MOHAWK VALLEY COMMUNITY COLLEGE

UTICA AND ROME, NEW YORK

COURSE OUTLINE

THERMODYNAMICS

ES281

REVIEWED AND FOUND ACCEPTABLE  ***04/24/2017***

I. CATALOG DESCRIPTION:

ES281 THERMODYNAMICS C-3, Cr-3

This course addresses these topics: the zeroth, first, and second laws of thermodynamics, thermodynamic equilibrium, thermodynamic properties, cycles, and applications to physical and chemical systems.

Pre-requisites: MA253 Calculus 3   
PH262 Engineering Physics 2

II. STUDENT LEARNING OUTCOMES:

1. Describe a thermodynamic system

2. Apply the First Law of Thermodynamics to various thermodynamic systems

3. Apply the Second Law of Thermodynamics to various thermodynamic systems

4. Synthesize the two laws in the operation of a real system

5. Analyze a system using the various thermodynamic variables and their interrelationships

6. Calculate the efficiencies of various heat engines

7. Explain and analyze the continuous flow system thermodynamically

8. Apply the thermodynamic equations to real gases and the two-phase systems.

III. DETAILED COURSE OUTLINE:

I. Introductory Topics and the 1st Law of Thermodynamics

A. Systems and Units

1. Defining Systems

2. Mass, Length, Time, and Force

3. Specific Volume, Pressure, Temperature

B. Energy and the 1st Law

1. Work and Kinetic Energy

2. Potential Energy

3. Expansion and Compression Work

4. Other Works

5. Heat

6. Energy Balance

7. Cycles

C. Evaluating Properties

1. Phase and fixing the state

2. Pressure, volume, and temperature diagrams

3. Evaluating pressure, specific volume, and temperature

4. Evaluating specific internal energy and enthalpy

5. Applying energy balance using tables

6. Specific Heats

7. Liquids and Solids

8. Compressibility Charts

D. Ideal Gas Model

1. Introduction

2. Energy, enthalpy, and specific heats

E. Control Volumes

1. Mass rate balance

2. Energy balance for control volume

3. Steady-state

4. Nozzles and Diffusers

5. Turbines, Compressors and Pumps

6. Transient Analysis

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II. 2nd Law, Entropy, and Cycles

A. 2nd Law of Thermodynamics

1. Introduction

2. Forms of the 2nd Law

3. Irreversible and Reversible Processes

4. Application to Power Cycles

5. Application to Heat Pump Cycles

B. Entropy

1. Entropy Definition

2. Entropy Data

3. Entropy in the 1st Law

4. Application to Ideal Gas

5. Application to Closed Systems

6. Application to Control Volumes

7. Isentropic Processes

C. Vapor Power Systems

1. Rankine Cycle

2. Rankine Cycle Performance

3. Other Vapor power cycles

D. Gas Power Systems

1. Air Standard

2. Otto Cycle

3. Diesel Cycle

4. Gas Turbine systems

E. Refrigeration and Heat Pump Systems

1. Vapor systems

2. Heat pump systems

3. Gas refrigeration systems

TEST

III. Selected Topics: This section is retained for various selected topics to be determined by instructor based on student interests and pursuits. May include: Thermodynamic Relations, Exergy Analysis, Psychrometric Analysis, and Chemical Reaction analysis