

UNIVERSITY CURRICULUM COMMITTEE

DATE OF OPEN HEARING (if necessary): 2/10/99 (College Level only)

APPROVED

NOT APPROVED

COMMENTS:

Paulette Reeves 4/1/99
SIGNATURE DATE

SENATE

Date announced at Senate: 4/23/99

Voted upon at Senate: Approved Not Approved Date:

EXECUTIVE VICE PRESIDENT/PROVOST

APPROVED

NOT APPROVED If no, reasons are as follows:

STUDENT CREDIT HOURS _____ FACULTY LOAD HOURS _____ EQUALIZED CREDIT HOURS _____

OFFICIAL COPY & APPROVAL SHEET FILED (DATE): _____

DATE/SIGNATURE EXECUTIVE VICE PRESIDENT/PROVOST [Signature]

REGISTRAR

DATE APPROVED COURSE DESCRIPTION RECEIVED _____

HEGIS TAXONOMY & COURSE NUMBER ASSIGNED 0910.414

DATE/SIGNATURE OF REGISTRAR Robert G. Kubat 4/14/99

NOTIFICATION FORWARD:

SENATE CURRICULUM COMMITTEE CHAIRPERSON

DEPARTMENT CHAIRPERSONS

ACADEMIC DEAN(S)

REGISTRAR

SPONSOR(S)

T/A 4/22/99

Course Proposal

1. Details:

- a) Course Title: Introduction to Energy Conversion Systems (0910.414)
- b) Sponsor: Dr. H. Clay Gabler, Department of Mechanical Engineering, College of Engineering
- c) Credit Hours: 3 credit hours
- d) Course Level: Senior
- e) Curricular Effect: Senior level thermal sciences elective for Mechanical Engineering majors.
- f) Prerequisites: Engineering Thermodynamics II (910.312) and Fluids I (901.341), or equivalent courses.
- g) Suggested Time/
Scale of Implementation: Fall 1999
One section
- h) Resources:

Faculty is in place to teach the course within the Dept. of Mechanical Engineering. A 1130 square foot thermodynamics and engine laboratory, is in place which will be used in support of this course. Library resources are in place. Computer hardware resources are available in the Henry M. Rowan Hall 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.

Mechanical Engineering is broadly split between the study of mechanical systems and thermal/energy systems. At Rowan, Mechanical Engineering majors must take at least 2 electives in each of the above broad areas. The proposed course satisfies a Senior level elective in the thermal/energy systems area. Introduction to Energy Conversion Systems introduces Mechanical Engineering students to the important area of power generation systems. Knowledge of power generation systems is vital for many career paths in the energy services industry.

3. Essence of the Course:

a) Objectives:

Engineering Thermodynamics II briefly introduces Mechanical Engineering Students to the concept of thermal power generation cycles. The primary objective of the course Introduction to Energy Conversion Systems, is to provide students with insight into state-of-the-art technologies for electrical power generation and the environmental consequences of these technologies.

The following are the specific objectives of this course:

1. Compute Heating Value of Gas-Phase Fuels
2. Equilibrium Concentrations of Fuel Oxidation Products
3. Compute Adiabatic Flame Temperature
4. Derive Overall Rate Expressions for Gas Phase Pollutant Formation
5. Compute mass rate of vaporization for liquid fuel droplets
6. Compute Coal Char Combustion Rates
7. Compute Nuclear Fuel Number Densities and Macroscopic Fission Cross-sections
8. Compute the thermal heat generation rate in a nuclear reactor fuel pin.

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:

1. Review of Power Cycles and Cycle Analysis
 - 1.1. High Efficiency Steam Power Cycles
 - 1.2. High Efficiency Gas Turbine Cycles
 - 1.3. Advanced Gas Turbine Cycles
 - 1.4. Combined Cycle Technology and Systems
2. Gaseous Fuels
 - 2.1. Production
 - 2.2. Composition
 - 2.3. Thermodynamics
 - 2.4. Kinetics
 - 2.5. Gas-phase Pollutants
3. Liquid Fuels
 - 3.1. Production
 - 3.2. Composition
 - 3.3. Fuel Properties
 - 3.4. Atomization
 - 3.5. Droplet Combustion

- 3.6. Coking
- 3.7. Slagging and Ash
- 3.8. Alternative Liquid Fuels
- 4. Solid Fuels
 - 4.1. Production
 - 4.2. Coal Structure and Composition
 - 4.3. Devolatilization
 - 4.4. Char Combustion
- 5. Nuclear Energy
 - 5.1. Nuclear Fission
 - 5.2. Nuclear Core Design
 - 5.3. Reactor Steam Supply Systems
- 6. Direct Energy Conversion and Fuel Cells
- 7. Environmental Control
 - 7.1. Pollutant Generation Mechanisms
 - 7.2. NO_x
 - 7.3. SO_x
 - 7.4. Organic Emissions
 - 7.5. Inorganic Particulates
- 8. Alternative Energy Sources

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. Additional curriculum consultations were performed with outside consultants including, Professor Skip Fletcher of Texas, A&M. Professor Fletcher is a fellow of the American Society of Mechanical Engineers.

Catalog Description:

Introduction to Energy Conversion Systems (0910.414)

Prerequisites: Engineering Thermodynamics II (910.312) and Fluids I (901.341), or equivalent courses.

This course will introduce energy conversion technologies for the generation of electrical power. Topics will include a review of power cycles, steam and gas cycles, generation of thermal power, combustion and fuels, steam power plant design considerations, gas turbine power plant operation and design considerations, combined cycles, co-generation, nuclear power, alternative energy sources, fuel cells, and environmental considerations in power generation.