

ROWAN COLLEGE
CURRICULUM COMMITTEE

PROPOSAL TITLE: Numerical Analysis

 UNDERGRADUATE X GRADUATE 3 CREDIT HOURS

SPONSOR(S): Marcus Wright and John Sooy

DEPARTMENT & TELEPHONE# Mathematics 256-4500, Ext. 3873

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

<p style="text-align: center;">STEP #1 (DEPARTMENT)</p> <p><input checked="" type="checkbox"/> APPROVED/DATE: <u>10/13/95</u></p> <p><u> </u> NOT APPROVED/DATE:</p> <p style="text-align: center;"><u>Larry Howe</u> DEPT. CURRICULUM CHR.</p> <p><u> </u> REVIEWED/DATE:</p> <p style="text-align: center;"><u> </u> DEPT. CHR.</p>	<p style="text-align: center;">STEP #2 (RECEIPT)</p> <p>SCC# <u>95 96 90</u></p> <p>DATE RECEIVED: <u>15</u></p> <p style="text-align: center;"><u> </u> SENATE CURRICULUM CHR.</p>	<p style="text-align: center;">STEP #3 (SCHOOL)</p> <p>REVIEWED DATE: <u> </u></p> <p><input checked="" type="checkbox"/> RECOMMEND TO APPROVE</p> <p><u> </u> RECOMMEND NOT TO APPROVE</p> <p style="text-align: center;">FORWARD FOR OPEN HEARING</p> <p><u> </u> WITHOUT RESERVATIONS</p> <p><u> </u> WITH RESERVATIONS</p> <p>COMMENTS:</p> <p style="text-align: center;"><u> </u> SCHOOL COMMITTEE CHR.</p>
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<p>STEP #4 (ACADEMIC DEAN)</p> <p><u> </u> RECOMMEND</p> <p><u> </u> NOT RECOMMEND</p> <p><u> </u> CONDITIONALLY RECOMMEND (SEE COMMENTS)</p> <p>DATE & SIGNATURE, DEAN OF SCHOOL</p>	<p>COMMENTS:</p> <p style="text-align: center;"><u> </u></p> <p style="text-align: center;"><u> </u></p>
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<p>STEP #5 (SENATE CURRICULUM COMMITTEE)</p> <p>DATE OF OPEN HEARING <u> </u></p> <p>APPROVED BY SENATE CURRICULUM COMMITTEE (DATE) <u> </u></p> <p><u> </u> RETURNED TO SPONSOR(S) FOR THE FOLLOWING REASONS:</p> <p>_____</p> <p>_____</p>

<p>#6 (SENATE)</p> <p>DATE PRESENTED TO SENATE <u> </u> <u> </u> APPROVED <u> </u> NOT APPROVED</p> <p>NOTIFICATION TO EXECUTIVE VICE PRESIDENT/PROVOST (DATE) <u> </u></p> <p>SENATE CURRICULUM COMMITTEE CHAIR SIGNATURE/DATE <u> </u></p>

STEP #7 (EXECUTIVE VICE PRESIDENT/PROVOST)

DATE RECEIVED 4/12/96

APPROVED: YES NO

IF NO, REASONS ARE AS FOLLOWS:

STUDENT CREDIT HOURS 3

FACULTY LOAD HOURS 3

EQUALIZED CREDIT HOURS _____

OFFICIAL COPY & APPROVAL SHEET FILED (DATE) _____

SIGNATURE, EXECUTIVE VICE PRESIDENT/PROVOST _____

REGISTRAR

DATE APPROVED COURSE DESCRIPTION RECEIVED 14 May 96
HEGIS TAXONOMY AND COURSE NUMBER ASSIGNED 1701.529
DATE/SIGNATURE OF REGISTRAR B. J. Kelley 14 May 96

NOTIFICATION FORWARD:

SENATE CURRICULUM COMMITTEE CHAIRPERSON

DEPARTMENT CHAIRPERSON(S)

ACADEMIC DEAN(S)

REGISTRAR

SPONSOR(S)

Rowan College of New Jersey
Department of Mathematics

Course Proposal

Numerical Analysis

I. Details

- a) Course Title: Numerical Analysis
- b) Sponsor: Dr. Marcus Wright and Dr. John Sooy, Department of Mathematics
- c) Credit Hours: 3
- d) Course Level: Graduate
- e) Curricular Effect: Elective for students in the Master of Arts in Mathematics and in the Masters Degree Program in Engineering
- f) Prerequisites: Differential and Integral Calculus of One Variable (including series), Multidimensional Calculus (one semester), Linear Algebra, Real Analysis, and a programming course. All of the above prerequisites are undergraduate courses. One semester of graduate level analysis or the permission of the instructor.
- g) Suggested Time, Implementation: One section offered once per year
- h) Resources: Faculty, library resources, and equipment are adequate.

II. Rationale:

The applications of mathematics to the physical world almost always require extensive calculations by computer. To be applied, mathematics must be made algorithmic and the resulting algorithm must be realized using existing software or by creating new software. The mathematician who wishes to deal mathematically with the real world must study these processes in detail, and also be precisely aware of the limitations of computer solutions.

This course will examine the theoretical foundations of all numerical methods, study in detail existing numerical methods for solving many standard mathematical problems, and give the student insight into how to modify methods to apply to new problems and

to avoid the limitations of computing systems. The intent is also to show the students that a study of numerical analysis is essential to becoming well prepared to understand many of the significant aspects of using computers to solve problems. Studying some of the recent advances in the Theory of Chaos in Nonlinear Dynamics will provide the student with new insight into the uses of mathematics to solve physical problems

III. Essence of the Course

a) Objectives in Relation to Student Outcomes

Students will learn how the fundamental problems of calculus, linear algebra, and differential equations are translated into problems suitable for solution using computer programming and applications. They will also understand mathematically how the errors in computer computations affect the accuracy of numerical methods. They will also study the inherent limitations of numerical methods as presented in the Theory of Chaotic Dynamical Systems, and learn how to interpret the applicability of numerical methods to the solution of problems in mathematics, science, and engineering.

In particular, they will become familiar with numerical methods for dealing with the mathematics listed in the topical outline below. They will also learn how to implement some numerical methods in a programming language and how to use existing mathematical software packages.

b) Topical Outline:

1. Sources of errors in representation and arithmetic computations
2. Solutions of Systems of Equations - Linear and Non-linear
3. Approximation Methods for Functions, Integrals, Derivatives
4. Optimization
5. Simulation
6. Ordinary and Partial Differential Equations
7. Chaotic Dynamical Systems and Numerical Analysis

c) Evaluation and Grading:

Students will be evaluated using class participation, written assignments, examinations, and computer assignments.

d) Course Evaluation:

This course will be evaluated through customary student evaluations and by department review on a regular basis.

4. Consultations

This proposal has been reviewed by the Department of Mathematics Curriculum Committee and the Mathematics Masters Degree Committee.

5. Additional Information

Possible textbooks include:

Carl-Erik Froeberg, **Numerical Mathematics - Theory and Computer Applications**, Benjamin/Cummings, Inc., 1985

Catalogue description:

1702/5xx Numerical Analysis

(Prerequisites: 1701.131, 1701.210, 1701.230 (Calculus I - III), 0701.102 Intro. to Programming, one semester of graduate analysis or permission of the instructor.)

This course examines the theoretical foundations of numerical methods and studies in detail existing numerical methods for solving many standard mathematical problems in analysis and algebra. Error analysis will be developed for all methods. Some recent advances in the theory of chaos and nonlinear dynamics will also be presented.