

INDIANA UNIVERSITY OF PENNSYLVANIA
SENATE CURRICULUM COMMITTEE B-2

20

NEW COURSE PROPOSAL

Course Prefix and Number: MA 457

Course Title: Computers and Calculators in Secondary School Mathematics
Instruction

Department: Mathematics

Person to Contact for Further Information: Dr. Marlin E. Hartman

Course Affected: None

Desired Effective Semester for Change: Fall Semester 1987

Approvals:

Department Committee Chairperson

Marlin E. Hartman

Department Chairperson

John Brroughton

Charles W. Ryan

John [unclear]

School Committee Chairperson

Charles W. Ryan

School Dean

A. DESCRIPTION AND ACADEMIC NEED

- A1. See attached catalog description of course.
- A2. See attached course syllabus.
- A3. This course is intended for secondary school mathematics education majors only. It is not intended for inclusion on the regular General Education course list. It responds to the need of our graduates in mathematics education to be prepared to meet the challenge of the new technology afforded by computers and calculators in the doing and learning of mathematics. It also is in accordance with recommendations made in the 1983 report of the CIPM Panel on Teacher Training of the Mathematical Association of America and guidelines developed by the Commission on the Education of Teachers of Mathematics of The National Council of Teachers of Mathematics.
- A4. This proposed course is part of a package proposal for revision of the secondary mathematics education program. It does not require changes in content of other existing courses.
- A5. This course follows the traditional type of offering by the department. However, much of the instruction will be in a microcomputer laboratory setting with the students engaged in a hands-on approach to learning.
- A6. This course has never been offered at IUP on a trial basis.
- A7. This course is not to be a dual-level course.
- A8. There are no known institutions of higher education in our general area which currently offer an undergraduate level course specifically directed toward the use of computers and calculators in secondary school mathematics instruction.
- A9. As stated above, the course was designed following recommendations made by the Committee on the Undergraduate Program of the Mathematical Association of America in its 1983 report entitled "Recommendations on the Mathematical Preparation of Teachers" and according to guidelines developed by the Commission on the Education of Teachers of Mathematics of The National Council of Teachers of Mathematics in their report entitled "Guidelines for the Preparation of Teachers of Mathematics".

B. INTERDISCIPLINARY IMPLICATIONS

- B1. This course will be taught by one instructor.
- B2. No additional or corollary courses are needed with this course. However, it is hoped that the Computer Science Department will obtain the approval of two proposed courses that can be used as prerequisites in place of CO 200 and CO 110.
- B3. There is no direct relationship of the content of this course to the content of courses offered by other departments.

B4. This course is not applicable in a program of the School of Continuing Education directed to a clientele other than our full-time students.

C. EVALUATION

C1. Written examinations, quizzes, laboratory projects, and classroom participation are expected to be used to evaluate student progress.

C2. This course may not be taken for variable credit.

D. IMPLEMENTATION

D1. Resources, including faculty, space and library materials, are presently adequate to teach this course. Depending upon future enrollment in the mathematics education program, however, additional microcomputers and peripheral equipment may be required.

D2. At the present time, on the basis of the current number of mathematics education majors, we expect to offer this course each semester during the regular academic year.

D3. We presently anticipate one section each time the course is offered.

D4. We plan to accommodate a maximum of 18 students in a section of this course.

E. MISCELLANEOUS

All pertinent information has been included in the above.

COURSE SYLLABUS

Date Submitted: February 28, 1986

Submitted By: Marlin E. Hartman

Department: Mathematics

I. MA 457 Computers and Calculators in Secondary School Mathematics Instruction

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 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. The computer in 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 world 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. Simulations and modeling

- (a) Dynamic
- (b) Visuals 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, CAVDIT)
- (b) Public domain materials

V. Methodology and Procedure

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

Material 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.