King Fahd University of Petroleum & Minerals
Department of Mathematical Sciences
MATH 321
Introduction to Numerical Computing
(Term 171)
Course Syllabus

Course Coordinator: Dr. Muhammad Yousuf

Recommended Text: "Numerical Methods for Engineers", Steven C. Chapra and Raymond P. Canale. (6^{th} Edition).

Reference Text: "Numerical Analysis" by Richard L. Burden, J. Douglas Faires 9th (2011)

Main Topics to be Covered:
Floating-point arithmetic and error analysis. Solution of non-linear equations. Polynomial interpolation. Numerical integration and differentiation. Data fitting. Solution of linear algebraic systems. Initial and boundary value problems of ordinary differential equations.

Course Objectives: This course is designed to introduce numerical methods for solving a variety of problems, linear, nonlinear, and numerical approximation. In this course, we focus on both: the theoretical and computational aspects.

Students Learning Outcome: After completion of the course, the students should be able to:

1. Use Taylor Series to approximate functions and evaluate the approximation errors.
2. Understand and program algorithms to locate the roots of equations.
3. Understand and program algorithms to solve linear system of equations.
4. Learn how to smooth collected engineering data using least squares method.
5. Use polynomials to interpolate collected engineering data or approximate function
6. Understand and program algorithms to evaluate the derivative or the integral of a given function and evaluate the approximation error involved.
7. Understand and program to solve engineering Ordinary Differential Equations (ODE) or Partial Differential Equations (PDE).
8. Understand relationships among methods, algorithms and computer errors.
9. Apply numerical and computer programming tools to solve common engineering problems.

Computer Usage: Computer software is essential for this course. Mainly we will be using MATLAB as the computational platform.

Attendance: KFUPM attendance policy will be enforced.

Grading Policy:
1. Two Major Exams (20% each)
2. Final Exam (30%) (Comprehensive)
3. Classwork (10%)
4. MATLAB projects (20%)

Academic Integrity: All KFUPM policies regarding ethics apply to this course.

Week	Dates	Sec.	Topic
1	Sep 17 – 21	4.1	Taylor Series
		4.2	Errors Propagation
2	Sep 25 – 28	4.3	Total Numerical Error
		-	MATLAB
3	Oct 01 – 05	5.2	The Bisection Method
		6.1	Fixed- Point Iteration
4	Oct 07 – 12	6.2	Newton's Method and its Extensions
5	Oct 15 – 19	18.1	Divided Differences
		18.2	Interpolation and the Lagrange Polynomials
6	Oct 22 – 26	18.6	Spline Interpolation
7	Oct 29 – Nov 02	4.1	Numerical Differentiation ****
8	Nov 05 – 09	4.3	Element of Numerical Integration ****
		4.4	Composite Numerical Integration ****
9	Nov 12 – 16	5.1	The Elementary Theory of I.V.P. ****
		25.1	Euler' Methods
10	Nov 19 – 23	25.3	Runge – Kutta Methods
11	Nov 26 – 30	9.1	Linear systems of Equation
		9.4	Techniques for Improving Solutions
12	Dec 03 – 07	10.1	Matrix Factorization: LU Decomposition
13	Dec 10 – 14	11.2	The Jacobi and Gauss-Siedel Iterative Techniques
14	Dec 17 – 21	17.1	Linear Regression
15	Dec 24 – 28	11.3	Finite-Difference Methods for Linear Problems ****

**** The section numbers are in the Burden & Faires book. They are explained in a better way there.