

ROWAN UNIVERSITY CURRICULUM PROPOSAL

(P)

PROPOSAL TITLE:

Bachelor of Science Degree in Mathematics

984

CHECK APPROPRIATE: UNDERGRADUATE GRADUATE SEMESTER HOURS

SPONSOR(S): Dr. Gary Itzkowitz, Dr. Khaled Amer, Dr. Marcus Wright, Dr. Jim Zeng

DEPARTMENT/TELEPHONE # Mathematics 4844

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

Step #1 (Department)

Approved (Date)

Not Approved (Date)

[Signature]
Dept. Curriculum Chr.

[Signature]
Reviewed (Date)

[Signature]
Dept. Chr.

Step #2 (Receipt)

SCC# 97-98-865

10-22-97
Date Received Senate

[Signature]
Senate Curriculum Chr.

Step #3 (School)

Reviewed Date: 10/22/97

Recommend to Approved

Recommend NOT to Approve

Forward for Open Hearing:

WITHOUT Reservations

WITH Reservations:

Comments: [Handwritten]

[Signature]
School Committee Chr.

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

Comments: [Handwritten]

Dean Signature/Date: [Signature]

Step #5 (Senate Curriculum Committee) Open Hearing Date: 5-11-98 Approved by Curriculum Committee Date: 5-11-98

Returned to Sponsor(s) for the following reason:

Step #6 (Senate) Date announced/voted on at Senate: 5-11-98 If voted on: Approved NOT Approved

Date forwarded to Executive Vice President/Provost: _____

Senate Curriculum Committee chair Signature/Date: [Signature]

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 _____

AACh Comm
Appro 8/28/98

BOT appro 9/9/89

To New Prog Rev Comm
8/28/98

Approved
Provost Council
11/19/98

Registrar

Date Approved Course Description Received 11/19/98

Hegis Taxonomy and Course Number Assigned _____

Date/Signature of Registrar Robert A. Kulot 11/23/98

Notification Forward:

Senate Curriculum Committee Chairperson

Department Chairpersons

Academic Dean(s)

Registrar

Sponsor(s)

Transmitted 1/11/99

1. Abstract

Title: Bachelor of Science Degree in Mathematics
Sponsor: The Bachelor of Science Degree Committee
(Amer, Itzkowitz, Wright, and Zeng)

To measure the need for this program, the Bachelor of Science Degree Committee conducted a questionnaire. The respondents were juniors and seniors enrolled in the Bachelor of Arts Degree Program in Mathematics. The majority of those surveyed stated that they would have opted for the B.S. degree if they were given the choice. Moreover, the majority of respondents indicated that they are likely or very likely to do graduate studies. It is the view of the committee that students with a B.S. degree will be better prepared for this goal. This degree will be in addition to the present B.A. Degree in Mathematics and will more appropriately prepare students for graduate programs than the present B.A. Degree (which was originally established to prepare students for teaching high school).

Requirements include 49 s.h. of general ed courses (Arts: 3 s.h., Communication: 9 s.h., History, Humanities, and Language: 9 s.h., Social and Behavioral Sciences: 9 s.h., Science and Mathematics: 11 s.h., Gen Ed Free Electives: 8 s.h.), 8 s.h. of Free Electives, and 64 s.h. of Major Requirements. The major includes 52 s.h. of required courses (Calculus I, II, & III, Differential Equations, Intro to Real Analysis I & II, Intro to Complex Analysis, Linear Algebra, Modern Algebra I & II, Intro to Topology, Intro to Probability and Statistics I, Geometry I, Numerical Analysis, Physics III, and the Senior Seminar (WI); and at least 12 s.h. of Restricted Electives from the following courses: Intro to Prob. & Stat II, Applications of Math, Partial Differential Equations, Design & Analysis of Algorithms, Theory of Computing, Mathematical Physics, Theory of Numbers, History of Math, Geometry II, and Advanced Topics in Discrete Math.

We would like this program to be approved during the 1997/98 academic year and for it to start in the Fall of 1999. This will give us time to promote the program and get any additional course offerings into the course schedule on time.

Since this program is for existing math majors (from our BA program), we can run this with existing resources. The only additional resources would be the one or two extra sections of upper division math courses needed per semester. Given the growth of the math department due to the start of our new engineering school, we should not need any additional faculty, other than one or two additional adjuncts per semester to teach those classes freed up by the regular faculty teaching the additional sections of upper level courses described above.

2. Details

- a. **Title: Bachelor of Science Degree in Mathematics**
- b. **Sponsor: The Bachelor of Science Degree Committee
(Amer, Itzkowitz, Wright, and Zeng)**
- c. **Scope and Size of Program**

This program is designed to prepare math majors for graduate school in mathematics and other disciplines such as engineering, the physical science, computer science, and other areas requiring extensive mathematical training whether they go into applied or theoretical work. The working degree in industry for mathematicians is the Master's degree or higher. We see this program as a very selective one for about 60 majors at most. There will be very selective entrance requirements for this program to limit the number of prospective majors.

- d. **Need for Program:**

To measure the need for this program, the Bachelor of Science Degree Committee conducted a questionnaire. The respondents were juniors and seniors enrolled in the Bachelor of Arts Degree Program in Mathematics. The majority of those surveyed stated that they would have opted for the B.S. degree if they were given the choice (the results of this survey can be found in the Appendix). Moreover, the majority of respondents indicated that they are likely or very likely to do graduate studies. It is the view of the committee that students with a B.S. degree will be better prepared for this goal. A B.A. Degree major takes 12 math courses (39 s.h.) of which 7 are upper division. One of those is the Senior Seminar which is designed as a capstone course rather than one to teach new mathematics. Hence, a B.A. student really takes just 6 upper division mathematics courses. A B.S. Degree candidate takes 20 courses (64 s.h.), 14 of which are upper division, including the Senior Seminar or 13 courses if we omit the Senior Seminar. That is more than twice as many upper division courses as a B.A. major. Thus the B.S. student will remember far more math than the B.A. candidate and will therefore be far better prepared for Graduate School.

- e. **Requirements for admission and graduation**

- Requirements for admission
 - at least a 3.0 GPA in Calculus I, Calculus II, Calculus III, and Linear Algebra
- Requirements for graduation
 - At least a 2.5 GPA in all major course requirements
- General Education - 49 s.h.
 - Arts - 3 s.h.
 - Communications - 9 s.h.
 - College Composition I, College Composition II, and Public Speaking are required
 - History, Humanities, and Language - 9 s.h.
 - Introduction to Symbolic Logic and a year of foreign language are required

Social and Behavioral Sciences - 9 s.h.
Science and Mathematics - 11 s.h.
Physics with Calculus I, Physics with Calculus II, and a
Computer Science Programming Course are required
Free Gen Ed Electives - 8 s.h.

NOTE: one of the above courses must be labeled as a Multi cultural/Global Studies and one a Literature course.

- Free Electives - 8 s.h.

- Major Requirements - 64 s.h.

- Required courses - 52 s.h.

Calculus I
Calculus II
Calculus III
Differential Equations
Introduction to Real Analysis I
Introduction to Real Analysis II
Introduction to Complex Analysis
Linear Algebra
Modern Algebra I
Modern Algebra II
Introduction to Topology
Introduction to Probability and Statistics I
Mathematics Seminar (WI)
Geometry I
Numerical Analysis
Physics III

- Restricted Electives - 12 s.h.

Introduction to Probability & Statistics II
Applications of Mathematics
Partial Differential Equations
Design and Analysis of Algorithms
Theory of Computing
Theory of Numbers
History of Mathematics
Geometry II
Advanced Topics in Discrete Mathematics
Mathematical Physics

Also required is at least a 2.5 GPA in all Science and Math courses (including computer science).

f. Suggested time and scale

We would like this program to be approved during the 1997/98 academic year and for it to start in the Fall of 1999. This will give us time to promote the program and get any additional course offerings into the course schedule on time.

g. Resource Requirements

Since this program is for existing math majors (from our BA program), we can run this with existing resources.

h. Staffing

The only additional resources would be the one or two extra sections of upper division math courses needed per semester. Given the growth of the math department due to the start of our new engineering school, we should not need any additional faculty, other than one or two additional adjuncts per semester to teach those classes freed up by the regular faculty teaching the additional sections of upper level courses described above.

3. Rationale

Currently, the Mathematics Department offers a Bachelor of Arts degree. This degree prepares our students for school teaching and careers in industry. However, the amount of credit hours devoted to mathematics is somewhat low (see the "Need" statement in part 2.d. above). As a result, the grade scores of those students who take the specialized mathematics GRE are not as high as we would like. Once enrolled in a graduate program in a good institution, they encounter some difficulty due to lack of prerequisites. The committee feels that the only way to remedy this situation is to introduce a B.S. degree since we cannot increase the amount of mathematics credit hours in the B.A. degree.

4. Essence of the Program

a. Major Goals of the Program

The bachelor of science degree in mathematics is, first of all, designed to give the increasing number of our mathematics majors that do not intend to be teachers the opportunity to prepare more thoroughly for graduate work in mathematics and other disciplines such as engineering, the physical science, computer science, and other areas requiring extensive mathematical training. The requirements for this degree are also flexible enough so that students intending to seek employment in business, industry, or government can pursue courses of study that will allow them to enter their professions familiar with more of the relevant mathematics. The program is designed to allow students to study the mathematics that they will need with flexibility, breadth, and depth.

b. Specific objectives of the program

- i. Understand relationships among different areas of mathematics.
- ii. Develop diverse approaches to solving contemporary

- mathematical problems.
- iii. Gain knowledge of the theories and methods that are important in applied settings.
- iv. Analyze data and synthesize information from that analysis.
- v. Communicate mathematically, both orally and in writing.
- vi. Prepare for future work in mathematics or related subjects at the graduate level.
- vii. Prepare for employment as a mathematician in business industry, government, or education.

c. Structure of Program

The Bachelor of Science in Mathematic Program includes 64 semester hours in mathematics, physics, and computer science. Students will be provided with the core courses and the restricted elective bank which will allow each student to tailor her or his curriculum to meet individual goals and needs. All students will be required to complete 52 semester hours of core courses and to take at least 4 courses from the restricted elective bank.

(i) Curriculum Outline

Following is an outline of the Bachelor of Science in Mathematics program. Course syllabi may be found in the Appendix.

All students will be required to complete 52 semester hours of core courses:

- Calculus I
- Calculus II
- Calculus III
- Modern Algebra I & II
- Probability and Statistics I
- Intro to Real Analysis I & II
- Linear Algebra
- Differential Equations
- Math Seminar
- Intro to Complex Analysis
- Geometry I
- Intro to Topology
- Numerical Analysis
- Physics III

The following General Education courses are also required:

- Physics I with Calculus
- Physics II with Calculus
- Computer Science Programming Course
- Introduction to Symbolic Logic
- Foreign Language I and II

Students must take at least four courses from the restricted elective bank:

Probability and Statistics II
Applications of Mathematics
Design and Analysis of Algorithms
Partial Differential Equations
Theory of Numbers
Theory of Computing
History of Mathematics
Mathematical Physics
Geometry II
Advance topics in Discrete Mathematics

(ii) Sample courses of study.

Two sample programs, for the full-time student, are described in this section: one for the students preparing for employment in business and industry (applied) and another one for the students preparing for higher degree program in the sciences or mathematics (theoretical).

Sample Program for Applied Work:

First Semester

1701. Calculus I
1701. Discrete Mathematics
0701. Computer Science and Programming

Second Semester

1701. Calculus II (Prereq.: Discrete Math)
1902. Physics I with Calculus
1509. Introduction to Symbolic Logic

Third Semester

1701. Calculus III (Prereq.: Calculus II)
1701. Linear Algebra (Prereq.: Calculus II)
1911. Physics II with Calculus (Prereq.: Physics I)
0701. Theory of Computing

Fourth Semester

1701. Differential Equations (Prereq.: Calculus III,
 Linear Algebra)
1701. Real Analysis I (Prereq.: Calculus III)
1902. Physics III (Prereq.: Physics II)

Fifth Semester

- 1701. Real Analysis II (Prereq.: Real Analysis I)
- 1701. Modern Algebra I (Prereq.: Linear Algebra)
- 1703. Applications of Math (Prereq.: Calc III & Linear Algebra)

Sixth Semester

- 1701. Complex Analysis (Prereq.: Calculus III)
- 1701. Modern Algebra II (Prereq.: Modern Algebra I)
- 1701. Geometry I (Prereq.: Calculus II)

Seventh Semester

- 1701. Partial Differential Equations (Prereq.: Diff. Equations)
- 1701. Numerical Analysis (Prereq.: Intro to Programming, Linear Algebra, Calculus II)
- 1702. Probability and Statistics I (Prereq.: Calculus II)

Eighth Semester

- 1701. Topology (Prereq.: Real Analysis I)
- 1701. Mathematics Seminar (Senior Status)
- 1702. Probability and Statistics II (Prereq.: Prob. and Stat. I)

Sample Program for Graduate School Preparation:

First Semester

- 1701. Calculus I
- 1701. Discrete Mathematics
- 0701. Computer Science and Programming

Second Semester

- 1701. Calculus II (Prereq.: Calculus I)
- 1902. Physics I with Calculus (Prereq.: Calculus I)
- 1509. Introduction to Symbolic Logic

Third Semester

- 1701. Calculus III (Prereq.: Calculus II)
- 1701. Linear Algebra (Prereq.: Calculus II)
- 1911. Physics II with Calculus (Prereq.: Physics I)
- 0701. Theory of Computing

Fourth Semester

- 1701. Differential Equations (Prereq.: Calculus III)
- 1701. Real Analysis I (Prereq.: Calculus III)
- 1701. Geometry I (Prereq.: Calculus II)

Fifth Semester

- 1701. Real Analysis II (Prereq.: Real Analysis I)
- 1701. Modern Algebra I (Prereq.: Linear Algebra)
- 1701. Numerical Analysis (Prereq.: Intro. To Programming, Linear Algebra, Calculus II)

Sixth Semester

- 1701. Complex Analysis (Prereq.: Calculus III)
- 1701. Modern Algebra II (Prereq.: Modern Algebra I)
- 0701. Theory of Computing
- 1902 Physics III (Prereq.: Physics II)

Seventh Semester

- 1701. Theory of Numbers (Prereq.: Linear Algebra)
- 1701. Applications of Math (Prereq.: Calc III & Linear Algebra)
- 1702. Probability and Statistics I (Prereq.: Calculus II)

Eighth Semester

- 1701. Topology (Prereq.: Real Analysis I)
- 1701. Mathematics Seminar (Senior Status)

iii. Courses from other departments

There are several courses from other departments used in this major including Physics III and Mathematical Physics from the Chemistry and Physics Department, and Design and Analysis of Algorithms, and Theory of Computing from the Computer Science Department. Both departments have approved the major and stated that they can handle the additional students in their present courses. See the letters of consultation in the Appendix.

d. Compare and contrast the program with similar programs of high quality.

About 470 colleges and universities nationwide offer the bachelor of science degree in mathematics. Programs in New Jersey and nearby areas which have some similarity to our proposed program are at the University of Delaware, Villanova University, Rutgers, Saint Joseph's University and Temple University. Programs in North Jersey and out-of-state area require more travel time and the out-of-state and private school programs are much more expensive. Our program differs from these programs in cost, flexibility and location.

In our program, students will be provided with a total of 64 s.h. of math major courses. This is consistent with universities in the immediate area, i.e., Rutgers, Temple, Delaware, Villanova, and Drexel. Core courses will provide students with a solid foundational content in both pure and applied mathematics.

e. Administration

This program will be administered through the normal and already existent department organization. The department advisement coordinator will assign these majors to advisors. The chair and the advisement coordinator will talk to prospective majors and give them advice. There will be a new department committee to handle student applications to the program and to see to it that the students in the program are performing at the required academic level to stay in the program.

f. Program Evaluation

Evaluation and assessment of the program will be handled as for the BA program. Assessment of students will use the capstone Senior Seminar course. Evaluation will also be carried out in the program reviews. Included in this will be former-graduate surveys.

5. Results of Consultations

- a. There are no other departments on this campus offering programs or courses similar to ours.
- b. The following people were consulted:
 1. Don Stone, Chair, Computer Science Department
 2. Robert Newland, Chair, Chemistry and Physics Department and Eduardo Flores, Head of the Physics Section, Chemistry and Physics DepartmentAll three people listed above were strongly in favor of this new program.
3. Also included is the Memorandum of Agreement that was signed between the department and Dean Bartelt and Provost Matteson in which they agree to support the creation of a B.S. Degree program in the Mathematics Department. This agreement came out of our last Five Year Self Study and was signed in May of 1997.
- c. Copies of the Letters of Consultation are attached in the Appendix.

APPENDIX



Rowan College of New Jersey

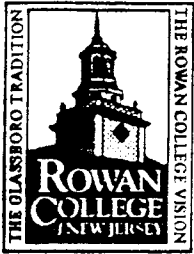
201 Mullica Hill Road
Glassboro, New Jersey 08028-1701 • (609) 256-4805

Computer Science Department

To: Bachelor of Science Degree Committee, Department of Mathematics
From: Don Stone, Chair, Computer Science Department *DCS*
Date: November 18, 1996
Re: Proposal for a Bachelor of Science degree in Mathematics

I have reviewed the proposal for a Bachelor of Science degree in Mathematics, and I think that the proposed curriculum is well-designed. It looks like this degree will be a good option for many mathematics students. The Computer Science courses included in this program should be able to accommodate some additional enrollment from B.S. mathematics students.

Your proposal has my strong support.



Rowan College of New Jersey
Glassboro, NJ 08028-1701

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

November 22, 1996

Dr. Khaled Amer
Department of Computer Science
Rowan College

Dear Dr. Amer,

I looked at your proposal for a BS in Mathematics and I found it very interesting. I think it is time for your department offer this program. I am aware of the excellent qualifications of the faculty in your department to teach courses leading to a BS in Mathematics. I am confident that you have all the ingredients at your disposal to make this program successful. The Physics Section fully support your proposal. We believe that we will be able to offer your students the physics courses that you include in your program.

I would like you to consider adding to the list of the restricted electives in Group A a course titled "Mathematical Physics" (1902.325) which is offered by our department every year. This course covers a series of topics in applied math such as Fourier Series, Vector Calculus, Special functions, partial differential equations, etc. with physics applications.

I wish you success with your proposal.

Sincerely,

Eduardo Flores

Dr. Eduardo Flores
Head of Physics Section

I am in agreement.
Robert J. Newland
Chair

Final Results !!

(82 questionnaires responded)

QUESTIONNAIRE

The Mathematics Department has formed a committee to implement a Bachelor of Science degree in mathematics if the need is there. The committee feels that the best way to find out is to survey our current majors.

To earn a B.S. degree, students would have to complete about 60 credit hours in mathematics and about 48 credit hours in general education. As a result, courses such as Modern Algebra II, Real Analysis II, Complex Analysis, and Topology would be required. Proofs are emphasized in all these courses.

It is the view of the committee that students with a B.S. degree will be better prepared for the GRE. Once enrolled in a graduate program, these students will not struggle as much as students with only a B.A. degree. Moreover, the B.S. degree will better serve the needs of students planning for careers other than school teaching. The actuarial field is a prime example.

Please answer the following questions:

- 1) If you could do it over, would you opt for a B.S. degree?
 Very Likely Likely Unlikely Very Unlikely
(29) (27) (19) (7)
- 2) Do you think that you will become a school teacher?
 Very Likely Likely Unlikely Very Unlikely
(43) (14) (11) (14)
- 3) Do you think that you will do graduate studies in the near future?
 Very Likely Likely Unlikely Very Unlikely
(26) (31) (18) (7)
- 4) Do you think that you will do graduate studies any time in the future?
 Very Likely Likely Unlikely Very Unlikely
(43) (31) (6) (2)

Agreement

The consultant suggested the development of joint undergraduate/graduate mathematics courses. Before following through on this suggestion, representatives of the department should meet with the graduate dean to see if this is an appropriate option.

Students

The consultant suggested and department agreed that the mathematics department should consider forming a branch of Pi Mu Epsilon, the mathematics honor society.

Agreement

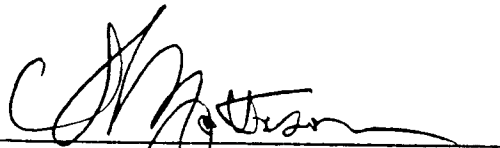
The department will work with the national Pi Mu Epsilon honor society to establish a chapter by FY99.

Library

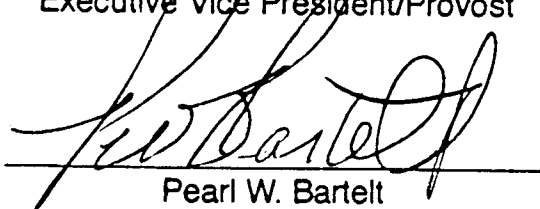
Both the consultant and the departmental response discuss the need for increased mathematics periodicals in the library.

Agreement

The department will work with the Periodical Librarian to identify additional journal subscriptions. \$4,000 will be provided in FY98, \$4,500 in FY99, and \$5,000 in FY00 and subsequent years, for these subscriptions.



Carol J. Matteson
Executive Vice President/Provost



Pearl W. Bartelt
Dean, School of Liberal Arts and Sciences



Gary Itzkowitz
Chairperson, Department of Mathematics