</strong></td>
<td></td>
</tr>
<tr>
<td>29 Jan 2020</td>
<td>Competency Test No. 1: Basic Concepts, Properties of pure substances</td>
<td>1,3</td>
</tr>
<tr>
<td>30 Jan 2020</td>
<td>Competency 2 Pre-Test</td>
<td>2, 4, 5</td>
</tr>
<tr>
<td>14 Feb 2020</td>
<td>Competency Test No. 2: Energy, Energy Analysis of Closed Systems, and Open Systems (CV)</td>
<td>2, 4, 5</td>
</tr>
<tr>
<td>15 Feb 2020</td>
<td>Competency 3 Pre-Test</td>
<td>6, 7</td>
</tr>
<tr>
<td>28 Feb 2020</td>
<td>Competency Test No. 3: Second Law of Thermodynamics, Entropy</td>
<td>6, 7</td>
</tr>
<tr>
<td>29 Feb 2020</td>
<td>Competency 4 Pre-Test</td>
<td>9, 10</td>
</tr>
<tr>
<td>9 Mar 2020</td>
<td>Competency Test No. 4: Gas Power Cycle, Vapor and Combined Power Cycles</td>
<td>9, 10</td>
</tr>
<tr>
<td>17 Mar 2020</td>
<td>Final Exam</td>
<td></td>
</tr>
</tbody>
</table>

Note that the course moves at a rapid pace. It will be imperative for each student to maintain a strong work ethic to complete the course.

J. COURSE POLICIES

Late Work and Make-up Exams
The only graded exercises in the class will be the five tests and the final exam. 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.

**Online Testing and Exams**
Students willing to take the pre-test for a competency must let the instructor know one day before the scheduled date for the test (see Table in Section I). Competency tests will be available on the scheduled days at a time to be decided. When the student clicks on the test or exam, a window will open and instructions will be displayed. Thereafter a click on the ‘begin’ button will display the questions on the screen. Each question will have answer box below it. The student should work the problems on his or her own paper and enter the answers in the answer boxes. After completion, the student should scan or photograph his or her work and transfer it to the computer and upload it. The uploading option is available in the last ‘question’ of the exam.

**Missed Exam**
See “Late Work and Make-up Exams,” above.

**Communications**
All outside-of-class communications from the instructor to the students will be conducted through the message and e-mail functions of the Blackboard site for the class. 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. Students are not required to go through Blackboard to contact the instructor but may do so through direct e-mail to the instructor. E-mails and other communications through Blackboard will be responded to during business hours (8 am to 5 pm) within 2 business days (Monday through Friday, excluding holidays). Responses outside of working hours (e.g., to queries on weekends) will be at the discretion of the instructor. Graded assignments will be returned within 3 business days unless otherwise specified.

**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)**

The grade of W will be assigned to any student officially dropping a course. Please consult with the instructor before you decide to drop to be sure it is the best thing to do. Just stopping attendance and participation WILL NOT automatically result in your being dropped from the class. Should dropping the course be the best course of action, visit the Office of the University Registrar for the Course Drop Form that must be submitted. No student is eligible to receive a W without completing the official drop process by this deadline. 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/](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, websites, 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.