COURSE SYLLABUS

Tunxis Community College

Education That Works For a Lifetime

Course Title:	Engineering Thermodynamics
Department:	Business and Technology
Curriculum:	Engineering Science
Date submitted:	March 2014 (AAC: 14-27)

Course Descriptors: Make certain that the course descriptors are consistent with college and Board of Trustees policies, and the current course numbering system.

Course Code: (eg. ACC 101)	EGR*214
Course Type:	L

A: Clinical B: Lab D: Distance Learning
I: Individual/Independent L: Lecture N: Internship
M: Seminar P: Practicum U: Studio
X: Combined Lecture/Lab Y: Combined Lecture/Clinical/Lab Z: Combined Lecture/Studio

Elective Type:	G/LAS

AH: Art History E: English FA: Fine Arts FL: Foreign Language G: General HI: History HU: Humanities LAS: Liberal Arts & Sciences M: Math S: Science SS: Social Science

Credit Hours:	3
Developmental: (yes/no)	N
Contact Hours: Lecture:	3
Clinical:	0
Lab:	0
Studio	0
Other:	0
TOTAL:	3
Class Maximum:	24
Semesters Offered:	F/Sp/Su

Prerequisites:

C- or better in Calculus-Based Physics I (PHY*221), and C- or better in Calculus I (MAT*254) or Precalculus (MAT* 186)

Corequisites:

None

Other Requirements:

None

Catalog Course Description:

Energy concepts and balances are covered. Basic definitions include the first and second laws of thermodynamics, ideal and real gases, thermodynamic properties, and introductory cycle analysis.

Topical Outline: List course content in outline format.

1. Introductory concepts and definitions
    a. Introduction
    b. Dimension and units
    c. Thermodynamic systems
    d. Density, specific weight, specific volume, specific gravity
    e. Pressure
    f. Temperature and the Zeroth law of thermodynamics
    g. Thermodynamic processes and cycles
    h. Reversible and irreversible processes
    i. Equation of state of an ideal gas
    j. Avogadro's number, Boltzman's constant and compressibility

2. Energy types and conversion laws

- a. Introduction
- b. Work, and work as a path function
- c. Energy: Work transfer
- d. Flow energy
- e. Potential energy, kinetic energy
- f. Internal energy
- g. Energy transfer by heat and the units
- h. Specific heat, latent heat
- i. Law of conservation of mass for a control volume
- j. Momentum principle
- k. Problems

3. First law of thermodynamics
   - a. First law of thermodynamics for a system
   - b. Internal energy
   - c. Internal energy of an ideal gas
   - d. Enthalpy
   - e. Application of the first law to a closed system
   - f. The first law of thermodynamics for a control volume
   - g. The steady state flow process
   - h. Work and the steady state reversible flow process
   - i. Application to steady state flow energy equation
   - j. Carnot cycle
   - k. First law applied to steady state chemical systems

4. Properties of pure substances
   - a. One component system
   - b. Liquid-vapor system
   - c. Extension to the solid phase
   - d. Thermodynamic surfaces
   - e. Tables of properties
   - f. The ideal-gas model
   - g. Compressibility factor
   - h. Problems

5. The second law of thermodynamics
   - a. The second law of thermodynamics
   - b. The Carnot cycle and principles
   - c. The thermodynamic principle scale
   - d. Clausius theorem
   - e. Entropy
   - f. Temperature: Entropy diagram
   - g. Gas tables
   - h. Isentropic relations for an ideal gas
   - i. Entropy change for a control volume
   - j. Entropic efficiency
   - k. Physical interpretation of entropy

6. Analysis of thermodynamics of cycles
   - a. Ideal processes
   - b. The reciprocating compressor cycle
   - c. The Rankine vapor-power cycle
   - d. Reheat cycle
   - e. The standard Otto cycle
   - f. The gas turbine cycle
   - g. Stage compression and expansion
   - h. Refrigeration cycle
   - i. Rankine vapor-compression refrigeration cycle

Outcomes: Describe measurable skills or knowledge that students should be able to demonstrate as evidence that they have mastered the course content.	**Upon successful completion of this course, the student will be able to do the following:** **COURSE:** 1. determine state property changes for pure substances and for ideal gases 2. compute the amount of energy transferred by heat and/or amounts of energy transferred by work for closed systems containing a pure substance or an ideal gas 3. compute heat transfer rate and /or shaft power of the flow of a pure substance or of an ideal gas through a control volume 4. compute the amount of energy transferred by work during an isentropic process in a closed system 5. use isentropic efficiency to analyze the operation of actual adiabatic turbines, compressors, nozzles and pumps 6. compute energy transfer rates and thermal efficiency for ideal Rankine cycles
	PROGRAM: *(Numbering reflects Program Outcomes as they appear in the college catalog)* **Engineering Science Associate Degree**: 1. demonstrate an understanding of the foundational mathematical and scientific concepts appropriate to the fields of mechanical, civil, or industrial engineering **Technology Studies Associate Degree**: 1. identify and apply the design principles of engineering and technology when solving basic engineering problems
	GENERAL EDUCATION: *(Numbering reflects General Education Outcomes as they appear in the college catalog)* **7. Quantitative Reasoning -**Students will learn to recognize, understand, and use the quantitative elements they encounter in various aspects of their lives. Students will develop a habit of mind that uses quantitative skills to solve problems and make informed decisions. **Demonstrates**: Interprets numerical information and applies sufficient laws of logic and mathematics to solve problems using numbers, symbols, graphs and/or descriptions. **Does Not Demonstrate:** Misinterprets numerical information or insufficiently applies laws of logic and mathematics to solve problems using numbers, symbols, graphs and/or descriptions.
Evaluation: List how the above outcomes will be assessed.	**Assessment will be based on the following criteria:** Quizzes Exams Homework
Instructional Resources: List library (e.g. books, journals, on-line resources), technological (e.g. Smartboard, software), and other resources (e.g. equipment, supplies, facilities) required and desired to teach this course.	**Required:** Engineering/Computer Lab **Desired:**
Textbook(s)	Check with program coordinator for list of approved texts