New Course Request

Indiana University

South Bend Campus

Check Appropriate Boxes: 
Undergraduate credit [X] 
Graduate credit [ ] 
Professional credit [ ]

1. School/Division: Liberal Arts and Sciences
2. Academic Subject Code: MATH
3. Course Number: 7436 (must be cleared with University Enrollment Services)
4. Instructor: Brown, and others
5. Course Title: Secondary Mathematics for Teachers: an Advanced Perspective
   Recommended Abbreviation (Optional): Secondary Math for Teachers
   (Limited to 32 Characters including spaces)

6. First time this course is to be offered (Semester/Year): Spring 2004

7. Credit Hours: Fixed at 3 or Variable from _______ to _______

8. Is this course to be graded S-F (only)? Yes [ ] No [X]

9. Is variable title approval being requested? Yes [ ] No [X]

10. Course description (not to exceed 50 words) for Bulletin publication: P: M216 and one 300-level mathematics course. Emphasizes developing a deeper understanding of secondary mathematics by examining its fundamental ideas from an advanced perspective. Topics selected from real and complex number systems, functions, equations, integers, polynomials, congruence, distance and similarity, area and volume, and trigonometry.

11. Lecture Contact Hours: Fixed at 3 or Variable from _______ to _______

12. Non-Lecture Contact Hours: Fixed at 0 or Variable from _______ to _______

13. Estimated enrollment: 15 of which 0 percent are expected to be graduate students.

14. Frequency of scheduling: every other Will this course be required for majors? Secondary Education majors (Math)

15. Justification for new course: Spring See attached

16. Are the necessary reading materials currently available in the appropriate library? Yes

17. Please append a complete outline of the proposed course, and indicate instructor (if known), textbooks, and other materials.

18. If this course overlaps with existing courses, please explain with which courses it overlaps and whether this overlap is necessary, desirable, or unimportant.

19. A copy of every new course proposal must be submitted to departments, schools, or divisions in which there may be overlap of the new course with existing courses or areas of strong concern, with instructions that they send comments directly to the originating Curriculum Committee. Please append a list of departments, schools, or divisions thus consulted.

Submitted by: ________________________________ Date 2/17/03

Department Chairman/Division Director

Approved by: ________________________________ Date 4/14/03

Dean

Date

Chancellor/Vice-President

Date

University Enrollment Services

Date

Dean of Graduate School (when required)

After School/Division approval, forward the last copy (without attachments) to University Enrollment Services for initial processing, and the remaining four copies and attachments to the Campus Chancellor or Vice-President.

University Enrollment Services—White; Chancellor/Vice-President—Blue; School/Division—Yellow;
Department/Division—Pink; University Enrollment Services Advance—White
TITLE: Secondary Mathematics for Teachers: An Advanced Perspective (3 credits)
PRE-REQUISITE: M216 (Calculus II) and one 300 level mathematics course
INSTRUCTOR: Anne Brown, and possibly others

Rationale for course
This is a required course in the recently revised secondary mathematics education program. The main objective of the course is to provide an opportunity for future teachers to examine secondary mathematics from an advanced perspective. The focus is on developing the ability to conduct deeper analyses of the problems of secondary mathematics, and to connect secondary mathematics to the advanced mathematics studied during college. Through this experience, future teachers will develop new mathematical insights and understandings, not simply review the mathematics they should have learned in high school. The course will also contribute to the growth of their pedagogical content knowledge of secondary mathematics -- that integrated knowledge of mathematics and pedagogy that supports teachers’ efforts to represent and communicate mathematical knowledge, and that informs the design of day to day and long term instructional plans.

The need for courses of this type is highlighted in the recent report of the Conference Board of the Mathematical Sciences, The Mathematical Education of Teachers. In Chapter 5 on the preparation of high school teachers, the following recommendation is made:

First, core mathematics major courses can be redesigned to help future teachers make insightful connections between the advanced mathematics they are learning and the high school mathematics they will be teaching. Second, mathematics departments can support the design, development, and offering of a capstone course sequence for teachers in which conceptual difficulties, fundamental ideas and techniques of high school mathematics are examined from an advanced standpoint.

The proposed course will begin to address both of these goals, although we cannot describe this course as a capstone course per se due to scheduling constraints. Because we offer upper level mathematics courses on an alternating year schedule, some students will have to take this course in the spring of their sophomore year, while others will take it in the spring of their junior year. There are benefits to the students in either circumstance, as explained further below.

Note also that we use the term “secondary” to include both high school and middle school. This is appropriate since there is often not a clear distinction in school mathematics curricula – e.g. some middle school schools offer Algebra II, while virtually all high schools offer Algebra I and even Pre-Algebra in some cases. Moreover, many of those who graduate from IUSB with certification to teach secondary mathematics actually teach in middle schools rather than high schools.

About the course textbook
The most well-known curriculum development project in this area is a combined effort of faculty at the University of Chicago and the University of California–Berkeley. The textbook produced by this project Mathematics for High School Teachers – An Advanced Perspective (authors Dick Stanley, Zalman Usiskin, Tony Peressini, and Elena Marchisotto) has just been published by Prentice Hall. This is the textbook I plan to use for the first offering of this course.
Course outline
Briefly, the course will promote three types of analysis in helping future teachers develop an advanced perspective of secondary mathematics (from Chapter 1 of the proposed textbook):

- **concept analysis**: tracing the origins and applications of a concept, looking at the ways in which it appears both inside and outside mathematics, and examining various representations and definitions used to describe it and their consequences
- **problem analysis**: includes both finding a variety of ways to solve a problem and more importantly, a retrospective analysis of a problem after it has been solved
- **analysis of mathematical connections**: connections between different areas of mathematics, between elementary and advanced mathematics, and analogies between concepts.

The mathematical topics for this course will be drawn from the following areas:

- real and complex number systems, including geometric connections
- the concept of function: history, properties, data analysis
- the concept of equation, algebraic structures, and solution processes
- integers and polynomials
- congruence: transformations and symmetry
- distance and similarity
- area and volume
- trigonometry

There is sufficient material in the proposed textbook for two 3-credit courses but the chapters are independent. The guiding principle in selecting specific topics for T436 will be to emphasize connections with the topics covered in other required courses without overlapping with the courses in Euclidean Geometry (T336), Abstract Algebra (M403), and Real Analysis (M413). Thus, for some students, this course will provide a concrete basis for the other courses, while others will see the content in this course as applying what they have learned in T336, M403, or M413 to their future teaching practice.

**Connection to graduate education and professional development of teachers**
While this course is intended for future teachers, in the future it could also be offered for graduate credit to current teachers (using 500 level number and requiring some additional work). The Professional Development Committee of the Department of Mathematical Sciences sent a survey in Spring 2002 to area middle and high school mathematics teachers. The results indicate that there would be strong interest in such a course: more than two-thirds of the 54 teachers who returned the survey checked "possibly interested" or "very interested" for the item "studying the mathematics you teach, at a deeper level, for graduate mathematics credit".