

PROPOSAL NUMBER: 92- 404
(330 + 998 300)

CURRICULUM PROPOSAL FORM

DEADLINES:

REGULAR COURSE PROPOSALS: OCTOBER 23, 1998 FOR FALL, 1999 AND FEBRUARY 19, 1999 FOR SPRING, 2000
 SHORT-TERM COURSE PROPOSALS: DECEMBER 11, 1998 FOR FALL, 1999 AND MARCH 26, 1998 FOR SPRING 2000

PROPOSAL TITLE: Introduction to Rocket Propulsion

SPONSOR/S: Dr. Anthony J. Marchese and the Department of Mechanical Engineering

DEPARTMENT: Mechanical Engineering

C916.412

CHECK ALL THAT APPLY:
 UNDERGRADUATE GRADUATE

COLLEGE: Engineering

If LAS: History/Humanities
 Math/Sciences
 Social/Behavioral Sciences

* * * * *

TYPE OF PROPOSAL (Check ALL that Apply)

<input type="checkbox"/> General Education	<input checked="" type="checkbox"/> New Course (NOT Gen. Ed.)
<input type="checkbox"/> New Course in _____ Bank	<input type="checkbox"/> Name Change (Dept., School, Major)
<input type="checkbox"/> Existing course, Add To _____ Bank	<input type="checkbox"/> Changes in Degree Requirements
<input type="checkbox"/> Multicultural/Global Designation	<input type="checkbox"/> Changes Involve Gen. Ed. requirements
<input type="checkbox"/> Writing Intensive Designation	
	<input type="checkbox"/> Minor Changes to Existing Courses
<input type="checkbox"/> New Minor/Concentration/Specialization	<input type="checkbox"/> Course is NOT General Education
<input type="checkbox"/> New Major/Degree Program	<input type="checkbox"/> Course IS General Education
<input type="checkbox"/> Short Term Course Proposal	

DEPARTMENT
 (SIGNATURE INDICATES APPROVAL)

See attached for signature

 DEPT. CURRICULUM CHAIR / DATE

 DEPT. CHAIRPERSON / DATE

COLLEGE CURRICULUM COMMITTEE
 DATE OF OPEN HEARING (if necessary) _____

APPROVED
 NOT APPROVED

COMMENTS:

Robert P. Herbath 11/5/98
 SIGNATURE DATE

ACADEMIC DEAN (& GRADUATE DEAN, for New Graduate Programs Only)

APPROVED
 NOT APPROVED

COMMENTS:

 SIGNATURE (Academic Dean) DATE

 SIGNATURE (Graduate Dean) DATE

UNIVERSITY CURRICULUM COMMITTEE

DATE OF OPEN HEARING (if necessary) College level only

APPROVED

NOT APPROVED

COMMENTS:

Annita K. ...

11/18/98

SIGNATURE

DATE

SENATE

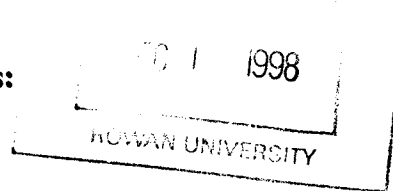
Date announced at Senate 11/16/98

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 412

DATE/SIGNATURE OF REGISTRAR Robert A. Libat 12/10/98

NOTIFICATION FORWARD:

SENATE CURRICULUM COMMITTEE CHAIRPERSON

DEPARTMENT CHAIRPERSONS

ACADEMIC DEAN(S)

REGISTRAR

SPONSOR(S)

Transmittal 1/10/99

ROWAN UNIVERSITY CURRICULUM PROPOSAL

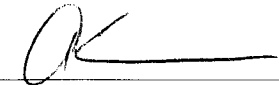
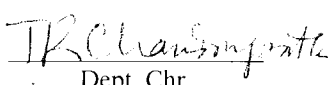
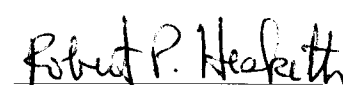
PROPOSAL TITLE:
Introduction to Rocket Propulsion

CHECK APPROPRIATE: UNDERGRADUATE GRADUATE SEMESTER HOURS

SPONSOR(S):
Dr. Anthony J. Marchese and the Department of Mechanical Engineering

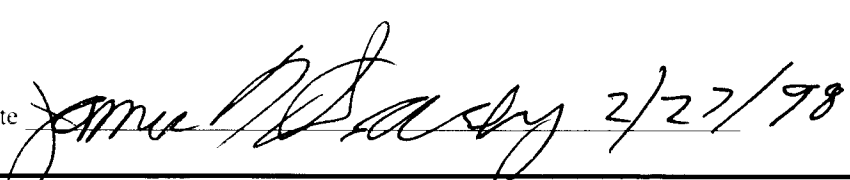
DEPARTMENT/TELEPHONE # Mechanical Engineering x4627

CHECK ONE: COURSE MINOR PROGRAM CONCENTRATION SPECIALIZATION
 ACHIEVEMENT CERTIFICATE CERTIFICATION PROGRAM MAJOR PROGRAM

<p>Step #1 (Department)</p> <p><input checked="" type="checkbox"/> Approved (Date)</p> <p><input type="checkbox"/> Not Approved (Date)</p> <p style="text-align: center;"> Dept. Curriculum Chr.</p> <p style="text-align: center;"><u>2/25/98</u> Reviewed (Date)</p> <p style="text-align: center;"> Dept. Chr.</p>	<p>Step #2 (Receipt)</p> <p style="text-align: center;">SCC# <u>97-98- 303</u></p> <p style="text-align: center;"><u>2-27-98</u> Date Received Senate</p> <p style="text-align: center;">_____ Senate Curriculum Chr.</p>	<p style="text-align: center;">Step #3 (School)</p> <p style="text-align: right;">Reviewed Date: <u>2/25/98</u></p> <p><input checked="" type="checkbox"/> Recommend to Approved</p> <p><input type="checkbox"/> Recommend NOT to Approve</p> <p>Forward for Open Hearing:</p> <p><input type="checkbox"/> WITHOUT Reservations</p> <p><input type="checkbox"/> WITH Reservations:</p> <p>Comments:</p> <p style="text-align: center;"> School Committee Chr.</p>
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Step #4 (Academic Dean): Recommended NOT Recommended Conditionally Recommended (See Comments)

Comments:

Dean Signature/Date  2/27/98

Step #5 (Senate Curriculum Committee): Open Hearing Date: _____ Approved by Curriculum Committee Date _____

Returned to Sponsor(s) for the following reason:

Step #6 (Senate) Date announced/voted on at Senate _____ If voted on: Approved NOT Approved

Date forwarded to Executive Vice President/Provost _____

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) _____

Executive Vice President/Provost Signature _____

Registrar

Date Approved Course Description Received _____

Hegis Taxonomy and Course Number Assigned _____

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:** Introduction to Rocket Propulsion (0910.412)
- b) **Sponsor:** Dr. Anthony J. Marchese, Department of Mechanical Engineering, College of Engineering
- c) **Credit Hours:** 3 credit hours
- d) **Course Level:** Senior
- e) **Curricular Effect:** A senior elective for Mechanical Engineering majors. May also be taken by Chemical Engineering majors.
- f) **Prerequisites:** Engineering Thermodynamics II (0910.312) and Fluid Mechanics II (0910.313) or equivalent.
- g) **Suggested Time/
Scale of Implementation** Spring 2000
One section
- h) **Resources:** Faculty is in place to teach the course within the Dept. of Mechanical Engineering. An 1130 square foot thermo and engine laboratory will be available to support this course. A Turbojet gas turbine engine and a supersonic nozzle flow apparatus have been purchased in support of this course. Library resources are in place. Computer hardware resources are available in the Engineering Building to support this course.

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.

Rocket propulsion is a key technology in the areas of space exploration, commercialization of space and automotive vehicle restraint systems. Space exploration (e.g. a manned Mars mission) has seen a renewed interest in light of the results from the Mars Pathfinder mission. The primary obstacle that has prevented man from walking on the surface of Mars is the propulsion system requirements. In terms of the commercialization of space, the recent explosion in communications technology has put an unprecedented demand for communication satellite launches. And, every automobile sold in this country today includes two solid rocket motors that are used to quickly inflate the air bags. Clearly, it is of vital importance to the national interest that we educate a new breed of rocket scientist. This is particularly important today, since many of the early pioneers in rocket propulsion have retired or passed on.

3. Essence of the Course:

a) Objectives:

Rocket propulsion draws on the fundamental concepts of thermodynamics, chemistry and fluid mechanics. By definition, the Rocket Propulsion course is an application based course which uses these principles to design propulsion systems. At the conclusion of the course the student will be able to:

1. Analyze the performance of an ideal rocket motor.
2. Design a rocket system based on mission requirements.
3. Perform thermochemical calculations (by hand or using the NASA CEC program) to determine the rocket chamber temperature and chemical composition for any chemical propellant combination.
4. Explain the difference between frozen and shifting equilibrium nozzle flow and calculate specific impulse for both limiting cases.
5. Design a liquid propellant rocket engine by considering the propellant combination, combustion chamber, injector, igniter, nozzle, heat transfer and cooling characteristics
6. Design a solid propellant rocket engine based on the propellant combination, burning rate laws and grain design.

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:

Rocket Performance Theory

- Performance analysis of an ideal rocket motor
- Departure from ideal performance
- Thermochemistry and theoretical calculations

Chemical Rocket Propellants

- Characteristics of liquid propellants
- Characteristics of solid propellants

Design of Liquid Propellant Rocket Engines

- Combustion chamber design
- Nozzle design
- Heat transfer
- Cooling
- Manufacturing

Design of Solid Propellant Rocket Motors

- Propellants and classes

Burning rate laws
Accessories
Restricted burning rockets
Unrestricted burning rockets

Electric Propulsion Rockets
Ion propulsion
Resistojet thrusters
Arcjet thrusters
MPD thrusters

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:

0910.412

3 s.h.

Introduction to Rocket Propulsion

(Prerequisites: *Engineering Thermodynamics II (0910.312) and Fluid Mechanics II (0910.313) or Equivalent*)

In this course, the principles of rocket propulsion theory are presented along with practical applications of rocket propulsion design. Theoretical topics include performance analysis of ideal rocket engines, departure from ideal performance and detailed thermochemical propellant calculations. Practical design issues are addressed for both liquid propellant engines and solid rocket motors. The course also includes an introduction to electric propulsion.