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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 460 Comp&Calc Sec Sc Ma
Suggested 20 character title

____ New Course* _____
Course Number and Full Title

X Course Revision — MA 460 Computers and Calculators in Secondary School Mathematics Instruction
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

X Number and/or Title Change — MA 460 Computers and Calculators in Secondary School Mathematics Instruction
Old Number and/or Full Old Title

MA 460 Technology in Mathematics Instruction
New Number and/or Full New Title

X Course or Catalog Description Change — MA 460 Computers and Calculators in Secondary School Mathematics Instruct
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)

Department Curriculum Committee — Department Chair — 9/15/97

College Curriculum Committee — 10/15/97 — College Dean — 10/15/97

÷Director of Liberal Studies (where applicable) — *Provost (where applicable)

2. Summary of the proposed revisions.

Title:
The title will change from Computers and Calculators in Secondary School Mathematics Instruction to Technology in Mathematics Instruction.

Catalog description
The catalogue description will change from:

Students will explore how computers and calculators can be used as tools to enhance the instruction in secondary school mathematics.

to:

This course is designed to provide preservice mathematics teachers with expertise in instructional technology for teaching mathematics at the secondary level. Pedagogical and content knowledge are integrated within the context of technology and current curriculum reforms.

Course revisions: Topics, hardware and software have been updated to include the following: graphing calculators, Calculator Based Laboratory (CBL), distance education, video taping, internet resources, presentation software.

3. Justification for the changes.

Title: The new title reflects the inclusion of more technology than simply computers and calculators.

Catalog description: The catalog description has been up-dated to give a more accurate description of the revised course.

Course revisions: Both technology and software have greatly changed since this course was developed in 1987. For example, the internet did not exist at that time and graphics calculators were in their infancy. The new topics reflect those changes which we feel will most benefit mathematics teachers in the secondary classroom.

Course Syllabus

## I. Catalog Description

MA 460 Technology in Mathematics Instruction

3 credits
3 lecture hours
0 lab hours
(3c-0l-3sh)

Prerequisites: CO 205

This course is designed to provide preservice mathematics teachers with expertise in instructional technology for teaching mathematics at the secondary level. Pedagogical and content knowledge are integrated within the context of technology and current curriculum reforms.

## II. COURSE OBJECTIVES

The overall goal of this course is for students to learn to integrate appropriate technology in the teaching of mathematics. A laboratory approach to instruction will provide students experience with instructional tools for teaching in the 21st century.

Specific instructional objective for this course include:

1. The students will be able to use technology in the teaching of secondary school mathematics.
2. The students will become aware of current national policies and trends in the use of technology in secondary mathematics.
3. The students will have hands-on experience with a wide variety of modern technologies.
4. The students will be able to integrate technology in the teaching of pre-algebra, algebra, probability, statistics, geometry, calculus, and discrete mathematics.
5. The students will become better problem-solvers in mathematics through using technology.
6. The students will become capable of using technology to encourage more active learning from secondary school mathematics students.
7. The students will gain a deeper conceptual understanding of mathematical content taught in secondary schools.
8. The students will be exposed to research and literature related to technology.

To accomplish these goals, students will work with:

computers
a variety of software tools for teaching mathematics
calculators
telecommunication systems
other modern technology

## III. COURSE OUTLINE

| | Weeks |
|---|---|
| A. Introduction to Technology in Mathematics Education | 1 week |
| 1. Review of Literature | |
| 2. Current Research | |
| B. Using Technology to Teach Mathematics | |
| 1. Computer Software | 6 weeks |
| a. Spreadsheets/Graphing | |
| b. Database | |
| c. Applied Mathematics software | |
| d. Algebraic software | |
| e. Geometry software | |
| f. Problem-solving software | |
| g. Internet Resources | |
| h. Presentation software | |
| 2. Calculators | 3 weeks |
| a. Non-programmable | |
| b. Scientific | |
| c. Graphing Calculators | |
| d. CBL:Calculator-based laboratory | |
| 3. Other Technology | 3 weeks |
| a. Distance learning | |
| b. Videotaping | |
| C. Student Project Presentations | 1 week |

## IV. EVALUATION METHODS

Evaluation of student performance will be base upon:

| | |
|---|---|
| Class Work/Participation | 20% |
| Tests/Quizzes | 30% |
| Projects | 30% |
| Portfolio | 20% |

## V. REQUIRED TEXTBOOKS, SUPPLEMENTAL BOOKS AND READINGS

Required textbook: There is no required text.

## VI. SPECIAL RESOURCE REQUIREMENTS

This course requires the availability and use of a computer lab, a classroom set of graphing calculators with an overhead display unit, and video technology equipment.

## VII. BIBLIOGRAPHY


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Heid, M. K., & Baylor, T. (1993). Computing technology. In P. S. Wilson (Ed.), Research ideas for the classroom: High school mathematics. New York: Macmillan.

Hirschbuhl, J. H., & Bishop, D. (1996). Computers in education (7 ed.) Dushkin Publishing Group/ Brown & Benchmark Publishers: Guillford, CT.

Hopkins, M.H. (1992). The use of calculators in assessment of mathematics achievement. In J.T. Fey (ed.), Calculators in mathematics education (pp. 158-166). Reston, VA: National Council of Teachers of Mathematics.

Kaput, J.J. (1992). Technology and mathematics education. In D. A. Grouws (Ed.) Handbook of research on mathematics teaching and learning (pp. 515-556). New York: Macmillan.

Mercer, J. (1992). What is left to teach if students can use calculators? The Journal of Technological Horizons in the Classroom, 34(September), 415-417.

Munday, R., Stamper J., & Windham, R. (1991). Teachers must become better prepared to teach with the use of technology. Educational Technology, 31(3), 29-31.

Nichols, J. A., & Taylor, L. J. C. (1994). Graphing calculators are becoming increasingly important in the middle school, as well as the high school Mathematics Teaching in the Middle School, 1(3), 190-196.

Py, D. (1993). The use of computer software to ease the process of solving proofs. Computers and Education, 20(1), 141-146.

Romberg, T. A., & Carpenter, T. P. (1986). Research on teaching and learning mathematics: Two disciplines of scientific inquiry. In M. C. Wittrock (Ed.), Handbook of research on teaching, Third edition (pp. 850-873). New York: Macmillan Publishing Co.

Sandholts, J. H., Ringstaff, C., & Dwyer, D. C. (1997). Teaching with technology: Creating student-centered classrooms. Williston, VA: Teachers College Press.

Steen, D. R., Roddy, M.R. Sheffeld, D. & Stout, M.B. (1995). Teaching with the internet, Resolution Business Press, Inc.: Bellevue, WA.

Wilson, J. W., & Kilpatrick, J. (1989). Theoretical issues in the development of calculator-based mathematics tests. In J. W. Kenelly (Ed.) The use of calculators in the standardized testing of mathematics. New York: College Entrance Examination Board.

Zimmerman, W., & Cunningham, S. (Eds.) (1991). Visualization in teaching and learning mathematics. Washington, DC: Mathematical Association of America.

Other Selected Journals:

Educational Technology
Journal for Research in Mathematics Education
The Journal of Techological Horizons in the Classroom
Learning and Leading with Technology
The Mathematics Teacher
School Science and Mathematics
Teaching Mathematics in the Middle School

Course Syllabus

Date: February 29, 1986

Submitted by: Marlin E. Hartman

Department: Mathematics

I. MA 460 Computers and Calculators in Secondary School Mathematics

II. Catalog Description:
Students will explore how computers and calculators can be used as tools to enhance the instruction in secondary school mathematics. Prerequisites: CO 200 and CO 110. Three lecture hours per week.

III. Course Rationale and Objectives:
Calculators, and computers are playing an ever increasing role in the doing of mathematics and consequently should be employed in the learning of mathematics. This course is intended to educate students in the uses of computers and calculators in the doing and learning of mathematics.

At the present, our curriculum is constructed upon the assumption that this computing power is not available. In the near future (see April, 1985 issue of the Mathematics Teacher), radical changes will take place in the emphasis of what we teach in the secondary schools. Our students need to be prepared to understand and implement these changes in the curriculum.

In addition to the change in curriculum, the computer offers new pedagogical opportunities. The course is intended to demonstrate how the dynamics of the classroom can be affected by this technology. Therefore our students will be able to take advantage of this technology from both a mathematical and pedagogical point of view.

IV. Course Outline

A. Philosophical and Psychological Issues of Computers in Instruction

1. General uses of the computer in the classroom
   a. Computer assisted instruction
   b. Computer managed instruction
   c. the computer as a problem solving tool
   d. the computer as a pedagogical tool
   e. limitations of the above as determined by research results

2. How the computer functions in:
   a. expository teaching
   b. discovery teaching
   c. individualized instruction

B. The Computer and the Curriculum

1. Algebra. Discussion of the use of the computer in teaching algebra. These discussions will include how the computer might be used to instruct students in the following topics.
   a. equations
   b. Pythagorean theorem
   c. ratio and proportion
   d. Cramer's rule
   e. Quadratic formula
   f. graphing

2. Geometry. The students will explore how computer language can be used as an environment in studying concepts of distance, congruence, similarity, arc length and angle measurement, as well as other geometrical concepts of secondary school mathematics. The students will see how the work of the Turtle (LOGO) can be used to construct an axiomatic system, thus eliciting a greater understanding of Euclidean geometry and creating a need for proof.

3. Probability and statistics.
   a. Monte Carlo methods
   b. Binomial theorem
   c. Random walks on a computer
   d. Using statistical packages

4. Simulation and modeling
   a. Dynamo
   b. Visicalc for modeling mathematical problems
   c. Using numerical simulations software

5. Trigonometry and calculus
   a. Functions
   b. wrapping function
   c. functional notation
   d. roots and graphs of functions
   e. limits
   f. differentiation and integration (an historical approach)

6. Number theory
   a. Prime tests and generators
   b. Euclidean algorithm
   c. Perfect, abundant, and deficient numbers
   d. Polygonal numbers
   e. Sorting numbers

C. Other Issues in Technologically Enhanced Instruction

1. Teacher authoring
   a. Superpilot
   b. methods of evaluating software
   c. software development

2. Classroom Management
   a. How to manage and maintain equipment

3. Resources
   a. Projects (i.e., MECC, CONDUIT)
   b. Public Domain materials

V. Methodology and Procedures

Classroom lectures and discussion. Much of the instruction will be in a microcomputer laboratory setting with the students engaged in a hands-on approach to learning.

VI. Probable Text

Materials for this course will be prepared primarily by the instructor.

VII. Other Readings

Selected articles from current journals.

VIII. Evaluation

Examinations, quizzes, classroom participation, and individual laboratory projects/programs.

IX. Scholarly Papers/Research Requirements

None.

X. Supplemental/Field Experiences

None.

XI. Other requirements that have not been specified above.

None.