



## MATH 345 Numerical Methods (Required Course)

**Code and Name:** MATH 345 Numerical Methods

**Credit Hours:** 3 (Lecture: 3, Tutorial: 1)

**Textbook:**

- Numerical Methods for Engineers, Chapra, S.C., Raymond P. Canale, 7<sup>th</sup> Edition, McGraw Hill, 2015

**Other References:**

- Applied Numerical Methods with MatLab for Engineers and Scientists, Chapra, S.C., 3<sup>rd</sup> Edition, McGraw Hill, 2005.

**Course Description:**

Introduction to numerical methods for students in science and engineering, Topics include floating-point computation, systems of linear equations, approximation of functions and integrals, the single nonlinear equation, and the numerical solution of ordinary differential equations. Applications in science and engineering: include some programming as well as the use of high quality mathematical library routines.

**Pre-requisites:** MATH 226 Linear Algebra, MATH 235: Differential Equations, CS 107: Computer Programming

**Co-requisites:** None

**Course Learning Outcomes:**

With relation to ABET Student Outcomes (SOs: 1-7)

1. Describe fundamental principles of mathematical modeling, numerical methods and problem solving (1, 6)
2. Develop programs with MATLAB (1, 2, 4, 6)
3. Recall methods for finding Roundoff and truncation errors (1, 6)
4. Explain how to find roots of nonlinear equation using bracketing and open methods (1, 6)
5. Explain how to solve linear algebraic equations: Gauss Elimination (1, 6)
6. and Iterative Methods (1, 6)
7. Explain the basic knowledge of linear regression, general linear least-squares and nonlinear regression (1, 6)
8. Formulate and solve numerical integration formulas (1, 6)
9. Formulate and solve numerical differentiation (1, 6)
10. Identify and solve initial-value problems (1, 6)
11. Demonstrate how to participate in class discussion and act efficiently to provide opinion on a topic (5)
12. Develop ability to share ideas with colleagues (5)

**Topics to be covered:**

- Mathematical Modeling, Numerical Methods and Problem solving
- MATLAB fundamentals and Programming with MATLAB
- Roundoff and Truncation Errors
- Roots: Bracketing and Open Methods
- Linear Algebraic Equations and Matrices: Gauss Elimination and Iterative Methods
- Linear Regression and General Linear Least-Squares and Nonlinear Regression
- Numerical Integration Formulas
- Numerical Differentiation
- Initial-Value Problems

**Grading Policy:**

The grading for the course are 60% coursework and 40% Final Exam. The course work consists of two Midterm Exams, where each midterm exam is worth 20%. It also includes quizzes, homework, and projects for the remaining 20% that is modified by the course instructor.

