ME 2410: Thermodynamics

2022 Spring Session	
Total Class Sessions: 25	**Instructor: Staff**
Class Sessions Per Week: 5	**Classroom: TBA**
Total Weeks: 5	**Office Hours: TBA**
Class Session Length (Minutes): 145	**Language: English**
Credit Hours: 4	

Course Description:

This course introduces the fundamentals of thermodynamics and its practice in engineering and technology. Topics include: energy concepts and balances; the first and second laws of thermodynamics. Meanwhile classic cycles like Carnot, Otto and Diesel cycles will also be introduced. Advanced applications of Rankine cycle; Brayton cycle; Refrigeration cycle will be discussed as well.

Prerequisites: MATH 1210 Calculus I, PHYS 1110, Physics I or Other Equivalent Course.

Objectives:

1. Learn to analyze energy transfer and transformation in systems using fundamental concepts of work, heat, internal energy, density, entropy and equations from the First and Second Laws of Thermodynamics.
2. Learn to measure or estimate thermodynamic properties using property tables and relations.
3. Learn to perform simple thermodynamic analysis of engineering devices and systems.

Course Materials:

Thermodynamics: An Engineering Approach (Mechanical Engineering) by Yunus Cengel (Author), Michael Boles (Author)

Publisher: McGraw-Hill Education; 9th edition (January 24, 2018))

Language: English

ISBN-13: 978-1260048667

ISBN-10: 1260048667

Course Format and Requirements:

Students will go through the material principally by means of lectures and visual presentations, and also in-class discussion and assigned readings. It will be hard for you to achieve a good grade in this course without regular attendance. Please turn off all cell phones during lecture. No texting during class lectures. You are encouraged to ask questions since extra credit may be given for thoughtful questions.

Course Assignments:

Quizzes: There will be 6 quizzes administered through the whole semester and the lowest one will be dropped. Quizzes will always be completed in the first ten minutes of class and cannot be made up. Quizzes will consist of a series of multiple choice, calculation, true/false, and short-answer questions.
Exams: Exams will be testing your comprehension of concepts and arguments. The midterm and final exams will both contain true/false, multiple choice and short answer questions. The exam content will be selected from readings, lectures and class discussions.

Course Assessment:

Quizzes	20%
Midterm Exam	35%
Final Exam	45%
Total	**100%**

Grading Scale (percentage):

A+	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	F
98-100	**93-97**	**90-92**	**88-89**	**83-87**	**80-82**	**78-79**	**73-77**	**70-72**	**68-69**	**63-67**	**60-62**	**<60**

Academic Integrity:

Students are encouraged to study together, and to discuss lecture topics with one another, but all other work should be completed independently.

Students are expected to adhere to the standards of academic honesty and integrity that are described in the Chengdu University of Technology's *Academic Conduct Code.* Any work suspected of violating the standards of the *Academic Conduct Code* will be reported to the Dean's Office. Penalties for violating the *Academic Conduct Code* may include dismissal from the program. All students have an individual responsibility to know and understand the provisions of the *Academic Conduct Code*.

Special Needs or Assistance:

Please contact the Administrative Office immediately if you have a learning disability, a medical issue, or any other type of problem that prevents professors from seeing you have learned the course material. Our goal is to help you learn, not to penalize you for issues which mask your learning.

Course Schedule:

Class 1:

Go through syllabus;
Introduction; Units;
Dimensional
Homogeneity

Class 2:
Thermodynamic systems;
Density, specific weight, specific volume, specific gravity

Class 3:
Pressure, temperature and volume; Ideal Gas Law;
Temperature and the Zeroth law of thermodynamics;

Class 4:
Quiz 1
Thermodynamic processes and cycles;
Reversible and irreversible processes;

Class 5:
Equation of state of an ideal gas
Avogadro's number, Boltzman's constant and compressibility

Class 6:
Concepts of energy, work and heat transfer; Work, and work as a path function; Energy and Work transfer

Class 7:
Flow energy;
Potential energy; Kinetic energy; Internal energy;

Class8:
Quiz 2
Energy transfer by heat and the units;
Specific heat, latent heat; Balance Analysis;

Class 9:
Law of conservation of mass for a control volume
First Law of Thermodynamics; energy balances in closed systems; Internal energy of an ideal gas

Class 10:

First Law of Thermodynamics; energy balances in closed systems; Internal energy of an ideal gas (Cont.);
Evaluating properties of pure substances;

Class 11:
Quiz 3
P-v-T relations; Property diagrams: P-v, T-v;
The first law of thermodynamics for a control volume;

Class 12:
The steady state flow process; Control volume analysis - open systems;
Conservation of mass and energy; Work and the steady state reversible flow process;

Class 13:
Midterm Exam

Class 14:
Application to steady state flow energy equation; Open system (control volume)
Devices: turbines, compressors, pumps

Class 15:
Properties of pure substances; One component system;
Liquid-vapor system;
Solid phase; Property tables; The ideal-gas model;

Class 16:
Quiz 4
Phase mixtures; Equations of State
Second Law of Thermodynamics;

Class 17:
Carnot cycle; Principles of Carnot Cycle; Clausius theorem
Entropy;
Process efficiencies; Temperature-Entropy diagram

Class 18:
Gas tables; Isentropic relations for an ideal gas
Entropy change for a control volume;

Class 19:

Quiz 5
Entropic efficiency;
Physical interpretation of entropy

Class 20:
Ideal Processes: ideal liquids, solids, and ideal Gases;
T-S Diagrams and TdS relations

Class 21:
The reciprocating compressor cycle;
The Rankine vapor-power cycle

Class 22:
The Rankine vapor-power cycle (Cont.)
Internal combustion engine power cycles

Class 23:
Quiz 6
Refrigeration and heat pump systems
The standard Otto cycle;

Class 24:
The gas turbine cycle;
Stage compression and expansion;

Class 25:
Rankine vapor-compression refrigeration cycle;
Rankine cycle enhancement: reheat

Final Exam (Cumulative): TBA