Curriculum Proposal Cover Sheet - University-Wide Undergraduate Curriculum Committee

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Proposing Department/Unit Mathematics	Phone 7-2741

Check all appropriate lines and complete all information. Use a separate cover sheet for each course proposal and/or program proposal.

1. Course Proposals (check all that apply)

☐ New Course   ☐ Course Prefix Change   ☐ Course Deletion

☑ Course Revision   ☐ Course Number and/or Title Change   ☐ Catalog Description Change

Current course prefix, number and full title: MATH 340: Principles of Secondary School Mathematics

Proposed course prefix, number and full title, if changing:

2. Liberal Studies Course Designations, as appropriate
This course is also proposed as a Liberal Studies Course (please mark the appropriate categories below)

☐ Learning Skills   ☐ Knowledge Area   ☐ Global and Multicultural Awareness   ☐ Writing Across the Curriculum (W Course)

☐ Liberal Studies Elective (please mark the designation(s) that applies – must meet at least one)

     ☐ Global Citizenship   ☐ Information Literacy   ☐ Oral Communication

     ☐ Quantitative Reasoning   ☐ Scientific Literacy   ☐ Technological Literacy

3. Other Designations, as appropriate

☐ Honors College Course   ☐ Other: (e.g. Women's Studies, Pan African)

4. Program Proposals

☐ Catalog Description Change   ☐ Program Revision   ☐ Program Title Change   ☐ New Track

☐ New Degree Program   ☐ New Minor Program   ☐ Liberal Studies Requirement Changes   ☐ Other

Current program name: _____

Proposed program name, if changing: _____

5. Approvals

	Signature	Date
Department Curriculum Committee Chair(s)	_Jan M Walk_	3-12-12
Department Chairperson(s)	_[signature]_	3/26/12
College Curriculum Committee Chair	_Anne Kondo_	4/3/12
College Dean	_Dean_	4/4/12
Director of Liberal Studies (as needed)		
Director of Honors College (as needed)		
Provost (as needed)		
Additional signature (with title) as appropriate	_Edel Reilly TECC Chair_	4/19/12
UWUCC Co-Chairs	_Gail Sechrist_	4/25/12

Part II. Description of the Curriculum Change

1. New syllabus of record, including catalog description with course title, number of credits, class and lab hour designation, prerequisites, an appropriately written course description, and an updated bibliography.

I. Catalog Description

MATH 340 Principles of Secondary School Mathematics   **3c-0l-3cr**

Prerequisite: MATH 271

Provides students with mathematics content and mathematical thinking they will need to teach in secondary schools, as well as to connect the content learned in college mathematics courses with the secondary curriculum. Open to secondary mathematics education majors only.

II. Course Objectives

Students will be able to:
1. Experience mathematics as a process: that of conjecturing, problem solving and posing, forming generalizations, finding multiple representations or solutions to mathematical ideas and problems, seeking connections within and outside of mathematics, and communicating mathematical ideas.

2. Become proficient with mathematics content that they need to teach in secondary schools, such as functions, complex numbers, theory of equations, and discrete mathematics.

3. Make connections of some higher-level mathematics topics to secondary school mathematics topics.

Danielson Model	INTASC Standards	NCATE/NCTM Program Objectives	Course Objectives	Course Assessment
1a	1.11, 1.13	1.1, 1.2, 1.3, 1.4, 3.1, 3.2, 3.4, 4.1, 4.2, 4.3, 5.1, 8.8	1	**Final Exam** Quiz
1a	1.11, 1.13	10.1, 10.4, 13.1, 13.2, 13.3	2	**Final Exam** **Project**
1a	1.11	4.1, 4.3	3	**Final Exam** Quiz

III. Course Outline

A. Structure of the Real Numbers   6 hours
   1. Subsets of the Real Numbers
   2. Decimal Representation of the Real Numbers
   3. Periods of Periodic Decimals

B. Functions   12 hours
   1. Transformations and Families of Functions
         a. Polynomial Functions
         b. Trigonometric Functions
         c. Exponential and Logarithmic Functions
   2. Applications of Functions
   3. Sequences as Functions
   4. Recursive and Explicit Representations of Sequence Formulas
   5. Matrices in Relation to Recursive Representations
   6. Problem Solving Related to Sequences and Functions
   7. Curve Fitting and Data Exploration

Test #1   1 hour

C. Complex Numbers   7 hours
   1. Complex Arithmetic
   2. Complex Number Representations
   3. Roots of Unity, Roots of Complex Numbers

D. Equations and Inequalities   4 hours
   1. Groups, Rings, Fields and Relationship to Solving Equations
   2. Applying Functions to both sides of an equation/inequality

Test #2   1 hour

E. Theory of Polynomial Equations   6 hours
   1. Solutions of Polynomial Equations with Real Coefficients
   2. Descartes' Rule of Signs, Factor Theorem, Fundamental Theorem of Algebra
   3. Relationship of Coefficients to Roots
   4. Factoring and Irreducibility

F. Finite Differences and Discrete Mathematics Topics   5 hours
   1. Polynomial Differences
   2. Generalized Binomial Coefficients
   3. Newton's Difference Formula
   5. Lagrange Interpolation and Curve Fitting

Final exam given during final exam week.   2 hours

IV. Evaluation Methods

Students will present projects, problems, and applications to the class. They will submit written work explaining mathematical ideas, proofs, or solutions including relating some work to the secondary classroom. Grades will be based on quizzes, assignments, projects, class participation, class presentations, two tests, and a comprehensive final exam.

The final grade will be determined as follows:

Class assignments and participation	10%
Presentations and **Project**	20%
Quizzes	20%
Writing Assignments (proofs, problem solutions)	20%
Tests/**Final Exam**	30%

Grading Scale: A: 90-100%; B: 80-89%; C: 70-79%; D: 60-69%; F: below 60%

V. Attendance Policy:

Students are expected to attend class. The attendance policy will be defined by the instructor according to the University Course Attendance Policy in the IUP undergraduate catalog.

VI. Required Textbooks, Supplemental Books and Readings

There is no required textbook.

VII. Special Resources or Requirements

Students are required to have a TI-83, TI-84, TI-89, TI Voyage 200, or TI NSpire CAS graphing calculator.

VIII. Bibliography

Bremigan, Elizabeth, Ralph Bremigan, and John Lorch (2011). *Mathematics for Secondary School Teachers*. Washington, DC: Mathematical Association of America

Common Core State Standards Initiative (CCSSI). 2010. *Common Core State Standards for Mathematics*. National Governors Association Center for Best Practices and the Council of Chief State School Officiers. http//www.corestandards.org.

Connally, Eric, et al (2011). *Functions Modeling Change: A Preparation for Calculus*. New York: John Wiley and Sons.

Consortium for Mathematics and Its Applications – COMAP (1997). *Principles and Practice of Mathematics*. New York : Springer-Verlag.

Washington, Allyn J. (2000). *Basic Technical Mathematics*. Boston: Addison Wesley.

2. Summary of the proposed revisions: The Course Outline, Special Resources or Requirements, and the Bibliography are the sections that have changed in this syllabus. The matrix with standards and key assessments has also been added.

In the course outline, we took out Section A: Methods of Mathematical Reasoning, Section C: Matrices, Section E. Probability, and Section F: Analytic Geometry and replaced them with more relevant content. All of these sections are taught in other courses. Section A is taught in MATH 271: Introduction to Proofs I, Section C is taught in MATH 171: Linear Algebra, Section E is taught in MATH 430: Seminar in Teaching Secondary Mathematics, and Section F is taught in MATH 355: Foundations of Geometry. The content that replaced these sections includes Structure of the Real Numbers, Complex Numbers, Equations and Inequalities, and Finite Differences and Discrete Mathematics Topics.

In the Special Resources or Requirements section, we allow students to choose from a variety of graphing calculators.

We updated the Bibliography section.

3. Justification/rationale for the revision: This course was designed and first implemented in Fall 2005. At that time, it was designed to solidify future teacher's knowledge of secondary mathematical concepts. It still serves this purpose, but with program evaluations of students' content knowledge, the National Council of Teachers of Mathematics' (NCTM) program standards, and the actual content that was being taught in the course, it became clear that we needed to update the syllabus of the course.

Furthermore, The IUP Secondary Mathematics Education program passed the last National Council for Accreditation of Teacher Education (NCATE) review unconditionally, however there was a noted weakness in the area of Discrete Mathematics. This revision is in response to the absence of Discrete Mathematics in the program.

Thus, we have reorganized content in the course and added several important topics, including those stated above.

4. Old syllabus of record

I. Catalog Description

MATH 340: Principles of Secondary School Mathematics

3 class hours
0 lab hours

Prerequisite: MATH 271

3 credit hours
(3c-0l-3cr)

This course is designed to provide students with mathematics content and mathematical thinking they will need to teach in secondary schools, as well as to connect the content learned in college mathematics courses with the secondary curriculum. Open to secondary mathematics education majors only.

II. Course Objectives

Students will be able to:

4. Experience mathematics as a process: that of conjecturing, problem solving and posing, forming generalizations, finding multiple representations or solutions to mathematical ideas and problems, seeking connections within and outside of mathematics, and communicating mathematical ideas.

5. Become proficient with mathematics content that they need to teach in secondary schools, such as complex numbers, theory of equations, combinatorics, and probability.

6. Make connections of some higher-level mathematics topics to secondary school mathematics topics.

III. Course Outline

A. Methods of Mathematical Reasoning
   1. Venn Diagrams
   2. Conditional Statements
   3. Negations of Quantified Statements
   4. Deductive vs. Inductive Reasoning

B. Functions
   1. Transformations and Families of Functions
   2. Applications of Functions
   3. Sequences as Functions
   4. Recursive and Explicit Representations of Functions and Sequences
   5. Problem Solving Related to Sequences and Functions
   6. Mathematical Induction

C. Matrices
   1. Relationship to Systems of Equations
   2. Relationship to Linear programming
   3. Properties of Matrices

D. Theory of Equations
  1. Solutions of Polynomial Equations with Real Coefficients
  2. Complex Number Solutions
  3. Descartes' Rule of Signs, Factor Theorem, Fundamental Theorem of Algebra
  4. DeMoivre's Theorem
  5. Lagrange Polynomials and Curve Fitting
  6. Complex Number Representations

F. Probability
  1. Counting principles
  2. Theoretical Probability
  3. Experimental Probability

G. Analytic Geometry
  1. Conic Sections
  2. Applications and Problem Solving Related to Conic Sections
  3. Transformations on Conic Sections

IV. Evaluation Methods

Students will present projects, problems, and applications to the class. They will submit written work explaining mathematical ideas, proofs, or solutions.

Grades will be based on quizzes, assignments, projects, class participation, class presentations, a midterm exam, and a comprehensive final exam.

The final grade will be determined as follows:

Class assignments and participation	10%
Presentations	20%
Quizzes	20%
Writing Assignments (proofs, problem solutions)	20%
Midterm/Final Exams	30%

Grading Scale: A: 90-100%; B: 80-89%; C: 70-79%; D: 60-69%; F: below 60%

V. Attendance Policy

Students are expected to attend class. The attendance policy will be defined by the instructor according to the University Course Attendance Policy.

VI. Required Textbooks, Supplemental Books and Readings

There is no required textbook.

VII. Special Resources or Requirements

Students are required to have a TI-83+ graphing calculator.

VIII. Bibliography

Connally, Eric, et al (1999). *Functions Modeling Change: A Preparation for Calculus*. New York: John Wiley and Sons.

Consortium for Mathematics and Its Applications – COMAP (1997). *Principles and Practice of Mathematics*. New York : Springer-Verlag.

Dossey, Giordano, McCrone, Weir, COMAP (2002). *Mathematics Methods and Modeling for Today's Mathematics Classroom*. Pacific Grove, CA: Brooks/Cole.

Even, Ruhama (1993). "Subject-Matter Knowledge and Pedagogical Content Knowledge: Prospective Secondary Teachers and the Function Concept," *Journal for Research in Mathematics Education*, Vol. 24, No. 2, March 1993, p. 94.

Foerster, Paul A. (1998). *Algebra and Trigonometry: Functions and Applications*. Boston: Addison-Wesley.

Herr, Ted and Ken Johnson (1994). *Problem Solving Strategies: Crossing the River with Dogs*. Emeryville, CA: Key Curriculum Press.

Kenney, Margaret J. and Stanley J Bezuska (1993). "Implementing the Discrete Mathematics Standards: Focusing on Recursion," *Mathematics Teacher*, Vol. 86, No. 8, November 1993, p. 676.

Mason, John, with L. Burton and K. Stacey (revised edition) (1985) . *Thinking Mathematically*. Boston: Addison-Wesley.

Mathematical Sciences Education Board (National Research Council) (1998) . *High School Mathematics at Work*. Washington, DC: National Academy Press.

National Council of Teachers of Mathematics (2000). *Principles and Standards for School Mathematics*. Reston, VA: NCTM.

Nelsen, Roger B. (1993). *Proofs Without Words: Exercises in Visual Thinking*. Washington, DC: Mathematical Association of America (MAA).

Nelsen, Roger B. (2000). *Proofs Without Words II: More Exercises in Visual Thinking*. Washington, DC: MAA.

Sobel, Max A.; and Evan M. Maletsky (1988). *Teaching Mathematics: A Sourcebook of Aids, Activities, and Strategies*. Englewood Cliffs, NJ: Prentice Hall.

Washington, Allyn J. (2000). *Basic Technical Mathematics*. Boston: Addison Wesley.

Part III. **Letters of Support or Acknowledgment**

No other programs or departments are affected by these changes.

Part II. Description of Curriculum Change

Current Program		Proposed Program	
Program/Track: Associate of Arts – General Studies		Program/Track: Associate of Arts – General Studies	
Liberal Studies: As outlined in Liberal Studies section with the following specifications: Fine Arts 3cr Health and Wellness/ROTC 3cr Humanities 9cr Learning Skills 10cr Natural Science 7cr Social Science 9cr Controlled Liberal Studies Electives 9cr	50	Liberal Studies: As outlined in Liberal Studies section with the following specifications: Fine Arts 3cr Dimensions of Wellness/ROTC 3cr Humanities 9cr Learning Skills 9cr Natural Science: Option II 7cr Social Science 9cr Controlled Liberal Studies Electives 9cr	49
College:		College:	
Major:		Major:	
Minor:		Minor:	
Other Requirements:		Other Requirements:	
Free Electives:	10	Free Electives:	11
Total Degree Requirements:	60	Total Degree Requirements:	60