I. Course Title
   • Numerical Analysis

II. Course Prefix/Number
   • MATH 330

III. Credit Hours
   • 3

IV. Prerequisites
   • MATH 121 minimum grade: C AND (CSCI 150 minimum grade: C OR CSCI 208 minimum grade: C OR MATH 210 minimum grade: C).

V. Catalog Description
   • The study, development, implementation, and analysis of algorithms for obtaining numerical solutions to various mathematical problems. Typical topics include error analysis, stable and unstable computations, rates of convergence, solutions of nonlinear equations, solutions of systems of linear equations, function approximation and interpolation, optimization, numerical differentiation and integration, and numerical solutions to ordinary differential equations.

VI. Curricular Relationships
   • This course is required of Mathematics majors, Mathematics-Secondary Teacher Licensure majors, and Mathematics-Physics Emphasis majors. It is also taken by many students attempting to gain entry to medical school. This course enhances content knowledge in the following state model content standards areas of mathematics: 1, 2, 5, and 6.

VII. Student Learning Outcomes
   • Students will be able to develop and implement numerical schemes for solving a variety of mathematical problems.
   • Students will be able to analyze numerical algorithms in terms of accuracy, speed, stability, and convergence.
   • Students will be able to determine the best algorithm(s) for a particular purpose.
   • Students will be able to demonstrate competency in using standard numerical techniques and algorithms.
• Students will demonstrate knowledge and understanding of the mathematics of scientific computing.

VIII. Content Outline
• Computer Arithmetic, error analysis, stability analysis and conditioning, and rates of convergence.
• Solution of single variable equations using bisection, functional iteration, Newton-Raphson method, and Secant methods.
• Methods for solving systems of linear equations, including LU and Cholesky factorizations, Gaussian elimination with pivoting, and steepest descent and Conjugate Gradient methods.
• Function approximation and interpolation using Taylor series, Lagrange polynomials, splines, and adaptive approximation.
• Numerical integration and differentiation, including Simpson's rule, trapezoidal rule, adaptive quadrature, and other techniques.
• Numerical solution of Ordinary Differential Equations, using Taylor series, Runge-Kutta, and multistep methods.

IX. Course Procedures/Policies/Grading Scale
• Homework: Regular assignments are a component in determining the course grade.
• Exams: The course typically has three to four examinations and a comprehensive final examination.
• Students frequently use a mathematics software package on their homework and will be required to write programs.

X. Required/Recommended Readings

XI. Issues Unique to this Course
• None.

XII. Additional Departmental Issues
• None.