EG421
Numerical Methods
[Onsite]

Course Description:

This course addresses numerical solutions for a number of common problems in mathematics, including methods such as interpolation, numerical integration, finding roots of higher-order equations and least-squares approximations.

Prerequisite(s) and/or Corequisite(s):

Prerequisite: An introductory level Calculus course

Credit hours: 4

Contact hours: 40 (40 Theory Hours)

STUDENT SYLLABUS

Instructor: _____

Office hours: _____

Class hours: _____

Course Overview

This course is a survey of Numerical Methods. This course contains methods to approximate the roots of equations, solving systems of linear equations. In addition, the course contains methods of interpolation, using series to approximate real numbers and functions, and methods for fitting curves to data. It also contains methods to compute derivatives of functions and for numerically estimating the value of definite integrals. Except for introductory calculus, the course contains all pre-requisite material that students require to understand the Numerical Methods covered here.

Major Instructional Areas

- Errors and their types
- Binary arithmetic
- Euclid's algorithm
- Horner's method for synthetic division
- Equations in one variable
- Systems of linear equations
- Interpolation and curve fitting
- Series
- Numerical differentiation
- Numerical integration

Course Objectives

Upon successful completion of this course, the student should be able to:

1. Convert numbers from binary to decimal/octal format and vice-versa.
2. Distinguish between errors and relative errors.
3. List the types of errors in numerical calculations.
4. State Euclid's algorithm for polynomials over integers.
5. State the Remainder theorem.
6. State the Factor theorem.
7. List the algorithm for Horner's method.
8. Use Horner's method to divide polynomials by a linear factor.
9. Approximate the roots of an equation using Numerical Methods.
10. Solve an upper triangular or a lower triangular system.
11. Use the Gauss Elimination method to solve a system of equations.
12. Find interpolating functions fitting given data.
13. Apply the Binomial series to simplify expressions.
14. Compute the least squares line and parabola fitting given data.
15. Define Cubic Splines.
16. Compute the derivative of a function using Numerical Methods.
17. Compute definite integrals using the trapezoidal method, Simpson's rule, and Simpson's 3/8 rule.
18. Use the Golden Ratio Search method to find the relative minimum of a unimodal function.
19. Use difference methods to find patterns in sequences.

Teaching Strategies

Curriculum is designed to promote a variety of teaching strategies that support the outcomes described in the course objectives and that foster higher cognitive skills. Delivery makes use of various media and delivery tools in the classrooms.

Student Textbook

- Numerical Methods, Pearson Custom Publishing, Reprint February 2005

Course Outline

Unit	Topic (Lecture Period)	Chapters	Lab and Other Coverage
1	Introduction to Numerical Analysis	1	Exercises, Homework
2	Number Theory	2	Exercises, Homework
3	Equations in One Variable	3	Exercises, Homework Review for Exam 1
4	Exam 1 System of Linear Equations	4	Exercises, Homework
5	Interpolation	5	Exercises, Homework
6	Series	6	Exercises, Homework
7	Curve Fitting	7	Exercises, Homework Review for Exam 2
8	Exam 2 Derivatives	8	Exercises, Homework
9	Numerical Integration	9	Exercises, Homework
10	Sequences	10	Exercises, Homework Review for Final Exam
11	Final Examination	11	The final examination will be based on the content covered in Chapters 1-10.

Evaluation Criteria and Grade Weights

- Exam 1 15%
- Exam 2 15%
- Final Exam 30%
- Quizzes 15%
- Assignment 25%

Final grades will be calculated from the percentages earned in class as follows:

A	90 - 100%	4.0
B+	85 - 89%	3.5
B	80 - 84%	3.0
C+	75 - 79%	2.5
C	70 - 74%	2.0
D+	65 - 69%	1.5
D	60 - 64%	1.0
F	<59%	0.0

