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CURRICULUM PROPOSAL COVER SHEET
University-Wide Undergraduate Curriculum Committee

I. **CONTACT**

Contact Person James L. Wolfe Phone x6104

Department Computer Science

II. **PROPOSAL TYPE (Check All Appropriate Lines)**

XX **COURSE** Intro to Num Methods
Suggested 20 character title

____ New Course* _____
Course Number and Full Title

XX Course Revision CO 250 Introduction to Numerical Methods
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 Title

____ 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

_____ _____
College Curriculum Committee College Dean

_____ _____
+Director of Liberal Studies (where applicable) *Provost (where applicable)

Part II. Description of the Curriculum Change

1. Catalog Description and New Syllabus

CO 250 Introduction to Numerical Methods 3c-0l-3sh
Prerequisites: CO 110, MA 122 or MA 123 or MA 127
Algorithmic methods for function evaluation, roots of equations, solutions to systems of equations, matrix operations, curve fitting, interpolation, numerical integration and differentiation; errors in computation.

Syllabus - see attachment A.

2. Summary of proposed revision.

The prerequisites omit MA 102 which is listed in the current catalog description.

3. Rationale for the revision.

MA 102 has not been taught by the Mathematics Department for more than two years. Elimination of the MA 102 prerequisite makes it no longer necessary to waive this requirement for CO 250. Also, MA 102 did not contribute substantially to the background needed by a student in CO 250 - if was originally required to insure some mathematical maturity on the part of the students in CO 250. The Computer Science Department now considers MA 122 or MA 123 or MA 127 as providing sufficient maturity for CO 250.

4. Old syllabus.

See attachment B.

5. Letters of Support.

See attachment C.

IUP Computer Science Department
CO250 Introduction to Numerical Methods

Course Syllabus

I. CATALOG DESCRIPTION

CO250 Introduction to Numerical Methods 3c-01-3sh

Prerequisite: CO110, MA122 or MA123 or MA127

Algorithmic methods for function evaluation, roots of equations, solutions to systems of linear equations, matrix operations, curve fitting, interpolation, numerical integration and differentiation; errors in computation.

II. COURSE OBJECTIVES

1. Students should know the role of and the limitations of the computer in solving mathematical and engineering problems.

2. Students should know how to implement mathematical algorithms using the Fortran 90 programming language.

3. Students should know how to use software packages such as Matlab as an aid in solving numerical problems.

4. Students should know selected numerical algorithms for solving a variety of commonly encountered mathematical problems.

III. COURSE OUTLINE

	Topic	Hours
1.	Introduction	
	a. Problem Solving	2
	b Matlab	2
	c Fortran 90	3
2.	Fundamental Computations	
	a. Number Representation and Errors	2
	b. Scalar and Array Computations	2
	c. Statistical Measurements	2
	d. Matrix Computations	2
	e. Plotting Capabilities in MatLab	2
3.	Numerical Algorithms	
	a. Locating roots of Equations	5
	b. Solutions to Systems of Linear Equations	6
	c. Interpolation and Curve Fitting	6
	d. Polynomial Analysis	6
	e. Numerical Integration and Differentiation	6

IV. EVALUATION METHODS

The final grade for the course will be determined as follows:

50% Tests. At least two tests (mid term and final) consisting of mathematical problems and programming questions.

50% Homework and Projects.
At least six computer projects will be assigned. Projects will be graded on output and style. Short homework papers from the textbook problem sets may also be assigned.

V. REQUIRED TEXTBOOKS, SUPPLEMENTAL BOOKS AND READINGS

Textbook: Etter, D.M., Engineering Problem Solving with Matlab, Prentice Hall, 1993.

Supplemental Books: Metcalf, Michael and John Reid, Fortran 90 Explained, Oxford University Press, 1990.

VI. SPECIAL RESOURCE REQUIREMENTS

There are no special resource requirements for this course.

VII. BIBLIOGRAPHY

Burden, Richard and J. Douglas Faires, Numerical Analysis, Third Edition, Prindle, Weber & Schmidt, 1985.

Cheny, Ward and David Kincaid, Numerical Mathematics and Computing, Third Edition, Brooks/Cole, 1994.

Fortran 90, ISO/IEC JTC1/SC22/WGS Internal document N692 Submitted as Text for ISO/IEC 1539:1991, 1991.

Lastman, Gary J. and Naresh K. Sinha, Microcomputer-Based Numerical Methods for Science and Engineering, Saunders, 1989.

Mathews, John H., Numerical Methods for Mathematics, Science, and Engineering, Prentice Hall, 1992.

CO 250 - SYLLABUS

Catalog Description

CO 250 INTRODUCTION TO NUMERICAL METHODS 3 s.h.

Prerequisites: CO 110, MA 102, MA 122 or MA 123 or MA 127

Algorithmic methods for function evaluation,, roots of equations, solutions to systems of equations [operations], matrix operations, curve fitting, interpolation, numerical integration and differentiation, errors in computation.

COURSE SYLLABUS

OBJECTIVE: To provide the student an introductory understanding of a structured, algorithmic, computer-oriented approach to some basic techniques of numerical analysis. Additional experience in FORTRAN is afforded, together with experience in use of standard numerical software packages, and graphical display/analysis of subject functions.

Representative Course Outline:

I. Preliminary Topics:

a. Review of calculus
b. Computer arithmetic, "round-off" (chopping) errors, loss of significance
c. Algorithms and convergence
d. Function approximation, Taylor polynomials, truncation error
e. Review and reinforcement of FORTRAN; use of software libraries.

[Project 1]

II. Roots of Equations in One Variable:

a. Bisection method
b. Fixed-point iteration
c. Newton, Secant, Mueller methods
d. Error analysis for iterative methods

[Project 2, with graphics, curve-plotting]

TEST 1

III. Interpolation; Polynomial Approximation

a. Lagrange polynomials
b. Iterated interpolation - methods of Neville and Aitken
c. Divided differences, Newton formulas
d. Cubic spline interpolation

[Project 3, with curves]

IV. Numerical Differentiation and Integration

a. Differentiation methods
b. Richardson extrapolation
c. Newton-Cotes and composite integration rules
d. Romberg method
e. Gaussian quadrature

[Project 4]

TEST 2

V. Systems of Linear Equations

a. Gaussian elimination and backward substitution
b. Elementary concepts of linear algebra-matrix inversion-determinant
c. Pivoting strategies
d. Special types - band, tridiagonal, symmetric matrices
e. Direct factorization - LU, Doolittle, Crout, Choleski

[Project 5]

VI. Least-Square Approximation

a. Matrix methods for linear combination of approximating functions

FINAL EXAM

To: James Wolfe, Chairman
Computer Science Department Curriculum Committee

From: Gerald Buriok, Chairman GMB
Mathematics Department

Date: October 19, 1993

Subject: Prerequisite Change for CO 250

As you are aware, when the Computer Science Department revised the undergraduate curriculum two years ago, an agreement was reached with the Mathematics Department to delete the requirement of MA 102 Finite Mathematics and replace it with MA 219 Discrete Mathematics. Since that time, the Mathematics Department has phased MA 102 out and has begun to phase in MA 219. MA 102 will not be offered on a regular basis in the near future, so deleting MA 102 from the list of prerequisites is the appropriate action to take. Furthermore, the content of CO 250 need not be changed since MA 102 was listed as a prerequisite only to ensure the proper level of mathematical maturity for entering CO 250. The calculus prerequisite should accomplish this same goal.