

ROWAN UNIVERSITY CURRICULUM PROPOSAL

(R)

PROPOSAL TITLE:

1701-386

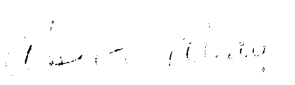


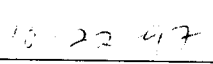
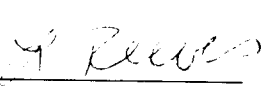
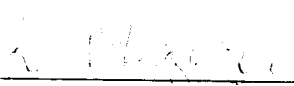
Introduction to Partial Differential Equations

CHECK APPROPRIATE: UNDERGRADUATE GRADUATE 3 SEMESTER HOURS

SPONSOR(S): Dr. Thomas Osler and Dr. Marcus Wright

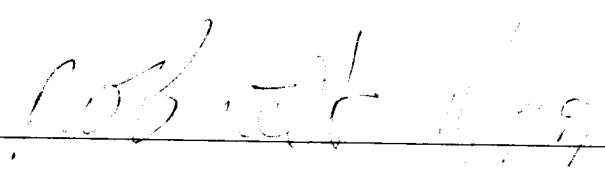
DEPARTMENT/TELEPHONE # Mathematics 4844

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

Step #1 (Department)	Step #2 (Receipt)	Step #3 (School)
<input type="checkbox"/> Approved (Date) _____ <input type="checkbox"/> Not Approved (Date) _____ <div style="text-align: center;">  Dept. Curriculum Chr. </div> <div style="text-align: center;">  Reviewed (Date) </div> <div style="text-align: center;">  Dept. Chr. </div>	<p style="text-align: center;">SCC# <u>97-98-87</u></p> <div style="text-align: center;">  Date Received Senate </div> <div style="text-align: center;">  Senate Curriculum Chr. </div>	<p style="text-align: center;">Reviewed Date: <u>1/2/98</u></p> <input type="checkbox"/> Recommend to Approved <input type="checkbox"/> Recommend NOT to Approve Forward for Open Hearing: <input checked="" type="checkbox"/> WITHOUT Reservations <input type="checkbox"/> WITH Reservations: Comments: <div style="text-align: center;">  School Committee Chr. </div>

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

Comments:

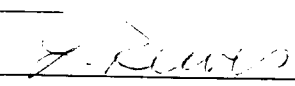
Dean Signature/Date:  _____

Step #5 (Senate Curriculum Committee): Open Hearing Date: 12/2/97 Approved by Curriculum Committee Date: 12/2/97

Returned to Sponsor(s) for the following reason:

Step #6 (Senate) Date announced/voted on at Senate: 1-27-98 voted on: Approved NOT Approved

Date forwarded to Executive Vice President/Provost: _____

Senate Curriculum Committee chair Signature/Date:  1/27/98

Step #7 (Executive Vice President/Provost): Date Received JAN 28 1998

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 [Signature]

Registrar

Date Approved Course Description Received 2-9-98

Hegis Taxonomy and Course Number Assigned 1701-386

Date/Signature of Registrar B. J. Kilmer 2-9-98

Notification Forward:

_____ Senate Curriculum Committee Chairperson

_____ Department Chairpersons

_____ Academic Dean(s)

_____ Registrar

_____ Sponsor(s)

Rowan University
Department of Mathematics

Course Proposal

Introduction to Partial Differential Equations

I. **Details**

- a) **Course Title:** Introduction to Partial Differential Equations
- b) **Sponsors:** Dr. Thomas Osler and Dr. Marcus Wright, Department of Mathematics
- c) **Credit Hours:** 3 credit hours
- d) **Course Level:** Junior or Senior
- e) **Curricular Effect:** Elective course for students majoring in Mathematics, Engineering, Physics and other sciences.
- f) **Prerequisites:** 1701.231 Ordinary Differential Equations
- g) **Suggested Time, Implementation:** This course will be offered once each year.
- h) **Resources:** Faculty, equipment and library resources are adequate.

II. **Rationale:**

Since the discovery of the calculus some 300 years ago, the major area of applications of mathematics has been through the use of differential equations. These equations are of two types: ordinary differential equations and partial differential equations. The former treat problems in one independent variable (often time), while the latter treat problems in more than one independent variable (often the coordinates of space and time). The existing course called Differential Equations treats only ordinary differential equations. Since many applications in physics, engineering and other sciences require partial differential equations, and since most engineering schools have traditionally offered such a course at the undergraduate level, it seems natural to offer this course here at Rowan.

III. **Essence of the Course**

a) **Objectives in Relation to Student Outcomes**

Students in this course will become familiar with the three main types of partial differential equations (PDEs) and how they arise from physical problems. The important technique of separation of variables will be used to reduce the PDE to a system of ODEs (ordinary differential equations). The use of Fourier series and integrals will be explained. Solutions in other orthogonal functions will be examined. The use of a high level mathematics programming language (such as Mathematica) to simplify the analytical computations will be encouraged.

b) **Topical Outline:**

1. Partial Differential Equations of Physics

- Linear Boundary Value Problems
- The Vibrating String
- Other examples of Wave Equations
- Conduction of Heat
- Laplace's Equation
- Cylindrical and Spherical Coordinates
- Types of Equations and Conditions

2. Superposition of Solutions

- Linear Combinations
- Series Solutions
- Separation of Variables
- A Plucked String

3. Fourier Series

- The Basic Series
- Examples
- Fourier Sine and Cosine Series

4. Orthogonal Sets of Functions

- Functions as Vectors
- Inner Products and Orthonormal Sets
- Generalized Fourier Series
- Sturm-Liouville Problems

5. Fourier Integrals
 - The Fourier Integral Formula
 - Sine and Cosine Forms
 - Exponential Form
6. Boundary Value Problems
 - Formal and Rigorous Solutions
 - The Vibrating String, Initially Displaced
 - Nonhomogeneous Differential Equations
 - Elastic Bar
 - Temperatures in a Bar
 - A Dirichlet Problem
7. Bessel Functions and Applications
 - Bessel's Equation
 - Bessel Functions
 - Differentiation and Recurrence Formulae
 - Zeros of the Bessel Functions
 - Temperatures in a Long Cylinder
 - Vibration of a Circular Membrane
8. Legendre Polynomials and Applications
 - Derivation of Legendre Polynomials
 - Legendre's Series
 - Temperatures in a Hemisphere

c) **Evaluation and Grading:**

Students will be evaluated by the traditional methods of grading homework problems and through written tests. In addition, students will prepare computer solutions of assigned problems.

d) **Course Evaluation:**

This course will be evaluated through customary student evaluations as well as regular departmental review.

IV. **Consultation**

The content and nature of this course was discussed with:

1. Dr. T. R. Chandrupatla, Dept. of Mechanical Engineering
 2. Dr. Eduardo Flores, Dept. of Chemistry and Physics
- Their letters of support are attached.

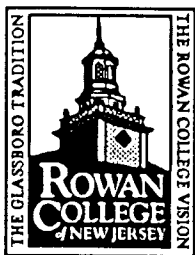
V. This proposal has been reviewed by the Department of Mathematics' Curriculum Committee.

Catalogue description:

1701.335 Introduction to Partial Differential Equations

(Prerequisite: 1701.231 Ordinary Differential Equations)

This course is a study of partial differential equations and their applications. Topics include the derivation of the wave equation, Laplace's equation and the heat equation, Fourier series and integrals, boundary value problems, Bessel functions and Legendre Polynomials.



Rowan
Glassboro, NJ 08028-1701

Dr. Eduardo Flores
Department of Chemistry & Physics
(609) 256-4500 Ext. 3598 Fax (609) 256-4921
e-mail: flores@rowan.edu

MEMO

TO: Gary Iitzkowitz
FROM: Eduardo Flores
RE: A New Course Proposal
Partial Differential Equations
DATE: October 7, 1997

In practically all of our physics courses, from introductory to advanced levels, partial derivatives and partial differential equations are fundamental mathematical tools. I think that the course you propose, Partial Differential Equations, can greatly benefit all science and engineering majors but specially physics majors. I will strongly recommend that all our majors to take this course when available.

Sincerely,

Eduardo Flores

Dr. Eduardo Flores
Head of Physics Section



Department of Mechanical Engineering
201 Mullica Hill Road, Glassboro, NJ 08028-1701

MEMO

TO: Gary Itzkowitz

FROM: T.R. Chandrupatla *TR Chandrupatla*

REF: New course proposed "Introduction to Partial Differential Equations"

DATE: October 10, 1997

I have gone through the proposal for "Introduction to Partial Differential Equations" at Junior or Senior level. Partial differential equations (PDEs) play an important role in science and engineering. Offering such a course at Junior/Senior level will be very useful. The course will also be useful in the graduate program where our students need to develop a mathematical background in order to formulate and solve problems in solid, fluid, thermal, and electromagnetic systems.

I strongly support the offer of a course on partial differential equations.