LSC Use Only No:	LSC Action-Date:	UWUCC USE Only No.	UWUCC Action-Date:	Senate Action Date:
		09-24C	AP-10/20/09	App-12/1/09

Curriculum Proposal Cover Sheet - University-Wide Undergraduate Curriculum Committee

Contact Person	Email Address
John D. Baker	jdbaker@iup.edu
Proposing Department/Unit	**Phone**
Mathematics	724-357-3795

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

1. Course Proposals (check all that apply)

_____New Course _____Course Prefix Change _____Course Deletion

__X__Course Revision __X__Course Number and/or Title Change __X__Catalog Description Change

MATH 457 Number Theory for Elementary and Middle School Teachers	MATH 457 Number Theory for Elementary/Middle Level Teachers
***Current* Course prefix, number and full title**	***Proposed* course prefix, number and full title, if changing**

2. Additional Course Designations: check if appropriate

_____ This course is also proposed as a Liberal Studies Course.

_____ This course is also proposed as an Honors College Course.

_____ Other: (e.g., Women's Studies, Pan-African)

3. Program Proposals

_____Catalog Description Change _____Program Revision

_____New Degree Program _____Program Title Change _____Other

_____New Minor Program _____New Track

***Current* program name**	***Proposed* program name, if changing**

4. Approvals		**Date**
Department Curriculum Committee Chair(s)		3.9.9
Department Chair(s)		3-9-09
College Curriculum Committee Chair		03/16/09
College Dean		3-16-09
Director of Liberal Studies *		
Director of Honors College *		
Provost *		
Additional signatures as appropriate: (include title)	Joseph Domaracki TECC	07.06.09
	Mary Ann Rafoth	7.29.09
UWUCC Co-Chairs	Gail Sechrist	10-23-09

* where applicable

Received
OCT 23 2009
Liberal Studies

Received
SEP 01 2009
Liberal Studies

1. New Syllabus of Record, etc.

I. Catalog Description

MATH 457 Number Theory for Elementary/Middle Level Teachers (3c-0l-3cr)
Prerequisite: MATH 152

Introduction to topics of elementary number theory including divisibility, prime numbers, factorization, binary numbers, modular arithmetic, identification codes, cryptography, Diophantine equations, Euclidean algorithm, and alternative algorithms. Explores curricular materials, resources, and activities relevant to teaching number theory at the Elementary/Middle Level.

II. Course Outcomes

Students will:

1. acquire skills related to the number theory topics of divisibility, primes, and factorization. PDE Guidelines: II.B.1, II.B.2.a, II.B.2.d, II.B.6
2. recognize, describe, analyze, and extend properties about divisibility, prime numbers, and factorization. PDE Guidelines: II.B.1, II.B.2.a, II.B.2.d, II.B.6
3. define, examine, and apply the concepts of modular arithmetic. PDE Guidelines: II.B.1, II.B.2.a, II.B.2.d, II.B.6
4. examine multiple representations for modular arithmetic concepts. PDE Guidelines: II.B.1, II.B.2.a, II.B.2.d, II.B.6
5. investigate special uses and applications of mathematical content related to the course, utilizing appropriate technology. PDE Guidelines: II.B.1, II.B.2.a, II.B.2.d, II.B.6
6. examine the role of number theory topics for the Elementary/Middle Level curriculum. PDE Guidelines: I.E.5, I.E.6, I.E.10

Course Outcomes	College Conceptual Framework / Danielson	INTASC Standard/ Principle	NCATE / NCTM Middle Level Mathematics Standards	Course Assessment Measuring Outcome
#1	1	1	1, 2, 3, 4, 5, 9, 10	**Key Assessment: Final Exam**
#2	1	1	1, 2, 3, 4, 5, 7, 9, 10	Projects, Quizzes, Activities Midterm &Final Exam
#3	1	1	1, 2, 3, 4, 5, 9, 10	Projects, Quizzes, Activities Midterm &Final Exam
#4	1	1	3, 4, 5, 9, 10	Projects, Quizzes, Activities Midterm &Final Exam
#5	1	1	4, 6, 7, 8	Projects, Quizzes, Activities Midterm &Final Exam
#6	1	1	4, 7, 8	Projects, Quizzes, Activities Midterm &Final Exam

III. Detailed Course Outline

A. Divisibility *(Outcome #1, #2)* 3 academic hours
   1. LCM / GCF
   2. Euclidean algorithm
   3. Combinations and Diophantine equations

B. Primes and Relatively Prime *(Outcome #1, #2)* 5 academic hours
   1. Primes and prime factorization
   2. Sieve of Eratosthenes / Euler Phi Function
   3. Infinitude of primes
   4. Twin primes, Goldbach Conjecture, Great Internet Mersenne Prime Search

C. Modular Arithmetic *(Outcome #3, 4)* 6 academic hours
   1. Operations
   2. Congruence
   3. Inverses

D. Powers and Roots, Arithmetic Mod n *(Outcome #3)* 4 academic hours
   1. Fermat's Theorem (for n prime)
   2. Euler's Theorem (for any n)

E. Cryptography *(Outcome #3, 4, 5)* 5 academic hours
   1. Introduction
   2. Public Key (RSA)

F. Divisibility Tests *(Outcome #3, 4, 5, 6)* 6 academic hours
   1. Relationship to base ten
   2. Extending tests to find remainders

G. Special Topics and Applications *(Outcome #3, 4, 5, 6)* 6 academic hours
   1. Alternative algorithms
   2. Fibonacci sequence
   3. Binary numbers
   4. Identification codes

H. Role of Number Theory in School Curriculum *(Outcome #6)* 4 academic hours
   1. Topics for curricular enrichment
   2. Topics with a new perspective

This syllabus covers 39 academic hours, leaving 3 academic hours for testing and/or review. The final is an additional 2 academic hours.

IV. Evaluation Methods

Class work / assignments	30%
Presentations / projects / portfolios	40%
Midterm	15%
Final (***Key Assessments***)	15%

The Final is the Key Assessment and shall be required of all instructors.

V. Grading Scale

A: 90% - 100%
B: 80% - 89%
C: 70% - 79%
D: 60% - 69%
F: 0% - 59%

VI. Undergraduate-Course Attendance Policy

Attendance policy will conform to university guidelines.

VII. Required Textbook

Gross, B., and Harris, J. (2004). *The Magic of Numbers*. Upper Saddle River, NJ: Pearson Prentice Hall.

VIII. Special Resource Requirements

None.

IX. Bibliography

Brown, S. I. (1978). *Some Prime Comparisons*. Reston, VA: National Council of Teachers of Mathematics

COMAP (7^{th} ed., 2006). *For All Practical Purposes*. New York, NY: W. H. Freeman and Company.

Jacobs, H. R. (1994). *Mathematics: A Human Endeavor*. New York, NY: W. H. Freeman and Company.

Flannery, Sarah; with David Flannery (2001). *In Code: A Mathematical Journey*. New York, NY: Workman.

Marshall, D., Odell, E., and Starbird, M. (2007). *Number Theory Through Inquiry*. Washington, DC: Mathematical Association of America.

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

National Council of Teachers of Mathematics (1993). *Assessment Standards for School Mathematics*. Reston, VA: NCTM.

National Council of Teachers of Mathematics (1991). *Professional Standards for Teaching Mathematics*. Reston, VA: NCTM.

National Council of Teachers of Mathematics (1989). *Curriculum and Evaluation Standards for School Mathematics*. Reston, VA: NCTM.

Speiser, R., and Walter, C. (2000). *Five Women Build A Number System*. Stamford, CT: Ablex Publishing.

Wells, D. (2005). *Prime Numbers*. Hoboken, NJ: John Wiley and Sons.

2. Summary of the Revision

We propose to change the name and prerequisite for the course, and establish a current syllabus of record. We have no syllabus of record on file.

Current – MATH 457 Number Theory for Elementary and Middle School Teachers 3c-0l-3cr

Prerequisites: MATH 152, Elementary Education concentrate.

An introduction to topics of elementary number theory including divisibility, prime numbers, factorization, modular arithmetic, problem solving, and place of number theory in the elementary school curriculum. Examines many number theory activities which can help to strengthen skills with basic facts in an interesting, nonroutine setting.

Proposed – MATH 457 Number Theory for Elementary/Middle Level Teachers 3c-0l-3cr

Prerequisites: MATH 152

Introduction to topics of elementary number theory including divisibility, prime numbers, factorization, binary numbers, modular arithmetic, identification codes, cryptography, Diophantine equations, Euclidean algorithm, and alternative algorithms. Students will explore and discuss curricular materials, resources, and activities relevant to teaching number theory to elementary / middle level students.

3. Rationale for the Revision

Overview

The state of Pennsylvania has mandated changes to teacher training programs to support its new teacher licensing scheme. The current program for elementary grades K-6 is being replaced by new requirements for two training programs in: (1) Grades pre-K to 4 and (2) Grades 4-8.

These mandates from the state require revisions to existing courses and the addition of new courses. For Grades pre-K to 4, the new IUP teacher training program includes two courses in methods of teaching. The two new methods courses are revisions of existing methods courses for early childhood and elementary education.

For Grades 4 to 8, the new IUP teacher training program must provide coursework for prospective teachers to teach all subjects, but with a specialty in one subject area. The new program has four subject area tracks with mathematics being one track. The Mathematics Department, which supports the current K-6 program through a math concentrate for elementary education majors, will have a greater role in the math-track program.

The new math-track program will consist of nine mathematics content and one methods of teaching courses. The existing math concentrate courses (of which MATH 457 is one) need approval for revisions to fit the requirements of the new math-track program. Three new courses also need approval. The three other tracks will include three math content courses and one methods of teaching course drawn from the Mathematics Department's math-track courses.

1. Catalog Name Change

   Rationale: This change makes the name of the course consistent with the course name designations in new state guidelines.

2. Prerequisite Change

   Rationale: The reference to a concentrate was eliminated. Under the new state mandates for teacher preparation programs, the concentrate for elementary education majors will no longer exist.

3. Catalog Description Change

   Rationale: The current catalog description does not reflect how the course is currently taught. The change is consistent with the content prescribed in new state guidelines.

4. Course Revision - Syllabus of Record

   Rationale: A syllabus of record could not be located and this revision is consistent with the content prescribed in the new state guidelines. As requested by TECC, the syllabus below is from a prior teaching of the course.

4. Old Syllabus

Next page

I. Catalog Description

MATH 457 – Number Theory for Elementary and Middle School Teachers

3 credits
3 lecture hours
(3c-01-3sh)

Prerequisite: MATH 152; Elementary Education concentration.

Introduction to topics of elementary number theory including divisibility, prime numbers, factorization, binary numbers, modular arithmetic, identification codes, cryptography, Diophantine equations, Euclidean algorithm, alternative algorithms, and the place of number theory in the elementary and middle school curriculum.

II. Course Objectives

The student will:
1. understand and perform skills related to the number theory topics of divisibility, primes, and factorization.
2. recognize, describe, analyze, and extend properties about divisibility, prime numbers, and factorization.
3. define, examine, and apply the concepts of modular arithmetic.
4. examine multiple representations for modular arithmetic concepts.
5. investigate special uses and applications of mathematical content related to the course.
6. examine the role of number theory topics for the elementary and middle school curriculum.

Course emphasis: The emphasis is on learning number theory in an investigative manner. Group work, readings, discussion, short assignments, projects, and activities are designed to facilitate the understanding of number theory concepts.

III. Course Outline

A.	Divisibility	3 hours
1.	LCM / GCF	
2.	Euclidean algorithm	
3.	Combinations and Diophantine equations	
B.	Primes and Relatively Prime	4 hours
1.	Primes and prime factorization	
2.	Sieve of Eratosthenes Euler Phi Function	
3.	Infinitude of primes	
4.	Twin primes, Goldbach Conjecture, Great Internet Mersenne Prime Search	
C.	Modular Arithmetic	6 hours
1.	Operations	
2.	Congruence	
3.	Inverses	
D.	Powers and Roots, Arithmetic Mod n	4 hours
1.	Fermat's Theorem (for n prime)	

2.	Euler's Theorem (for any n)	
E.	Cryptography	4 hours
1.	Introduction	
2.	Public Key (RSA)	
F.	Divisibility Tests	6 hours
1.	Relationship to base ten	
2.	Extending tests to find remainders	
G.	Special Topics and Applications	6 hours
1.	Alternative algorithms	
2.	Fibonacci sequence	
3.	Binary numbers	
4.	Identification codes	
H.	Role of Number Theory in School Curriculum	4 hours
1.	Topics for curricular enrichment	
2.	Topics with a new perspective	
I.	Exams and Review	5 hours

IV. Evaluation Methods

Class work / participation / daily work	30%
Presentations / projects / portfolios	40%
Midterm and final exams	30%

A: 91% - 100%
B: 81% - 90%
C: 71% - 80%
D: 61% - 70%
F: 0% - 60%

Attendance policy will conform to university guidelines.

V. Required Textbook

Gross, B., and Harris, J. (2004). The Magic of Numbers. Upper Saddle River, NJ: Pearson Prentice Hall.

VI. Special Resource Requirements

None.

VII. Bibliography

Brown, S. I. (1978). Some Prime Comparisons. Reston, VA: National Council of Teachers of Mathematics

COMAP (2003). For All Practical Purposes. New York, NY: W. H. Freeman and Company.

Jacobs, H. R. (1994). Mathematics: A Human Endeavor. New York, NY: W. H. Freeman and Company.

Flannery, Sarah; with David Flannery (2001). In Code: A Mathematical Journey. New York, NY: Workman.

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

National Council of Teachers of Mathematics (1993). Assessment Standards for School Mathematics. Reston, VA: NCTM.

National Council of Teachers of Mathematics (1991). Professional Standards for Teaching Mathematics. Reston, VA: NCTM.

National Council of Teachers of Mathematics (1989). Curriculum and Evaluation Standards for School Mathematics. Reston, VA: NCTM.

Speiser, R., and Walter, C. (2000). Five Women Build A Number System. Stamford, CT: Ablex Publishing.

Wells, D. (2005). Prime Numbers. Hoboken, NJ: John Wiley and Sons.