EP.09.11
(Rev. 9/18/08)

PROPOSAL TO THE SENATE COMMITTEE ON EDUCATIONAL POLICY

Revision of the Undergraduate Major in the Sciences and Letters Curriculum in Mathematics:
BSLAS: Math
BSLAS: Math: Graduate Prep
BSLAS: Math: Applied Math
BSLAS: Math: Operations Res
BSLAS: Math: Teaching Optn

Department of Mathematics, College of Liberal Arts and Sciences.

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BRIEF DESCRIPTION:

1. MATH 417, Abstract Algebra, will be made a core requirement.
2. MATH 416, Abstract Linear Algebra, will replace MATH 415, Linear Algebra, as a core requirement.
3. MATH 220/221 and MATH 231, Calculus I and II, will be removed from the core requirements, although they must remain in the Teaching of Mathematics concentration.
4. Only 400-level and 500-level courses may be used to fulfill the free-choice advanced math course requirements.
5. The **General Mathematics** concentration (formerly Mathematics) will have a slightly revised list of course choices.
6. The **Graduate Preparatory** concentration will require MATH 441, Differential Equations, and the lists of course choices will change slightly. Students will be required to complete at least two Mathematics Honors Sequence courses.
7. In the **Applied Mathematics** concentration, MATH 453, Elementary Theory of Numbers, will no longer be a listed choice.
8. In the **Operations Research** concentration, MATH 484, Nonlinear Programming, will become a choice rather than a requirement, while MATH 412, Graph Theory, will cease to be a listed choice.
9. The **Teaching of Mathematics** concentration will require MATH 453, Elementary Theory of Numbers, in place of one of the three advanced math electives.

JUSTIFICATION:

The mathematics major has not been updated for many years and represents standards that in some respects are weaker than those at many comparable institutions. The most important of the proposed changes is the insertion of a course in abstract algebra into the core requirements. The role of abstract algebra in mathematics is so central that it will significantly strengthen our major to require exposure to this subject. Our proposal requires all majors to take either Math 417 (Introduction to Abstract Algebra) or Math 427 (Honors Abstract Algebra) instead of providing a

choice between abstract algebra and number theory. The other important change in course requirements is the replacement in the core of the general-purpose linear algebra course Math 415 by Math 416, a new linear algebra course designed for math majors.

Calculus I and II are increasingly being taken at the high school level. Performance in these courses is not a good indicator of later success in the major, in part because the focus of these courses is primarily on computations rather than theory and proofs. Inclusion of these courses on the list of requirements also can present problems for transfer students. Many of these students receive Calculus I and Calculus II credit based on an AP score of 3, a score that Illinois does not accept. If these students have taken additional math courses at the transfer institution, they may not be eligible to take a proficiency exam at Illinois in Calculus I and Calculus II. Such issues do not arise with other courses in the major. The courses must remain in the Teaching of Mathematics concentration because of state teaching certification requirements.

With the renumbering of our engineering differential equations courses Math 385 and Math 386 as Math 285 and Math 286, and with the discontinuance of our advanced calculus course Math 380, the only 300-level courses the Math Department offers are Math 347 and Math 348 (both Fundamental Mathematics), Math 370 (Actuarial Problem Solving), and Math 390 (Individual Study). As neither Math 370 nor Math 390 is suitable for the major, all advanced electives in the major are to be chosen from our 400-level offerings.

The lists of courses from which students in the various concentrations choose have been revised in an attempt to provide a more appropriate background in each case. Please see Appendix A for a comparison of the current and proposed requirements.

The changes to the General Mathematics lists encourage students to explore new areas, particularly differential equations and complex analysis.

In the Graduate Preparatory concentration, differential equations is a good background for students interested in graduate school. Honors sequence courses are already taken by most students choosing the Graduate Preparatory option, and we make this a requirement.

In the Applied Mathematics concentration, Math 453 and Math 417 are currently part of a list of five courses from which a student makes one selection. This is a reflection of the current option #1 (Mathematics) requirements more than what is useful to students in applied mathematics, so we removed Math 453. Students may still choose it as their advanced math elective.

Operations Research is the only option not currently listing Math 417 or complex analysis. To avoid making it too difficult, two required courses and a choice of one from a list of two other courses were changed to one required course and a choice of one from a list of the two most relevant remaining courses. This option attracts very few students and it is hoped that the changes will draw more.

Teaching of Mathematics students greatly benefit from a background in number theory, both to improve their understanding of the material they teach and to prepare them to coach teams for math contests. Thus a requirement of Math 453 is most appropriate, and exchanging an elective

advanced math course for it still leaves two elective math courses without increasing the burden on the students. Formerly these students chose between Math 417 and Math 453; now they will take both.

BUDGETARY AND STAFF IMPLICATIONS:

- a. Additional staff and dollars needed

  0.33 FTE faculty per year needed to cover 2 additional sections (35 students each) of Math 417 per year, to be partially offset by a reduction of one section (70 students) of Math 285.

- b. Internal reallocations (e.g., change in class size, teaching loads, student-faculty ratio, etc.)

  None.

- c. Effect on course enrollment in other departments and explanations of discussions with representatives of those departments

  None.

- d. Impact on library, computer use, laboratory use, equipment, etc.

  None.

GUIDELINES FOR UNDERGRADUATE EDUCATION:

The proposed revisions to the major will realign our program so that it comfortably meets the national standard for major research institutions. With the abstract algebra requirement and the stronger linear algebra course, all our graduates will have the breadth and depth of knowledge to gain employment and to advance in careers requiring mathematical backgrounds and good quantitative reasoning skills. At the same time, the general education and supporting coursework requirements will contribute to our students' ability to think critically and creatively about areas outside of mathematics. The revisions will therefore meet the guidelines for undergraduate education.

CLEARANCES:

Joseph Miles — March 31, 2008

Joseph Miles, Director of Undergraduate Studies in Mathematics — Date

3/31/08

Sheldon Katz, Chair, Department of Mathematics — Date

4/20/08

College of Liberal Arts & Sciences — Date

Council on Teacher Education — Date

EFFECTIVE DATE: Upon approval.