RARITAN VALLEY COMMUNITY COLLEGE
ACADEMIC COURSE OUTLINE

EMET 217 Thermodynamics

I. Basic Course Information

A. Course Number and Title: EMET 217 Thermodynamics

B. New or Modified Course: New

C. Date of Proposal: Semester: Fall Year: 2020

D. Effective Term: Fall 2021

E. Sponsoring Department: Science & Engineering

F. Semester Credit Hours: 3

G. Weekly Contact Hours: 3 Lecture: 3
Laboratory: 0
Out of class student work per week: 6

H. Prerequisites: EMET 235 Statics for Technology, PHYS 102 General Physics II or PHYS 151 Analytical Physics II, MATH 151 Calculus I

I. Laboratory Fees: No

J. Name and Telephone Number or E-Mail Address of Department Chair and Divisional Dean at time of approval: Dr. Ed Carr, Edward.carr@raritanval.edu; Dr. Sarah Imbriglio, sarah.imbriglio@raritanval.edu

II. Catalog Description

Prerequisites: EMET 235 Statics for Technology, PHYS 102 General Physics II or PHYS 151 Analytical Physics II, MATH 151 Calculus I

This course will cover the basic concepts of thermal energy conversion, including the dual use of S.I. and English engineering units, gas laws, fluid processes, the first and second laws of thermodynamics, theoretical cycles, internal combustion engines, gas turbines and jet engines, refrigeration cycles, and the heat pump with an emphasis on

computer-based problem-solving. Heat transfer through radiation, conduction and convection will also be explored.

III. Statement of Course Need

A. This course is a requirement in the Mechanical Engineering Technology A.S. program. Students who complete this course will have a firm foundation in the laws of Thermodynamics and their applications.

B. This course does not have a lab.

C. This course generally transfers as a program requirement or a free elective.

IV. Place of Course in College Curriculum

A. Free Elective
B. This course meets a program requirement for the Mechanical Engineering Technology A.S. program.
C. To see course transferability: a) for New Jersey schools, go to the NJ Transfer website, www.njtransfer.org; b) for all other colleges and universities, go to the individual websites.

V. Outline of Course Content

A. Introduction. Basic
    a. Dimensions and Unit Systems
    b. Thermodynamic Calculations and Unit Cancellations
    c. Numerical Calculations
    d. Pressure and Temperature.
B. Thermodynamic Systems
    a. System Property
    b. State of a System
    c. Process Cycles
    d. Volume, Density, Energy, Power, Heat, and Work
C. First Law of Thermodynamics
    a. Conservation of Mass and Energy
    b. Steady Flow
    c. Uniform Flow
    d. Flow Energy and Enthalpy
D. Perfect Gas Law
    a. Specific Heat
    b. Properties of Pure Substances and Thermodynamic Tables.
E. Basic Thermodynamic Processes
    a. Second Law of Thermodynamics

b. Heat Engine and Carnot Cycles.

F. The internal combustion engine and the ideal Otto Cycle
G. Gas Turbine and Jet propulsion.
H. Refrigeration cycles and heat pump.
I. Jet engine
J. Computer use for problem solving

VI. General Education and Course Learning Outcomes

Outcomes (the term here is synonymous with *instructional objectives* and learning *objectives*) are specific statements about knowledge, competencies, attitudes and/or skills to be acquired by the student upon the completion of the course. The student learning outcomes (SLOs) should be measurable and include an appropriate range of levels from the appropriate domains (cognitive, affective, and psychomotor) described in Benjamin Bloom's *Taxonomy of Educational Objectives*.

A. General Education Learning Outcomes:

State the **General Education Learning Outcomes** for the academic course.

For example:

At the completion of the course, students will be able to:

1. Classify and interpret information related to thermodynamic systems. (GE-NJ 2, 3).
2. Identify, analyze, and solve appropriate thermodynamic system problems. (GE-NJ 2, 3*).
3. Use the scientific method to discover, report, and analyze information through research (GE-NJ 1, 3, 4).
4. Use computer programs (MATLAB) to solve thermodynamic problems, and develop an understanding of the implication of the results. (GE-NJ 4)*

(* embedded critical thinking)

B. Course Learning Outcomes:

State the **learning outcomes** for the academic course.

For example:

At the completion of the course, students will be able to:

- Use units in both SI and US engineering units for thermodynamic applications.

- Identify open, closed, and isolated systems, and apply the first law of thermodynamics.
- Perform air standard analysis for an ideal Otto engine.
- Demonstrate an understanding of the gas turbine and jet engine.
- Apply the three modes of heat transfer, conduction, convection, and radiation, to solve heat transfer problems.
- Use integration and area under a curve to determine energy.

C. Assessment Instruments

1. research papers
2. projects
3. quizzes
4. tests

VII. Grade Determinants

A. research papers
B. projects
C. quizzes
D. tests

Given the goals and outcomes described above, LIST the primary formats, modes, and methods for teaching and learning that may be used in the course:

A. lecture/discussion
B. small-group work
C. computer-assisted instruction
D. guest speakers
E. student collaboration

VIII. Texts and Materials

A. Suggested textbook: Thermodynamics and Heat Power, 6th edition, Kurt C. Rolle, Prentice Hall, 2005, ISBN: 0131139282
B. Computer Resources: MATLAB

Please Note: The course outline is intended only as a guide to course content and resources. Do not purchase textbooks based on this outline. The RVCC Bookstore is the sole resource for the most up-to-date information about textbooks.

IX. Resources

A. Computer lab with MATLAB

X. Honors Options [if relevant]

This course does not have an Honors Option.