

OFFICE OF THE PROVOST
PROCESS A
 FEB - 7 2005

NON-GENERAL EDUCATION - CURRICULUM PROPOSAL
 BINARY RESPONSE FORM (BOL-RED)

SCC #04-05- JH

Deadlines

Proposals due October 8, 2004 to be implemented Fall 2005 - February 11, 2005 to be implemented Spring 2006

PROPOSAL TITLE: Mathematical Modeling and Algebraic Reasoning

Sponsor(s): Janet Caldwell E-Mail: caldwell@rowan.edu Ext: 4827

DEPARTMENT: Math

COLLEGE: CLAS

If Liberal Arts & Sciences CHECK: History/Humanities Math/Sciences Social/Behavioral Sciences
 UNDERGRADUATE GRADUATE

THE ATTACHED NON-GEN-ED PROPOSAL IS BEST DESCRIBED BY THE ITEM(S) CHECKED

- New non-gen-ed course
- Short-term non-gen-ed course
- Minor curricular changes (fewer than three)
- Existing non-gen-ed course
- Non-gen-ed degree requirements
- Major
- Minor, specialization, concentration track, certificate program

THE FOLLOWING SIGNATURES REPRESENT APPROVAL

Department Chair: Bernad J. Goshen Date: 10/6/04
 Department Curriculum Chair: Abigail Hansen Date: 10/6/04
 Academic Dean: Joy Harp Date: 12-2-04

COLLEGE CURRICULUM COMMITTEE

OPEN HEARING Date: 19 Nov 2004 Approved: Not Approved:
 COLLEGE CURRICULUM CHAIR: [Signature]
 Senate Curriculum Chair Signature: [Signature] Date: 12/20/04
 Comments: _____

EXECUTIVE VICE PRESIDENT/PROVOST Signature: [Signature] Date: 2/15/05

Approved Not Approved

Date: 3/2/05 REGISTRAR Course Description Revised & Approved - Reg's Taxonomy & Course #: 1703510

Registrar Signature: [Signature]

NOTIFICATION FORWARD

- SCC Chair
- Academic Dean
- Department Chair
- Registrar
- IR
- OAP
- VP Student Affairs
- Others

Tm 3/24/05
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New Course Proposal

1. Details

- A. Title: Mathematical Modeling and Algebraic Reasoning
- B. Sponsor: Dr. Janet Caldwell, Department of Mathematics
- C. Credit Hours: 3
- D. Course Level: Graduate
- E. Prerequisites: Undergraduate degree in elementary education or elementary teaching certificate
- F. Suggested Time, Implementation: One section of the course to be offered once every summer
- G. Curricular Effect: Required in the COGS in middle grades mathematics education
- H. Adequacy: Present staff is adequate. Cost incurred would be limited to faculty summer pay for 3 sh
- I. Resources: Faculty, computer equipment, and mathematics department resources are adequate. Ten years of NJ SSI and the current MSP grant have collected a more than adequate library of materials.

2. Rationale:

a) With the completion and implementation of the NJ Mathematics Curriculum Frameworks (1996) across the state, the mathematical content knowledge of in-service teachers needs to be upgraded. There is content in the Standards (e.g: mathematical modeling) that many teachers did not learn as undergraduates, especially if they took only the minimum number of mathematics courses required for elementary certification. This course will provide the opportunity for teachers to update their mathematical content knowledge, preparing their students to pass the mathematics sections of the new state tests.

b) There is no current similar mathematics course at Rowan University that addresses the critical need that middle grades mathematics teachers have with respect to updating their content knowledge and the relationship between school mathematics and higher mathematics. Since algebra serves as the gatekeeper for higher-level mathematics and is more often being taught in the middle grades, it is important for middle grades mathematics teachers to have a particularly strong background in this area.

c) Similar courses exist at Salisbury State University, Wright State University, William Paterson, and Western Michigan University.

3. Essence of the Course and Outline:

The objective of this course is to develop a deeper understanding of mathematical modeling and a new appreciation of the beauty, logical structure, and applicability of

algebra. The course will take into account not only the many interconnections among school mathematics topics but also their relationship to higher mathematics.

The mathematical content for this course is an area of mathematics that is of great benefit to all those in middle grades mathematics teachers but is rarely seen by them.

Specifically, content includes:

- I. Mathematical Modeling
 - a. The modeling process
 - b. Linear models
 - c. Quadratic models
 - d. Exponential and logarithmic models
 - e. Trigonometric models
 - f. Polynomial models
 - g. Logistic models
- II. Algebraic reasoning
 - a. Variables and patterns
 - b. Functions - historical evolution, problem analysis, properties, limiting behavior, fitting data
 - c. Matrix modeling
 - d. Equations – isomorphism, algebraic structure
 - e. Number system structures - modular arithmetic, integer congruence, number fields

The above content will be examined with the following in mind:

- analyses of alternative definition, language, and algorithms for mathematical ideas and concepts
- why concepts arose and how they change over time
- a wide range of applications
- calculator and computer technology approaches to problems
- analyses of common middle grades math problems from a deeper mathematical level
- how problems and proofs can be extended and generalized
- how ideas studied in school mathematics relate to ideas studied later in mathematics

Resources:

Beaumont & Pierce (1963). *The Algebraic Foundations of Mathematics*. Addison-Wesley.

House & Coxford (eds). (1995). *Connecting Mathematics across the Curriculum, 1995 Yearbook of the NCTM*. NCTM.

Ifah, Georges (2000). *The Universal History of Numbers*. Wiley.

- Nelson, Roger (2000). *Proofs Without Words II: More Exercises in Visual Thinking*. MAA.
- Peressini, A. & Sherbert D. (1971). *Topics in Modern Mathematics for Teachers*. Holt, Rinehart & Winston.
- Polya, George (1954). *Induction and Analogy in Mathematics*. Volume I and II. Wiley.
- Ribenboim, Paulo (2000). *My Numbers, My Friends*. Springer-Verlag.
- Silvester, J. (2001). *Geometry: Ancient and Modern*. Oxford University Press.
- Usiskin, Peressini, Marchisotto, & Stanley (2003). *Mathematics for High School Teachers*. Pearson Education.

Evaluation & Grading:

Students will be evaluated through written homework and exams, including open-ended questions. Moreover, students will have written projects involving hands-on activities and requiring the development and testing of mathematical models.

Course evaluation:

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

4. Consultations: (pending) *Presented w/ 06-05-802*

- Dr. Carol Sharp, Dean of College of Education
- Dr. Jay Kuder, Dean of Graduate School
- Dr. Holly Willett, Department of Secondary Education
- Dr. Robin McBee, Department of Elementary Education

Catalog Description: Mathematical Modeling & Algebraic Reasoning

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Students in this course will learn about polynomial, rational, and exponential functions by building and analyzing mathematical models for a variety of situations. Using algebraic representations, problem solving, using technology, connecting abstract algebra with middle grades mathematics, and fluency with algebraic procedures will be stressed.

DB
4/15/05