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CURRICULUM PROPOSAL COVER SHEET
University-Wide Undergraduate Curriculum Committee

LSC Use Only
Number LS47
Action A
Date 2-2-89

UWUCC Use Only
Number _____
Action _____
Date _____

I. TITLE/AUTHOR OF CHANGE

COURSE/PROGRAM TITLE MA 102 - Finite Mathematics

DEPARTMENT Mathematics

CONTACT PERSON John Droughton

II. THIS COURSE IS BEING PROPOSED FOR:

- Course Approval Only
 Course Approval and Liberal Studies Approval
 Liberal Studies Approval only (course previously has been approved by the University Senate)

III. APPROVALS

Edward Goodman
Department Curriculum Committee

Douglas Olson
College Curriculum Committee

Charles Cohen
Director of Liberal Studies
(where applicable)

John Droughton
Department Chairperson

Marie He Katz
College Dean*

Provost
(where applicable)

*College Dean must consult with Provost before approving curriculum changes. Approval by College Dean indicates that the proposed change is consistent with long range planning documents, that all requests for resources made as part of the proposal can be met, and that the proposal has the support of the university administration.

IV. TIMETABLE

Date Submitted
to LSC _____
to UWUCC _____

Semester/Year to be
implemented _____

Date to be published
in Catalog _____

INDIANA UNIVERSITY OF PENNSYLVANIA
MATHEMATICS DEPARTMENT

COURSE NUMBER: MA 102

COURSE TITLE: Finite Mathematics

CREDITS: 3 semester hours

PREREQUISITES: 4 years of high school mathematics or a college mathematics course

CATALOG DESCRIPTION:

Credit toward graduation will not be given to anyone with credit in any course beyond calculus. An informal approach to practical applications of mathematics. Fundamental concepts of enumeration, matrices, linear systems, predicate calculus, probability and series will be introduced and used in considering mathematical models. Calculators or computer packages may be used in solving mathematical problems.

PRESENT TEXT: Finite Mathematics (with Applications to Business and Social Sciences) 2nd Edition
by Wheeler and Peeples

COURSE OUTLINE AND TIME SCHEDULE:

- I. Numbers and Numeration (6 hours)
 - A. Systems with bases of other than ten
 - B. Internal representation of positive and negative integers and positive real numbers
 - C. Modular arithmetic

- II. Logic (6 hours)
 - A. Connectives
 - B. Truth tables
 - C. Quantifiers
 - D. Implication and equivalence
 - E. Validity of Arguments

- III. The Algebra of Sets (3 hours)
 - A. Complements, unions, intersections
 - B. Distributive and DeMorgan laws
 - C. Number of elements in a set
 - D. Tree diagrams

- IV. Counting (6 hours)
 - A. Fundamental principle of counting
 - B. Permutations and combinations

- V. Probability (6 hours)
 - A. Historical definition of probability
 - B. Probability functions
 - C. Conditional probability

D. Independent events

VI. Vectors and Matrices (6 hours)

A. Matrices and their operations

B. System of linear equations and their solution

VII. Series (6 hours)

A. Arithmetic and geometric series

B. Recursion formulas

C. Applications from area of finance

LIBERAL STUDIES COURSE APPROVAL FORM

About this form: Use this form only if you wish to have a course included for Liberal Studies credit. The form is intended to assist you in developing your course to meet the university's Criteria for Liberal Studies, and to arrange your proposal in a standard order for consideration by the LSC and the UWCC. If you have questions, contact the Liberal Studies Office, 353 Sutton Hall; telephone, 357-5715.

Do not use this form for technical, professional, or pre-professional courses or for remedial courses, none of which is eligible for Liberal Studies. Do not use this form for sections of the synthesis course or for writing-intensive sections; different forms will be available for those.

PART I. BASIC INFORMATION

A. For which category(ies) are you proposing the course? Check all that apply.

LEARNING SKILLS

- First English Composition Course
- Second English Composition Course
- Mathematics

KNOWLEDGE AREAS

- Humanities: History
- Humanities: Philosophy/Religious Studies
- Humanities: Literature
- Fine Arts
- Natural Sciences: Laboratory Course
- Natural Sciences: Non-laboratory Course
- Social Sciences
- Health and Wellness
- Non-Western Cultures
- Liberal Studies Elective

B. Are you requesting regular or provisional approval for this course?

- Regular Provisional (limitations apply, see instructions)

NWCC course

C. During the transition from General Education to Liberal Studies, should this course be listed as an approved substitute for a current General Education course, thus allowing it to meet any remaining General Education needs? yes no

If so, which General Education course(s)? MA 102

PART II. WHICH LIBERAL STUDIES GOALS WILL YOUR COURSE MEET? Check all that apply and attach an explanation.

All Liberal Studies courses must contribute to at least one of these goals; most will meet more than one. As you check them off, please indicate whether you consider them to be primary or secondary goals of the course. [For example, a history course might assume "historical consciousness" and "acquiring a body of knowledge" as its primary goals, but it might also enhance inquiry skills or literacy or library skills.] Keep in mind that no single course is expected to shoulder all by itself the responsibility for meeting these goals; our work is supported and enhanced by that of our colleagues teaching other courses.

| | Primary | Secondary |
|--|-------------------------------------|-------------------------------------|
| A. Intellectual Skills and Modes of Thinking: | | |
| 1. Inquiry, abstract logical thinking, critical analysis, synthesis, decision making, and other aspects of the critical process. | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| 2. Literacy--writing, reading, speaking, listening | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 3. Understanding numerical data | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| 4. Historical consciousness | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 5. Scientific inquiry | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 6. Values (ethical mode of thinking or application of ethical perception) | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 7. Aesthetic mode of thinking | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| B. Acquiring a Body of Knowledge or Understanding Essential to an Educated Person | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| C. Understanding the Physical Nature of Human Beings | <input type="checkbox"/> | <input type="checkbox"/> |
| D. Certain Collateral Skills: | | |
| 1. Use of the library | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 2. Use of computing technology | <input type="checkbox"/> | <input checked="" type="checkbox"/> |

ADDENDUM TO LIBERAL STUDIES PROPOSALS: PART II

The Liberal Studies Goals met by the Course MA 102:

A. Intellectual Skills and Modes of Thinking:

1. Inquiry, abstract logical thinking, critical analysis, synthesis, decision making, and other aspects of the critical process is a primary goal of the course. It is apparent that the study of Mathematics requires that the student become involved in all of these categories. Problem solving requires the student to collect data, to clearly state the problem to be solved, to determine the best method to use that will produce a solution, to analyze and to interpret the outcome, and then to make a judgment about the validity of the work.
2. Literacy-writing, reading, speaking, listening, is a secondary goal of this course. All of these areas can be applied and improved during a course of study in mathematics. Reading skills are absolutely necessary for a clear understanding of the material; the writing of solutions to mathematical problems requires clarity of mind and organization of thought; the requirement of discussing mathematics in the classroom shows the student the importance of clear patterns of thinking and of the expression of those thoughts orally; and listening skills are very important in the understanding of mathematics. These skills can be improved through the writing of tests and of assigned papers, through the oral response to classroom questions, and through the reading of assignments.
3. Understanding numerical data is a primary goal of this course. This course stresses understanding and appreciation on the part of the student for the importance and usefulness of mathematics in our society. Topics studied in this course will prepare the student for the construction of algorithms that will facilitate the solution of applied problems with computers.
4. Historical consciousness is a secondary goal. Students should have some awareness of the historical significance of the role of mathematics in the development of western and other civilizations, and its importance in the application of contemporary computer technology.
5. Scientific inquiry is a secondary goal. Students should be made aware of the importance of mathematical logic and its role in the technical and scientific evolution of mankind. Of interest is the manner in which man uses the structure of mathematics to construct problem solving techniques that can be implemented by computers.
6. Aesthetic mode of thinking is a secondary goal. Mathematics can be appreciated as a beautiful art form for communication and learning. An effort should be made to develop in the student a sense of this beauty and an awareness for its power and utility.

B. Acquiring a Body of Knowledge or Understanding Essential to an Educated Person:

Secondary Goal

Although specific mastery of mathematics is not required of all students in this course, it is important that students develop a sense of its importance and utility for society. Moreover, this course of study should develop in the student a feeling of confidence toward elementary deductive reasoning, rudimentary problem solving skills, deductive reasoning, and the interpretation and use of the language of mathematics. As the student pursues a course of study in computer science, this knowledge will have many applications.

D. Certain Collateral Skills:

2. Use of computing technology is a secondary goal. Students need to be aware of the applicability of information learned in MA 102 to problem solving through computers and/or calculators and this relationship might best be established by using such technology to solve certain mathematical problems.

PART III. DOES YOUR COURSE MEET THE GENERAL CRITERIA FOR LIBERAL STUDIES? Please attach answers to these questions.

- A. If this is a multiple-section, multiple-instructor course, there should be a basic equivalency (though not necessarily uniformity) among the sections in such things as objectives, content, assignments, and evaluation. **Note: this should not be interpreted to mean that all professors must make the same assignments or teach the same way; departments are encouraged to develop their courses to allow the flexibility which contributes to imaginative, committed teaching and capitalizes on the strengths of individual faculty.**

What are the strategies that your department will use to assure that basic equivalency exists? Examples might be the establishment of departmental guidelines, assignment of responsibility to a coordinating committee, exchange and discussion of individual instructor syllabi, periodic meetings among instructors, etc.

- ✓ B. Liberal Studies courses must include the perspectives and contributions of ethnic and racial minorities and of women wherever appropriate to the subject matter. **If your attached syllabus does not make explicit that the course meets this criterion, please append an explanation of how it will.**

- C. Liberal Studies courses must require the reading and use by students of at least one, but preferably more, substantial works of fiction or nonfiction (as distinguished from textbooks, anthologies, workbooks, or manuals). **Your attached syllabus must make explicit that the course meets this criterion.**

[The only exception is for courses whose primary purpose is the development of higher level quantitative skills; such courses are encouraged to include such reading, but are not expected to do so at the expense of other course objectives. **If you are exercising this exception, please justify here.**]

- D. If this is an introductory course intended for a general student audience, it should be designed to reflect the reality that it may well be the only formal college instruction these students will have in that discipline, instead of being designed as the first course in a major sequence. That is, it should introduce the discipline to students rather than introduce students into the discipline. **If this is such an introductory course, how is it different from what is provided for beginning majors?**

ADDENDUM TO LIBERAL STUDIES PROPOSALS: PART III

B. Whenever appropriate, information will be introduced into the classroom discussion which will reflect the contributions made to mathematics by women and by minorities. Particular attention will be given to the following areas as they relate to this topic:

1. The classroom discussion will be sensitive to gender balancing with respect to language.
2. Quizzes, tests, examinations, and any other written information distributed to the students will be sensitive to gender balancing, especially in problem construction, and to minorities whenever possible.
3. Specific names and contributions made by women and other members of minority groups will be discussed in the classroom when the discussion of such is germane to the material being studied. It should be noted though that mathematics has been the domain of the male throughout history and only in recent time has there been numbers of women involved. Even today, there are too few women in the field of mathematics.

E. The Liberal Studies Criteria indicate six ways in which all courses should contribute to students' abilities. To which of the six will your course contribute? Check all that apply and attach an explanation.

- 1. Confront the major ethical issues which pertain to the subject matter; realize that although ~~"suspended judgment" is a necessity of intellectual inquiry, one cannot live forever in suspension; and make ethical choices and take responsibility for them.~~
- 2. Define and analyze problems, frame questions, evaluate available solutions, and make choices
- 3. Communicate knowledge and exchange ideas by various forms of expression, in most cases writing and speaking.
- 4. Recognize creativity and engage in creative thinking.
- 5. Continue learning even after the completion of their formal education.
- 6. Recognize relationships between what is being studied and current issues, thoughts, institutions, and/or events.

PART IV. DOES YOUR COURSE MEET THE CRITERIA FOR THE CURRICULUM CATEGORY IN WHICH IT IS TO BE LISTED?

Each curriculum category has its own set of specific criteria in addition to those generally applicable. The LSC provides copies of these criteria arranged in a convenient, check-list format which you can mark off appropriately and include with your proposal. **The attached syllabus should indicate how your course meets each criterion you check. If it does not do so explicitly, please attach an explanation.**

PART III (MA 102)

A. There will be a common syllabi of topics that should be covered by each of the individual instructors teaching this course. Such common syllabi should include but not be limited to topics which introduce the student to deductive reasoning, develop in the student problem solving skills, and enable the student not only to understand the underlying principles of formulae but also to have the ability to use and interpret numerical data.

B. Whenever appropriate, information will be introduced into the classroom discussion which will reflect the contributions made to mathematics by women and by racial minorities.

C. Two readings will be assigned during the course. The student is required to respond to each assignment in writing. The purpose of the writing is for each student to formulate and express his/her interpretation and impression of the reading. Reading lists for this course are as follows:

Reading #1: Read one of the following:

- (1) "A Tour of the Minefield" from the book "The Problems of Mathematics" by Ian Stewart.
- (2) "Engineer Consults Mathematician" from the work "Did You Say Mathematics?" by Ya Khungin.
- (3) "Game Theory" by Davis (two chapters).

Reading #2: Read two articles or chapters from the following:

- (1) "World of Mathematics" by Newman.
- (2) "Mathematics in Western Culture" by Kline.
- (3) "Mathematics Today" by Steen.

D. The thrust of MA 102 is not to be remedial in nature but rather to develop in the student an awareness of and an appreciation for the power and usefulness of mathematics and its important role in a technological society. A partial list of topics that would be appropriate for this course would include numbers and enumeration, logic, the algebra of sets, combinatorics, probability, vectors and matrices, and series. These topics would provide the course with a suitable mathematical strata that would improve the mathematical maturity of students especially those whose major is Computer Science. Additionally, this course would enable the student to develop confidence in handling numerical problems, would present the student with an opportunity to develop an appreciation for mathematics, and would allow the introduction to students of hand held calculators and possibly computers.

E. #2.- The very nature of mathematical study requires that problems be clearly analyzed and defined, that solutions be generated for such problems, and that an interpretation be assigned to each possible solution in order that a correct choice may be made.

#4.- Mathematics is exactly the art of creative thinking. One moves from the collection of data to the definition of the problem to the abstract generalization in which a solution or solutions are constructed to the interpretation of the solution or solutions to the application of the solution(s). This process requires one

to recognize creativity and to engage in creative thinking.
#5.- One is constantly exposed to information which needs the principles of mathematics for proper interpretation. Skills mastered in this course can last one a life time.

ADDENDUM TO THE SYLLABUS FOR THE COURSE MA 102

Course Objectives for the Course MA 102:

I. General Objectives:

- A. Students will develop an appreciation for the nature, the breadth, and the power of mathematics and for its role in a technological society.
- B. Students will develop an understanding for Mathematical Logic and will use that understanding as a basis for the improvement of their logical thinking.
- C. Students will develop elementary skills in the use of deductive reasoning.
- D. Students will learn to communicate in the language of mathematics. This learning will involve reading, writing, listening, and speaking.
- E. Students will be exposed to basic problem solving skills founded on the principles of mathematics and will learn to apply these skills to patterns of problems found in the study of computer science.
- F. Students will become confident in their mathematical awareness and will become adept at the application of basic numerical skills to patterns of problems found in the study of computer science.
- G. Students will become aware of the meaningful role played in our society by calculators and computers.

II. Some Specific Course Objectives:

- A. Students will be able to understand the important role that pattern recognition plays in the study of mathematics and will be able to use this awareness in the study of computer science.
- B. Students will study the concept of numbers and their properties.
- C. Students will study the elementary principles of mathematical logic, and the extension of these principles to problem solving techniques.
- D. Student will study the algebra of sets and their related properties.
- E. Students will study the basic principles of counting and then apply these principles to the study of permutations and combinations.
- G. Students will explore the rudiments of probability.
- H. Students may be introduced to certain calculators and other computing devices.
- I. Students will study the fundamental concepts of matrices and their properties.
- J. Students will apply the properties of matrices to the solution of linear systems of equations.
- K. Students will explore the concept of series and will study an application of this topic to mathematics of finance.
- L. Students will explore all of these topics within the framework of mathematical models as applied to computer science.

CHECK LIST -- MATHEMATICS
(Learning Skills Area)

Mathematics Criteria which the Course must meet:

- Introduce students to deductive reasoning
- Develop in the student problem solving techniques appropriate for the course.
- Enable the student to understand the underlying principles of formulas.
- Enable the student to use and interpret numerical information.

Courses appropriate to the Mathematics Learning Skills Area must be either:

- A. Mathematics courses that develop significant mathematical skills required by a major discipline.
- B. Mathematics courses designed for Liberal Studies.

Additional criteria which courses in Category B must meet:

- Develop the student's confidence in handling numerical problems and data.
- Be sensitive to the diverse background characteristics of the student.
- Include elements on the history or appreciation of mathematics.
- Introduce the hand-held calculator or the computer as a tool.