

**The University of Texas at Tyler**  
**Mechanical Engineering Bachelor of Science**

**ENGR 4326 – Numerical Methods (Elective)**

**Syllabus**

**Catalog Description:**

A basic exploration of the numerical methods used in the solution and analysis of engineering problems. Focus will be given to linear systems, ordinary differential equations, and partial differential equations.

**Prerequisites:** MATH 3305, successful completion of a structured programming language course.

**Credits:** 3 ( 3 hours lecture, 0 hours laboratory per week )

**Text(s):** *Numerical Methods for Engineers*, Chapra and Canale, 5<sup>th</sup> edition, McGraw-Hill, 2006

**Additional Material:** None

**Course Coordinator:** Costas Christofi

**Topics Covered:**

Taylor Series; Root solution techniques; Matrix solution methods; Least squares regression; interpolation; Fourier methods; Runge-Kutta solutions; Finite element methods; Finite difference methods.

**Evaluation Methods:**

1. Examinations / Quizzes
2. Homework
3. Reports
4. Computer Programming
5. Project
6. Presentation
7. Course Participation
8. Peer Review

**Course Objectives<sup>1</sup>:** By the end of this course students will be able to:

1. solve for the roots of complex equations by several techniques [1-3]
2. solve systems of equations via matrix solution methods [1-3]
3. curve-fit equations through least squares regression [1-3]
4. numerically solve ordinary differential equations [1-3]
5. numerically solve partial differential equations [1-3]
6. program numerical methods into computers [3]

<sup>1</sup>*Numbers in brackets refer to method(s) used to evaluate the course objective.*

**Relationship to Program Outcomes<sup>2</sup>:** This course supports the following Electrical Engineering Program Outcomes, which state that our students will be able to:

1. have the ability to apply knowledge of the fundamentals of mathematics, science, and

- engineering [1-6].
2. have the ability to use modern engineering tools and techniques in the practice of electrical engineering [1-6].
  3. have the ability to analyze electrical circuits, devices, and systems [1-6].
  4. have the ability to design electrical circuits, devices, and systems to meet application requirements [1-9].
  5. have the ability to design and conduct experiments, and analyze and interpret experimental results.
  6. have the ability to identify, formulate, and solve problems in the practice of electrical engineering using appropriate theoretical and experimental methods [6].
  7. have effective written, visual, and oral communication skills [6].
  8. possess an educational background to understand the global context in which engineering is practiced, including [2]:
    - a. knowledge of contemporary issues related to science and engineering.
    - b. the impact of engineering on society.
    - c. the role of ethics in the practice of engineering.
  9. have the ability to contribute effectively as members of multi-disciplinary engineering teams.
  10. have a recognition of the need for and ability to pursue continued learning throughout their professional careers.

This course supports the following Mechanical Engineering Program Outcomes, which state that our students will be able to:

1. apply science, mathematics, and modern engineering tools and techniques to identify, formulate and solve engineering problems [1-5]
2. be able to design thermal/fluid, mechanical, and electro-mechanical components or systems, individually or on interdisciplinary teams, and effectively communicate those designs in both technical and non-technical forums
3. be able to collect, analyze, and interpret data from prescribed and self-designed experimental procedures and formally communicate the results [1-5]
4. be able to apply a broad-based educational experience to understand the interaction of engineering solutions with contemporary business, economic, and social issues
5. recognize that ethical behavior and continuous acquisition of knowledge are fundamental attributes of successful mechanical engineering professionals
6. pass the Fundamentals of Engineering examination

<sup>2</sup>Numbers in brackets refer to course objective(s) that address the Program Outcome.

**Contribution to Meeting Professional Component: (in semester hours)**

Mathematics and Basic Sciences:		hours
Engineering Sciences and Design:	3	hours
General Education Component:		hours

**Prepared By:** Costas Christofi

**Date:** January 30, 2008