

MISSOURI WESTERN STATE UNIVERSITY

SCHOOL OF LIBERAL ARTS AND SCIENCES

DEPARTMENT OF COMPUTER SCIENCE, MATHEMATICS, AND PHYSICS

COURSE NUMBER: MAT 217

COURSE NAME: Mathematics and Technology

COURSE DESCRIPTION:

An introduction to numerical methods and symbolic computation using a computer algebra system. Iterative and recursive algorithms will be used to explore mathematical problem-solving techniques such as factoring and simplifying expressions, solving equations, differentiation and integration, and plotting curves and surfaces.

PREREQUISITE:

A grade of C or better in MAT 177.

TEXT:

None Required

Additional Resources:

Python Programming Language and Documentation available at <http://www.python.org>
Guide to Scientific Computing by Peter Turner, 2nd Edition, CRC Press, 2000 (tentative)
Introductory Scientific Computing by Landau, Princeton University Press, 2005
Introduction to Maple by Andre Heck, 3rd Edition, Springer-Verlag, 2003
Mathematical Computing: An Introduction to Programming Using Maple by Betounes and Redfern, Springer-Verlag, 2002
Maple Programming Guide, Maplesoft, 2011

TECHNOLOGY:

This course emphasizes the use of technology and computer software for mathematical problem-solving. Students will work with a computer algebra system (e.g., Maple, Mathematica, Sage, etc.) in a computer lab.

COURSE OBJECTIVES:

The course introduces basic techniques of computational mathematics. Students will learn the skills and judgment necessary for the effective use of a computer algebra system for mathematical problem-solving. Through computational examples, the course will reinforce students' understanding of mathematical concepts learned in previous courses.

Successful students will be able to:

1. Appreciate the features and limitations of computational methods and computer algebra systems.
2. Effectively use the functions and procedures of a computer algebra system.
3. Construct and implement algorithms for solving mathematical problems.

STUDENT COMPETENCIES:

In order to meet the above objectives, successful students will:

1. Understand loss of precision and error propagation associated with computational mathematics.
2. Implement basic programming structures (conditional statements, loops, etc.) required for construction of simple iterative and recursive algorithms.
3. Construct mathematical functions and procedures using a computer algebra system.
4. Expand, factor, and simplify mathematical expressions using a computer algebra system.
5. Compute approximate solutions of equations using iterative algorithms.
6. Perform curve-fitting and interpolation for a given set of data values.
7. Perform numerical differentiation and integration using mathematical algorithms.
8. Perform differentiation and integration using symbolic computation.
9. Solve systems of linear equations using matrix methods.
10. Create two- and three-dimensional plots using a computer algebra system.

COURSE OUTLINE:

- I. Number Representation and Error
- II. Iterative Solution of Equations
- III. Approximate Evaluation of Functions
- IV. Interpolation
- V. Numerical Calculus
- VI. Differential Equations

VII. Linear Equations