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Submission Date: _____
Action-Date: App. 12/16/97
Senate app. 2/3/98

CURRICULUM PROPOSAL COVER SHEET
University-Wide Undergraduate Curriculum Committee

I. CONTACT

Contact Person Gerald Buriok Phone 2608

Department Mathematics

II. PROPOSAL TYPE (Check All Appropriate Lines)

X COURSE MA 350 History of Mathemtcs
Suggested 20 character title

____ New Course* _____
Course Number and Full Title

X Course Revision MA 350 History of Mathematics
Course Number and Full Title

____ Liberal Studies Approval+ for new or existing course _____
Course Number and Full Title

____ Course Deletion _____
Course Number and Full Title

____ Number and/or Title Change _____
Old Number and/or Full Old Title

_____
New Number and/or Full New Title

____ Course or Catalog Description Change _____
Course Number and Full Title

____ PROGRAM: ____ Major ____ Minor ____ Track

____ New Program* _____
Program Name

____ Program Revision* _____
Program Name

____ Program Deletion* _____
Program Name

____ Title Change _____
Old Program Name

_____
New Program Name

III. Approvals (signatures and date)

Daniel C. Burkett 10/5/97
Department Curriculum Committee

Donald Bunch 10/5/97
Department Chair

10/15/97
College Curriculum Committee

John D. Eder 10/15/97
College Dean

_____
+Director of Liberal Studies (where applicable)

_____
*Provost (where applicable)

2. A summary of the proposed revisions.

a) MA 350 is being changed from a two credit course to a three credit cores.

b) The following topics are being included:
history of conic sections, medieval mathematics, history of logarithms, development of analytic geometry, development of calculus, some philosophies of mathematics.

c) Change in catalog description.

Current catalog description: The history of mathematics is concerned with the origins, philosophy, and development of the mathematical sciences.

New catalog description: Development of the central concepts of mathematics from ancient times up to the development of calculus in the seventeenth century. Mathematical concepts will be placed in historical perspective. The use of the history of mathematics as a pedagogical tool and its relationship to other sciences will be addressed.

d) Change in prerequisite.

Current prerequisite: Completion of a calculus sequence of permission of the instructor.

New prerequisite: MA 122 or MA 124 or permission of the instructor.

3. Justification/rationale for the revisions.

The history of mathematics is an excellent vehicle for helping students to develop an appreciation of multiculturalism in mathematics, as well as to see the integration within the various fields of mathematics. Since this is one of the few opportunities we have in mathematics to develop this appreciation. we would like to expand this course to three credits from two. Also. MA 350 is a writintg intensive course. Adding an additional semester hour will allow students more writing opportunities.

The additional topics that can be covered with the addition of a semester hour are crucial in the development of modern mathematics. The history of all the mathematics taught now in high schools can be addressed. Indeed. the development of analytic geometry. followed quickly by the development of calculus. is often viewed as one of the great moments in the history of science. As a two credit course. these topics received a brief treatment due to time limitations.

The catalog description is being expanded to indicate the time frame with which

the course will deal, and to reflect the fact that certain mathematical topics can be successfully taught by approaching them from a historical perspective.

The current catalog description shows the prerequisite for MA 350 as: Completion of a calculus sequence or permission of the instructor. There are currently 3 calculus sequences offered by the Mathematics Department, namely MA 127/128/227, MA 123/124, and MA 121/122. Accompanying the proposed revision for MA 350 are proposals by the department to remove MA 127/128/227 from the Math, Applied Math, Econ/Math, and Secondary Math Education programs. This sequence will be replaced by MA 123/124. When this change is fully implemented, MA 127/128/227 will go inactive and not be offered by the department. The statement in the current catalog would then be referring to MA 123/124 and MA 121/122.

The new catalog description shows the prerequisite for MA 350 as: MA 122 or MA 124 or permission of the instructor. Since MA 127/128/227 will no longer be offered, and MA 121 is a prerequisite for MA 122 and MA 123 is a prerequisite for MA 124, the new description has exactly the same meaning as the old description.

I. Catalog Description

MA 350 History of Mathematics — 3 credits, 3 lecture hours (3c-0l-3sh)

Prerequisites: MA 122 or MA 124 or permission of the instructor.

Development of the central concepts of mathematics from ancient times up to the development of calculus in the seventeenth century. Mathematical concepts will be placed in historical perspective. The use of the history of mathematics as a pedagogical tool and its relationship to other sciences will be addressed.

II. Course Objectives

The goals of the course are:

1. to give life to the people of mathematics;
2. to illustrate that mathematics did not simply "appear" in a polished form;
3. to see how the various mathematics courses the students have taken fit together;
4. to show that mathematics is part of our culture and other cultures;
5. to indicate how one might use history in future teaching;
6. to learn various research skills;
7. to improve mathematical communication skills (reading, writing, speaking).

These objectives will be met as we discuss the work of certain historical figures from various eras and cultures. This course is more a history of ideas rather than a history of great men and women or a social history. We concentrate on mathematics that is commonly taught in high school, that is, we address the development of numeration, computation, algebra, geometry, trigonometry, and calculus.

III. Course Outline

A. Protomathematics (4 hours)
   1. Ancient Mesopotamia
   2. Ancient Egypt

B. Ethnomathematics (2 hours)

C. Greek Mathematics (11 hours)
   1. Pythagoreans
   2. Hypocrates of Chios
      a. Quadratures
   3. The *Elements* of Euclid

4. Eudoxus
    a. Method of Exhaustion
    b. incommensurable numbers
5. Archimedes
    a. Method of Exhaustion
    b. Inscribed and circumscribed areas and volumes
    c. geometry
6. *Conics* of Apollonius
7. Ptolemy
    a. Chords
    b. Trigonometry
8. Diophantus
    a. Number theory
    b. Algebra

D. Arabic Primacy with Chinese and Indian Contributions (3 hours)
1. al-Khwarizmi
    a. algebra
    b. equations
2. al-Khayyami
    a. algebra
    b. equations
3. *Nine Chapters on Mathematical Art*
4. Bhaskara's *Lilavati*
    a. arithmetic
    b. geometry

E. Medieval-Renaissance-Reformation Periods in Europe (9 hours)
1. Leonardo of Pisa
    a. number theory
    b. solution of equations
2. Nicole Oresme
    a. rates of change
    b. physics
3. Girolamo Cardano
    a. algebra
    b. cubic equations
4. Rafael Bombelli
    a. cubic equations
    b. complex numbers
5. François Viète
    a. algebra
    b. variables
    c. cubic equations
6. Simon Stevin
    a. Decimal Fractions

7. John Napier
    a. Logarithms

F. Protocalculus/Geometric Analysis (6 hours)
    1. René Descartes
        a. theory of equations
        b. analytic geometry
        c. tangents and normals
    2. Pierre de Fermat
        a. analytic geometry
        b. "integration"
        c. maxima and minima
    3. Johannes Kepler
        a. "integration" methods
    4. Blaisè Pascal
        a. "integration" of $\sin^n x$

G. Birth of Calculus (5 hours)
    1. Gottfried Wilhelm Leibniz
    2. Isaac Newton

H. Philosophy of Mathematics (1 hour)
    1. Platonism
    2. Intuitionism
    3. Constructivism
    4. Formalism

I. Women in the Mathematical Community (1 hour)

IV. Evaluation Methods

Keeping in mind that this is a **writing intensive course**, the final grade for the course will be determined as follows (approximately):

40% Midterm and Final Examinations
Questions will address the major achievements and personalities of various eras, an analysis of certain important mathematical results of historical importance, and problems designed to test the knowledge of the mathematics of the various eras. Writing in the form of essay and short answer/discussion questions will comprise approximately 50% of these examinations.

10% Paper
The papers will be on various topics, but each paper will require synopsis writing, library research, an annotated bibliography, peer review, revision of a rough draft, and a final draft.

10% Other Writing
Other writing exercises appropriate to the discipline and the course will be assigned. This could include essays, in class writing, writing of synopses, and analysis of current literature.

10% History of Mathematics and Its Use in Teaching/Analysis of Classic Science
Students will complete assignments that are designed to help the future teacher incorporate history of mathematics into his/her classroom. This could include keeping a teaching portfolio, designing lesson plans, or giving mock lessons to the class. Non-education majors will complete other more appropriate assignments such as analyzing a work of historical importance in a scientific discipline.

30% "Traditional" Homework
These exercises will develop in more detail some of the mathematics of various eras, using techniques of that era coupled with modern techniques as a comparison. It is expected that the written homework conform to the standards of correct mathematical writing.

Suggested Grading Scale
Points will be assigned to each of the categories above in accordance with the stated percentages. Grades will be assigned according to the following scale for percentage of total points:
90% and above A, 80% to <90% B, 70% to <80% C, 60% to <70% D, and below 60% F.

V. Required Textbooks

Calinger, Ronald, ed. Classics of Mathematics. Englewood Cliffs, New Jersey: Prentice Hall, 1995.

Gillman, Leonard, Writing Mathematics Well, Washington, D.C.: Mathematical Association of America, 1987.

VI. Special Resource Requirements

Adequate library facilities including history of mathematics texts, biographies, classic works, up to date journal subscriptions to history of mathematics and science periodicals, and CD-ROM search capabilities are crucial to the success of this course.

VII. Bibliography

Anglin, W.S. Mathematics: A Concise History and Philosophy. New York: Springer-Verlag, 1994.

Ascher, Marcia. Ethnomathematics: A Multicultural View of Mathematical Ideas. New York: Chapman and Hall, 1991.

Boyer, Carl. A History of Mathematics. New York: John Wiley and Sons, Inc., 1991.

Brumbaugh, Robert. The Philosophers of Greece. Albany, NY: State University of New York Press, 1981.

Burton, David. History of Mathematics: An Introduction. Dubuque, IA, Wm. C. Brown Publishers, 1991.

Calinger, Ronald, ed. Vita Mathematica: Historical Research and Integration with Teaching. Washington, D.C.: Mathematical Association of America, 1996.

Dunham, William. Journey Through Genius: The Great Theorems of Mathematics. New York: John Wiley and Sons, Inc., 1990.

Eves, Howard. An Introduction to the History of Mathematics. Philadelphia: Saunders College Publishing, 1983.

Fauvel, John and Jeremy Gray, eds. The History of Mathematics: A Reader. London: The Open University, 1987.

Katz, Victor. A History of Mathematics: An Introduction. New York: Harper Collins Publishers, 1993.

Kline, Morris. Mathematics in Western Culture. London: Oxford University Press, 1974.

National Council of Teachers of Mathematics. Historical Topics for the Mathematics Classroom. Washington, D.C.: National Council of Teachers of Mathematics , 1969.

Smith, David Eugene, ed. A Source Book in Mathematics. New York: Dover Publications, Inc., 1959.

Stillwell, John. Mathematics and Its History. New York: Springer-Verlag, 1989.

Struik, D. J., ed. A Source Book in Mathematics, 1200-1800. Princeton, New Jersey, Princeton University Press, 1990.

Swetz, Frank, et al, eds. Learn from the Masters. Washington, D.C.: Mathematical Association of America, 1995.

COURSE SYLLABUS

Date Submitted: February 23, 1986

Submitted By: Merlin E. Hartman

Department: Mathematics

I. MA 350 History of Mathematics

II. Catalog Description

The history of mathematics is concerned with the origins, philosophy, and development of the mathematical sciences. The prerequisite is completion of a calculus sequence or permission of the instructor. Two lecture hours per week.

III. Course Objectives

The objectives of the history of mathematics course are to provide:

A. An understanding of mathematics both as a science and as an art.

B. The ability to develop a broad concept of the mathematical sciences as approachable from several points of view including

a. problem solving as a basis for the initial development of many concepts;
b. mathematics as a human endeavor, the role of individuals of both sexes with their insights and idiosyncrasies;
c. mathematics as a cultural heritage, the evolving role of mathematics in cultures throughout the world;
d. the impact of social, economic, and cultural forces on mathematical study and creativity;
e. interrelations among the various branches of mathematics, especially their role in the solution of significant problems and in extending the horizons of mathematics; and
f. the dynamic nature of mathematics, including the relatively recent development of probability and statistics and the increasing roles of calculators and computers.

C. Resources for developing the empirical and mathematical origins of several areas of mathematics including the notations, terminology and major topics of algebra, geometry, trigonometry, calculus, number theory, probability, statistics, computer science and non-physical-science applications of mathematics.

IV. Course Outline and Schedule

This history course is to include, but not necessarily be structured according to, the chronological development of the mathematical sciences. The emphasis is to be upon mathematical concepts and their interrelations. The topics suggested below are a sample of the many available and worthwhile possibilities. The number of class hours devoted to each topic is included to suggest approximate emphasis but is expected to vary according to the backgrounds and interests of both students and instructor.

A. INFORMAL ORIGINS (2 hours)

Arithmetic and geometric concepts in early and primitive cultures, mathematical procedures based upon experiences and presented by examples, early numeration systems, the nature and content of the Rhind Mathematical Papyrus and Babylonian cuneiform tablets, extensive uses of tables.

B. THE EARLY DEVELOPMENT OF MATHEMATICS AS A SCIENCE (4 hours)

The work of the early Greek philosophers, the beginning of demonstrative geometry, the Pythagoreans, figurate numbers, commensurable and incommensurable magnitudes, Zeno's paradoxes, Eudoxus' method of exhaustion and theory of proportion, the three famous problems, geometric algebra, postulational thinking, Aristotle's laws and his concern for foundations, Euclid's Elements.

C. MATHEMATICS IN THE GREEK CULTURE AFTER EUCLID (4 HOURS)

Continued efforts to understand the physical universe stimulate many aspects of the progress in mathematics. Note the continued development of geometry, properties of numbers, an early form of algebra, and the work of Archimedes, Eratosthenes, Apollonius, Hipparchus, Claudius Ptolemy, Heron, Diophantus, and Pappus.

D. MATHEMATICS OUTSIDE EUROPE BEFORE 1600 (3 hours)

The mathematics developed in Chinese, Hindu, Arabic and other cultures. Suggested topics include rod numerals, the Chou-pei Suan Ching, the algebraic methods of Chu Shih-chieh, the Sulvasutras, the algebraic methods of Brahmagupta and Bhaskara, the algebra of al-Khowarizmi and Khayyam, and the Arabic contributions through the preservation, compilation, and extension of Greek and Hindu mathematics.

E. MATHEMATICS IN EUROPE BEFORE 1600 (2 hours)

The introduction and transmission of Hindu-Arabic numerals, translations of Euclid's Elements and other manuscripts, development of trigonometry, development of arithmetic and algebraic notations, solutions of cubic and quartic equations, slow acceptance of decimal fractions, and extensions of synthetic geometry.

F. MATHEMATICS IN THE 17TH AND 18TH CENTURIES (5 hours)

Analysis emerges first as algebra and then as calculus. Algebra acquires a significant role. Geometry gives way to analysis as the leading area of activity. Suggested topics are logarithms, theory of equations, theory of numbers, probability, statistics, analytic and synthetic geometry, the boost from science, calculus, infinite series.

G. MATHEMATICS IN THE 19TH AND 20TH CENTURIES (5 hours)

Non-Euclidean geometry sets the stage for abstract mathematical systems that do not necessarily describe the physical universe. Geometry and algebra evolve into abstract mathematical systems. Set theory and logical foundations are developed. Gradually there is an increased recognition of the importance of each area of mathematics as a useful approach to the study of the mathematical sciences. Statistical methods, the use of computers, and a continued emphasis upon applications are important aspects of the ongoing development of the mathematical sciences.

V. Methodology and Procedure

Classroom lectures and discussions. Individual and/or group reports will also be used at the discretion of the instructor.

VI. Probable Texts

Eves, Howard, Great Moments in Mathematics (Before 1650), Dolciani Mathematical Expositions, Number Five, Mathematical Association of America, Washington, DC, 1980.

Eves, Howard, Great Moments in Mathematics (Since 1650), Dolciani Mathematical Expositions, Number Seven, Mathematical Association of America, Washington, DC, 1982.

VII. Other Readings

Selected readings at the discretion of the instructor (see bibliography).

VIII. Evaluation

Examinations, quizzes, and classroom participation, including individual and/or group reports.

IX. Scholarly Papers/Research Requirements

None.

X. Supplemental/Field Experiences

None.

XI. Other requirements that have not been specified above

None.

BIBLIOGRAPHY

Aaboe, Agar, Episodes from the Early History of Mathematics. New Mathematical Library, No. 13. The Mathematical Association of America, Washington, D.C., 1964.

Bell, E. T., Men of Mathematics. Simon and Schuster, Inc., New York, 1937.

Boyer, Carl B., A History of Mathematics. John Wiley and Sons, New York, 1968.

Cajori, Florian, A History of Mathematical Notations (2 vols.). Open Court Publishing Company, Chicago, 1928-29.

Eves, Howard, An Introduction to the History of Mathematics (5th edition). Saunders, Philadelphia, 1983.

Eves, Howard, Great Moments in Mathematics (Before 1650). Dolciani Mathematical Expositions, Number Five, Mathematical Association of America, Washington, D.C., 1980.

Eves, Howard, Great Moments in Mathematics (After 1650). Dolciani Mathematical Expositions, Number Seven, Mathematical Association of America, Washington, DC, 1982.

Wallerberg, Arthur E., et al, eds., Historical Topics for the Mathematics Classroom, Thirty-First Yearbook. National Council of Teachers of Mathematics (NCTM), Reston, VA, 1969.

Kline, Morris, Mathematical Thought from Ancient to Modern Times. Oxford University Press, New York, 1972.

Kline, Morris, Mathematics and the Physical World. Dover Publications, Inc., New York, 1959.

Kline, Morris, Mathematics in Western Culture. Oxford University Press, New York, 1953.

Smith, David Eugene, History of Mathematics (2 vols.). Dover Publications, Inc., New York, 1958.

From: GROVE::JBURIOK
To: CCULLUM
CC: JBURIOK
Subj: Screening Committee LS Questions

Charles: I sent Darlene Richardson a message about the items your screening committee said needed LS approval. I will forward that message to you. Below is Darlene's reply. Is this enough of a response to your committee's concerns involving MA 271, MA 350, MA 123, and MA 124? If not, please tell me what I need to do.

Jerry Buriok

From: GROVE::DRCHRDSN "Darlene Richardson, Liberal Studies" 14-NOV-1997 11 :32:58.92
To: GROVE::JBURIOK
CC: DRCHRDSN, CCULLUM
Subj: RE: LS questions - Screening Committee

Hi, Jerry. The designation of a course as writing-intensive is not part of the approval process of the course (reference to MA 271 and MA 350). The reasons for this is that a course may be taught writing-intensive one semester but not another; another reason is that one section of the course may be writing-intensive, but another section may be non-writing-intensive even in the same semester. You have notified the LS office that the objectives and writing assignments in MA 271 and MA 350 will remain the same, so that the Type II writing approval continues. Because the content and objectives of MA 123 and 124 are essentially the same (just a name change), simply send a memo to that effect to the LS office. Darlene

MAIL>