ROWAN UNIVERSITY CURRICULUM PROPOSAL

PROPOSAL TITLE: ENGINEERING THERMODYNAMICS II

NJ

09116-312

CHECK APPROPRIATE: ✓ UNDERGRADUATE ___ GRADUATE 2 SEMESTER HOURS

SPONSOR(S): ANTHONY J. MACCHESE

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# 97-98-68

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

Forwarded to Executive Vice President/Provost 11-25-97

Senate Curriculum Committee chair Signature/Date: _____

Step #7 (Executive Vice President/Provost): Date Received _____

\ Approved

___ NOT Approved If no, reasons are as follows:

Student Credit Hours _____

Faculty Load Hours _____

Equalized Credit Hours _____

Official Copy & Approval Sheet Filed (Date) 1/26/98

Executive Vice President/Provost Signature _____

Registrar

Date Approved Course Description Received 28 Jan 98

Hegis Taxonomy and Course Number Assigned 1104.312

Date/Signature of Registrar _____

Notification Forward:

_____ Senate Curriculum Committee Chairperson

_____ Department Chairpersons

_____ Academic Dean(s)

_____ Registrar

_____ Sponsor(s)

Course Proposal

1. Details:

a) Course Title:	Engineering Thermodynamics II (0910-312)
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; An elective for other engineering majors
f) Prerequisites:	Engineering Thermodynamics I or Chemical Process Principles II
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 directly follows Engineering Thermodynamics I and consists of applying the fundamental theory to the solution of gas power systems and refrigeration systems. In addition to the applications, more advanced thermodynamic principles are covered, such as thermodynamic relations of simple compressible substances, non-reacting ideal gas mixtures, psychometrics and reacting mixtures. An up-to-date introduction to availability (exergy) analysis is also presented.

The sequence of Engineering Thermodynamics I and II, which is required for all mechanical engineering majors, is the foundation for all following courses in the thermal/fluid science area.

3. Essence of the Course:

a) Objectives:

Having provided students with the fundamental background and analytical tools of thermodynamics in Engineering Thermodynamics I, the main objective of Engineering Thermodynamics II is to provide mechanical engineering students with practical applications that use the principles. In addition, more advanced thermodynamic topics are covered, such as thermodynamic relations of simple compressible substances, non-reacting ideal gas mixtures, psychometrics, reacting mixtures, phase equilibrium and chemical equilibrium.

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

1. Solve problems involving mobile gas power plants (Otto cycle, Diesel cycle, Brayton cycle, etc.),
2. Determine the performance and efficiency of refrigeration systems (vapor compression refrigeration, absorption cycles, heat pumps),
3. Determine the composition of a chemical reacting system at equilibrium and calculate the adiabatic flame temperature.
4. Perform availability (exergy) analyses on open and closed systems
5. Calculate vapor pressures for two-phase systems.
6. Use the Maxwell relations to construct tables of thermodynamic properties.
7. Design air-conditioning systems using the psychrometric principles.

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:

Gas power systems
- Otto and diesel cycles
- Brayton cycle
- Gas turbine engines
- Ericsson and Stirling cycles
- One-dimensional steady flow in supersonic nozzles

Refrigeration and heat pump systems
- Vapor-compression refrigeration
- Refrigerant properties
- Absorption systems
- Heat pumps
- Gas refrigeration systems

Availability (exergy) analysis
- Availability and flow availability
- Availability balances for closed and open systems
- Second law efficiency and thermoeconomics

Thermodynamic relations for simple compressible substances
- Equations of state
- Maxwell relations
- Constructing tables of thermodynamic properties
- Generalized charts for enthalpy and entropy

Non-reacting ideal gas mixtures
- p-v-T relationships for ideal gas mixtures
- Mixing of ideal gases
- Psychrometric principles
- Conservation of mass and energy for psychrometric systems
- Adiabatic-saturation and wet-bulb temperature
- Psychrometric charts and applications

Chemically reacting systems
- Combustion processes
- Conservation of energy for reacting systems
- Adiabatic flame temperature

Chemical and phase equilibrium
- Equation of reaction equilibrium
- Calculation of equilibrium compositions
- Phase equilibrium

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 II (0910-312)
(Prerequisites: *Engineering Thermodynamics I or Chemical Process Principles II*)

This course emphasizes application of the first and second laws of thermodynamics to a variety of systems, including gas power systems, refrigeration systems and combustion systems. In addition, advanced thermodynamics topics are covered, including Maxwell relations, exergy analysis, chemical equilibrium and phase equilibrium.