ROWAN UNIVERSITY CURRICULUM PROPOSAL

PROPOSAL TITLE: ENGINEERING THERMODYNAMICS I

C 916 · 311

CHECK APPROPRIATE: ✓ UNDERGRADUATE ___ GRADUATE 2 SEMESTER HOURS

SPONSOR(S): ANTHONY J. MARCHESE AND DEPT. OF MECHANICAL ENGINEERING CURRICULUM COMMITTEE

DEPARTMENT/TELEPHONE # MECHANICAL ENGINEERING x 4627

CHECK ONE: ✓ COURSE ___ MINOR PROGRAM ___ CONCENTRATION ___ SPECIALIZATION

___ ACHIEVEMENT CERTIFICATE ___ CERTIFICATION PROGRAM ___ MAJOR PROGRAM

Step #1 (Department)

✓ Approved (Date) 10/15/97

___ Not Approved (Date)

Dept. Curriculum Chr.

10/15/97
Reviewed (Date)

Dept. Chr.

Step #2 (Receipt)

SCC# 97-98-69

10-21-97
Date Received Senate

Senate Curriculum Chr.

Step #3 (School)

Reviewed Date: 10/20/97

✓ Recommend to Approved

___ Recommend NOT to Approve

Forward for Open Hearing:

✓ WITHOUT Reservations

___ WITH Reservations:

Comments:

Robert P. Hesketh
School Committee Chr.

Step #4 (Academic Dean): ✓ Recommended ___ NOT Recommended ___ Conditionally Recommended (See Comments)

Comments:

Dean Signature/Date 10/20/97

Step #5 (Senate Curriculum Committee): Open Hearing Date: 11-4-97 Approved by Curriculum Committee Date 11-4-97

Returned to Sponsor(s) for the following reason:

Step # 6 (Senate) Date announced/voted on at Senate 11-25-97 If voted on: ___ Approved ___ NOT Approved

Date Awarded to Executive Vice President/Provost 11-25-97

Senate Curriculum Committee chair Signature/Date: _____

Step #7 (Executive Vice President/Provost): Date Received [illegible]

___ Approved

___ NOT Approved If no, reasons are as follows:

Student Credit Hours 2

Faculty Load Hours 2

Equalized Credit Hours _____

Official Copy & Approval Sheet Filed (Date) _____

Executive Vice President/Provost Signature [signature]

Registrar

Date Approved Course Description Received 8 Jun 98

Hegis Taxonomy and Course Number Assigned 0910.311

Date/Signature of Registrar BF McCoy

Notification Forward:

_____ Senate Curriculum Committee Chairperson

_____ Department Chairpersons

_____ Academic Dean(s)

_____ Registrar

_____ Sponsor(s)

Taxonomy Code 11/23/98

Course Proposal

1. Details:

a) Course Title:	Engineering Thermodynamics I (0910-311)
b) Sponsor:	Dr. Anthony J. Marchese, Department of Mechanical Engineering, College of Engineering
c) Credit Hours:	2 credit hours
d) Course Level:	Junior
e) Curricular Effect:	Required course for mechanical engineering majors and environmental option of civil engineering majors; an elective for electrical engineering majors
f) Prerequisites:	Chemistry I, Physics I, Mathematics for Engineering Analysis II or equivalent.
g) Suggested Time/ Scale of Implementation	Fall 1998 One section
h) Resources:	Faculty is in place to teach the course within the Dept. of Mechanical Engineering. A new 1130 square foot thermodynamics and engine laboratory will be dedicated to this course. Laboratory equipment has already been ordered to support this course. Library resources are in place. Computer hardware resources are available in the Engineering Building to support this course. No new software resources are required.

2. Rationale:

The proposed course is part of the Engineering Curriculum Proposal approved by the College Senate in December 1994. The proposed course is consistent with the establishment of the School of Engineering approved by the Board of Trustees in February 1995.

The course is an essential introductory course for mechanical engineering majors, environmental option of civil engineering majors and all other engineering majors interested in a solid fundamental introduction to the concepts of thermodynamics as applied to engineering problems. The fundamental theme of the course is the study of thermodynamic equilibrium and the first and second laws of thermodynamics and their application to basic engineering applications such as vapor power systems. A follow on course, Engineering Thermodynamics II, will focus on application of the principles including gas power systems, refrigeration systems and combustion systems.

In summary, this course represents the first, fundamental engineering course for students interested in the thermal science area of mechanical engineering.

3. Essence of the Course:

a) Objectives:

The main objective of the course is to provide engineering students with the tools to perform first and second law analyses of engineering processes and cycles that utilize working fluids consisting of such as real, pure substances, real gases, and ideal gases. mixtures. A second objective is to provide students with an understanding of the conditions under which the *equilibrium* conditions of thermodynamics apply vs. *non-equilibrium* conditions wherein the principles of transport must be applied.

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

1) Derive and solve energy balances for closed systems and control volumes.
2) Determine the properties of pure substances using p-v-T relationships, tables or software.
3) Perform entropy balances on closed systems and control volumes.
4) Determine the performance and efficiency of vapor power systems.

b) Topical Outline:

The topical outline of the course may vary to some extent depending on the interests of the instructor and the students, and the advances in engineering technology. The topics to be covered will include the following:

Introduction , concepts and definitions
- Thermodynamic systems
- Properties, processes and equilibrium
- Specific volume, pressure, and temperature
- Methodology for solving thermodynamic problems

Energy and the first law of thermodynamics
- Mechanical concepts of energy
- Energy transfer by work
- Energy of a system
- Energy transfer by heat
- Energy balance, and energy analysis

Properties of a pure, simple compressible substances
- The state principle
- The *p-v-T* relation
- Thermodynamic property data
- The *p-v-T* relation for gases
- Ideal gas model

Control volume energy analysis
- Conservation of mass
- Conservation of energy
- Steady state, and transient analyses

Second law of thermodynamics
- Statement of the law
- Irreversible and reversible processes
- Corollaries for thermodynamic cycles
- The Kelvin temperature scale
- Maximum performance measures
- The Carnot cycle

Entropy
- The Clausius inequality
- Entropy change
- Entropy balance for closed systems
- Entropy rate balance for control volumes
- Isentropic processes
- Isentropic efficiency concepts

Vapor power systems
- Rankine cycle for heat engines
- Superheat and reheat cycles
- Regenerative vapor power cycle
- Cogeneration

Suggested Textbook: Fundamentals of Engineering Thermodynamics, Moran and Shapiro

c) Evaluation and Grading Procedure of Students:

Student grades will be determined on the basis of examinations, homework and/or projects, laboratory projects and reports.

d) Course Evaluation:

The proposed course will be evaluated on the basis of student evaluations and curriculum review by appropriate faculty.

4. Results of Consultations:

The proposed course is part of the Engineering Curriculum Proposal approved by the Faculty Senate in December 1994. Consultations were submitted with original proposal as specified by the Curriculum Committee.

Catalog Description:

Engineering Thermodynamics I (0910-311)
(Prerequisites: *Physics I, Chemistry I, Mathematics for Engineering Analysis II*)

The first and second laws of thermodynamics and their applications to energy transformations during various processes are introduced. Property relations are developed for pure simple compressible substances and ideal gases. Closed systems and open systems are analyzed using first and second law analyses. Steam power cycles are analyzed to determine the performance parameters and energy efficiencies.