Glassboro State College Senate Curriculum Committee

Approval Form

174.115

Proposal Title: [illegible]

Sponsor(s) [illegible] Dept.: [illegible] Ext. [illegible]

[illegible]

Check one: ☐ Course ☐ Specialization ☐ Concentration ☐ Minor ☐ Achievement Certificate

☐ Certification Program ☐ Major Program ☐ Minor Change ______
(please name deletion or credit/title/catalog change)

☒ Undergraduate ☐ Graduate 3 Credit Hours

Step 1 (Department)	**Step 2 (Receipt)**	**Step 3 (School CC)**
☐ Approved 11/[illegible] (Date)	☐ SCC# 88-89-22	Reviewed 1/30/89
☐ Not Approved	Proposal Received 12/12/88 (Date)	☒ Approved
[signature] Dept CC Chairperson		☐ Not Approved
☐ Reviewed ______ Date		**Comments:**
Dept Chairperson	Brenda A. Boley SCC Chairperson	Ronald J. [signature] School Curr. Comm. Chairperson

Step 4 (Academic Dean)

☒ Recommend
☐ Not Recommend
☐ Conditionally Recommend (see comments)

Reviewed 2-6-89
Date

Comments: [illegible]

[signature]
Signature, Dean of School

Step 5 (SCC)

Open Hearing 3/16/89 (Date) ☒ Approved by Senate Curriculum Committee 3/16/89 (Date)

☐ Returned to sponsor(s) for the following reasons:

Consideration - Experiencing Math
Pass OK [initials]

Step 6 (Senate)

Presented to Senate 3/17/89 (Date) ☒ Approved ☐ Not Approved

Notification to Executive Vice-President/Provost 3/31/89 (Date)

Brenda A. Boley
Signature, SCC Chairperson

Step 7 (Executive V.P./Provost)

Received 4/3/89
Date

Approved ☐ Yes ☐ No

If no, reasons are as follows:

Student credit hours 3

Faculty load hours 3

Equalized credit hours 3

Official copy and approval sheet filed 4/...
Date

[signature]
Signature, Executive Vice-President/Provost

Registrar

Approved course description received ______
Date

Hegis Taxonomy and Course Number assigned 1701.115 Ree Kae 4/17/89

______
Signature, Registrar

______
Date

Notification forwarded:

☐ Senate Curriculum Committee Chairperson

☐ Department Chairperson(s)

☐ Academic Dean

☐ Registrar

☐ Sponsor(s)

COURSE PROPOSAL FOR CONTEMPORARY MATHEMATICS

1. DETAILS
   a. Course Title - Contemporary Mathematics
   b. Sponsors - Dr. Janet Caldwell, Dr. Ronald Czochor, Dr. Francis Masat, and Dr. Marcus Wright.
   c. Credit Hours - 3 semester hours
   d. Course Level - Undergraduate (Freshman)
   e. Curricular Effect - General Education (see also "g.")
   f. Prerequisites - The minimum <u>prerequisites</u> for "Contemporary Mathematics" are proficiency in basic skills algebra and basic skills reading.

A second course in algebra, such as Intermediate Algebra or an equivalent experience and proficiency in basic skills writing are <u>recommended</u> as background, but are not required.

g. Suggested time and scale of implementation - Two pilot sections will be scheduled for both Fall of 1989 and Spring of 1990. Full implementation will begin with Fall of 1990.

If the new general education proposal for a required mathematics core were to be instituted there would be the following scheduling effects. The Department staffs nine sections each of "Elementary Statistics" and "Experiencing Mathematics" during the fall and spring semesters, and two sections of each during the summer. Most of these 20 sections will be rescheduled as "Contemporary Mathematics" sections.

Additional new sections for students presently not taking any mathematics as a part of their General Education will also be scheduled. That is, based on a scan of recent class rosters, the students who are presently not enrolling in General Education mathematics courses are primarily majors in communications, fine and performing arts, and areas of the humanities. Since the number of these majors per year is approximately 300, and since the Department's faculty to student ratio is 1:30, 300/30 or 10 new sections per year, including the summer, will be scheduled. We plan to do this by scheduling two new sections during the summer and five new sections in each of the fall and spring semesters, i.e., 10 new sections in all.

The total number of sections per year of "Contemporary Mathematics" is, therefore, anticipated to be 30. Note that this figure allows for approximately 30 x 30 or 900 students per year.

h. Adequacy of the present staff, resources, and facilities - There is a sufficient number of adequately prepared professors in the Department to pilot and staff at least 22 of the required 30 sections.

Workshop sessions for prospective instructors have been proposed that will include use of the course video tapes, the integration of course topics, the use of calculators and computers in the classroom, and the resolution of any issues.

Foremost in the course is the integration of technology and mathematics. Video tapes, hand held calculators, and computer software are all integral to the course. Plans have been made for obtaining the necessary facilities, equipment, video supplies, and computer software.

2. RATIONALE

An understanding of mathematics is an important aspect of any well-rounded general education. Students develop basic mathematical skills as secondary students, extending these to a broader and deeper understanding of mathematical concepts and skills in their collegiate studies. A major goal of mathematical study in college is to improve students' abilities to apply the ideas of mathematics to new contexts.

For many college students, an understanding of specific mathematical content is a prerequisite to study in their major; more than half of all college majors nationwide require the study of mathematics. Calculus has been described as a critical filter or gateway to many careers. Quantitative and statistical methods have become increasingly important as computers are more widely used. The decision-making processes of government, business, and industry are influenced greatly by the collection, organization, and manipulation of very large and complex data sets. Thus not only is mathematics now considered the foundation of the sciences, it is also widely used throughout business, economics, and the social sciences.

In addition to the social utility of mathematics, there are three major reasons for studying mathematics. Perhaps the most relevant one is that the study of mathematics is essentially the study of problem solving. By studying mathematics, students improve their critical thinking and logical reasoning skills(Resnick, 1987). Students learn to understand and organize information, to work toward goals, to identify alternative paths, to assess progress toward a solution, to discuss ideas in an organized way, and to develop and evaluate arguments. Unfortunately, this aspect of mathematics often receives short shrift in high schools; recent results of the National Assessment of Educational Progress (Brown, et al., 1988) indicate that most high school graduates have some knowledge of basic algebraic and geometric concepts but are often not able to apply this knowledge in problem-solving situations.

Further, mathematics is often studied for its contributions to our culture. General education can, to some extent, be considered to be the history of great ideas. Some of the most far-reaching ideas have grown out of mathematics. Calculus, for example, is one of the great intellectual achievements of civilization; studying how things change in an organized way has opened the door for many subsequent developments in mathematics and science.

Finally, mathematics may be studied for its aesthetic qualities. The formal deductive systems of mathematics have a unique elegance and purity; the analysis of mathematical structures leads students to discover interdisciplinary commonalities that have previously been unsuspected.

In developing this course, we have reaffirmed several assumptions about mathematics and its teaching. These assumptions also reflect the best current thinking about the discipline (e.g., Garfunkel 1988; Steen 1988; Douglas 1986).

First, mathematics is best taught in a natural, applied context. In teaching in this context, mathematical concepts can be approached first intuitively and then more formally, leading students to develop critical thinking skills. This approach permits students to integrate the various topic areas within mathematics, making logical connections, for example, between algebra and geometry.

Second, a good mathematics education is one that provides opportunities for students to discover mathematical ideas. Students learn mathematics best when they are encouraged to create, to invent, and to participate. The availability of computer software makes this kind of learning a reality.

Third, facility in computation is not a prerequisite to the study of contemporary applications of mathematics. However, understanding of the concepts and principles of high school algebra and geometry is necessary for success.

Fourth, the use of calculators and computers enhances the study of mathematics. Thus students learn mathematics best when they use these tools regularly. Each student, therefore, will have or will have access to a hand-held calculator.

Fifth, the ability to express mathematical ideas orally and in writing is an important communication skill. Students will need to read and interpret text, to distinguish ideas, to identify critical vocabulary, and to support their ideas with reasons and evidence. Critical thinking involving both analysis and synthesis will be required.

Finally, mathematical topics once considered peripheral, such as algorithms, statistical analysis, and estimation, are now present in the mainstream mathematics curriculum. Many of these topics reflect the increasing importance of the area of mathematics described as "discrete mathematics." While calculus has historically been the end course in the fully educated individual's liberal education (Kenelly, 1986), it is important that the course provided here reflect the changing emphases in mathematics, including continuous topics (calculus and geometry), discrete topics, and statistics.

Based on the preceding rationale and assumptions, this course is designed to address four general goals.

First, the course aims to develop the problem solving and critical thinking skills of the students.

Second, it expands the students' understanding of and appreciation for contemporary mathematics and its uses.

Third, the course helps students to understand both continuous and discrete applications of mathematics, highlighting some of the more recent developments in mathematics.

Finally, the course aims to improve students' mathematical and computer skills, particularly through the use of computational and computer-related algorithms.

3. ESSENCE OF THE COURSE

a. Objectives of the course - After completing each section, students will be able to:

I. Statistics.

1. Define sampling bias and describe methods for its control.
2. Explain the following:
   a. the benefits of experimental design.
   b. the relationship between discrete and continuous probability distributions.
   c. the Central Limit Theorem and its application in confidence interval estimation.
   d. the difference between descriptive and inferential statistics.
3. Apply graphical and numerical methods for describing data.
4. Use both a statistical computer package and a calculator.
5. Trace the logical flow of an elementary computer program.
6. Distinguish between writing a computer program and using a software package.
7. Define probability.
8. Compute expected values, as in simple games of chance.

II. Discrete Mathematical Models.

1. Define and give examples of a graph and its components, trees and their derivatives, Euler and Hamiltonian circuits, algorithm, and mathematical model.
2. Discuss the value of graphs in discovering optimal solutions to problems.
3. Given an graph, find an Euler or Hamiltonian circuit.
4. Describe why algorithms that do not guarantee an optimal solution are needed.

III. The Real Numbers and Topics in Continuous Mathematics.

1. Define, discuss, and give examples of axioms and fair division problems.
2. Distinguish between discrete and continuous mathematics, giving examples of each.
3. Analyze a fair division problem.
4. Discuss and give examples of the following terms: natural numbers, integers, rational numbers, and irrational numbers; decimal representation; terminating and non-terminating decimals; rounding.
5. Define and discuss prime numbers, the Goldbach conjecture, the greatest common divisor, the least common multiple and the division algorithm.
6. Use a calculator to compute with integers, fractions, decimals and percents.

7. Define, discuss, and give examples of the following terms: an "impossibility" theorem, apportionment, and outcomes - both desirable and undesirable.
8. Generate the solution to an apportionment problem.
9. Explain the advantages and disadvantages of a given apportionment method as it applies to a given situation.

IV. Geometry.

1. Define the four types of isometries of the plane.
2. Classify a one-dimensional pattern according to which isometries of the plane carry it into itself.
3. Define what is meant by a tiling of the plane.
4. Classify a tiling of the plane(or two-dimensional artistic pattern) as regular, periodic, or nonperiodic.
5. Describe what is meant by a Penrose tiling and explain the significance of five-fold symmetry in Penrose. tilings for the theory of crystals.
6. Compute the areas of parallelograms, triangles, and circles and volumes of prisms, pyramids, and spheres.
7. Determine the factors by which areas and volumes of common geometric figures change when their dimensions are changed.
8. Determine whether two geometric figures are similar.
9. Define conic section.
10. Give real life examples of ellipses, parabolas, and hyperbolas.
11. Do computational problems based on tables of data and analyze the significance of the results (e.g., determine whether astronomical data is consistent with Kepler's area law).
12. Define what is meant by a Euclidean or a non-Euclidean geometry and describe models and basic features of each.

b. Topical Outline - The objectives are specific and reflect the exact content.

c. Evaluation and grading procedure of students - Students will be evaluated with the aid of objective and essay examinations, written assignments, and class participation.

d. Course Evaluation - Student evaluations and department curriculum review will be used.

4. CONSULTATIONS

a. Parties consulted:

Members of the Mathematics and Computer Science Department
Members of the General Education Task Force
Dr. Tom Gallia, Assistant to the Dean of Education and Related Professional Studies
Mr. Dan Davis, MIS, School of Business Administration

5. ADDITIONAL INFORMATION

PLACEMENT

In general, there is no placement process, per se, relative to "Contemporary Mathematics". That is, any student who has met the prerequisites may enroll in "Contemporary Mathematics".

WAIVERS

Due to the general and post-secondary nature of the course, a waiver based on secondary level work is not recommended at this time.

The Department retains its present policy and procedures for granting waivers. The sponsors believe that it is likely that the Department will consider waivers for thosestudents successfully completing coursework in calculus, statistics, and discrete mathematics.

BIBLIOGRAPHY

Brown, Catherine A., Carpenter, Thomas P., Koulte, Vicky L., Lindquist, Mary M., Silver, Edward A., and Swafford, Jane O. "Secondary School Results for the Fourth NAEP Mathematics Assessment: Algebra, Geometry, Mathematical Methods, and Attitudes." The Mathematics Teacher, Vol. 81, No. 5, May 1988, pp. 337-347.

Douglas, R.G. (Ed.) Toward a Lean and lively Calculus. Mathematics Association of America, Washington D.C., 1986.

Kenelly, John W. "Calculus as a General Education Requirement," in Toward a Lean and Lively Calculus (R.G. Douglas, Ed.). Mathematical Association of America, Washington, D.C, 1988.

Resnick, Lauren B. Education and Learning to Think. Washington, D.C.: National Research Council, 1987.

Steen, Lynn "Celebrating Mathematics," The American Mathematical Monthly, 95 (5), May 1988, pp. 414 - 427.

COMAP, Garfunkel, Solomon (Director) and Steen, Lynn (Ed.) Contemporary Mathematics: For All Practical Purposes. Freeman, 1988.

CATALOG DESCRIPTION.

1701.115
Contemporary Mathematics
(Prerequisities: Basic Skills Algebra and Basic Skills Reading)

This course is designed to develop an appreciation of what mathematics is and and how it is used today. Topics covered include: statistics and probability; graphs, trees and algorithms; geometrical perspectives, the real numbers, elementary number theory and applications.