King Saud University
College of Sciences/ Department of Mathematics
Syllabus of: MATH351, First semester 1435/1436H

Course code: MATH351
Course title: Numerical Analysis
Pre-Requisite: MATH104

Instructor: Dr. Saleem Obaidat
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Text Book: Numerical Analysis, by Richard L. Burden and J. Douglass Faires

References:

- Introduction to Numerical Analysis Using MATLAB, by R. Butt
- Elementary Numerical Analysis, by K. Atkinson.

Course objectives

1. Learn the concepts of numerical methods in solving mathematical problems numerically
2. Analyse the error for these methods
3. Write computer algorithms to implement these methods for solving certain mathematical problems using computer.

Course learning outcomes

Students completing this course will be able to:

- Solve a nonlinear equation using different numerical methods: Bisection method, fixed point method, Newton's method, secant method.
- Analyze the errors in these methods
- Write computer algorithms to implement these methods.
- Compute the multiplicity of a repeated root.
- Compute the rate of convergence of a convergent iterative scheme.
- Solve a systems of linear equations using direct methods and analyze the related errors
- Solve a systems of linear equations using iterative methods and analyze the related errors
- Approximate functions and data using polynomial interpolation and analyzing the related errors
- Approximate first and second derivatives using difference formulas and analyze the errors
- Approximate definite integrals using trapezoidal and Simpson's rules and analyze the errors

Course contents

Week #	Date	Topics	Contact hours (Lectures+Tutorials)
1	31 Aug. 4-Sep.	Errors and their sources, Nonlinear equations, Bisection method	3+2
2	September 7-11	Fixed point method, Newton's method,	3+2
3	September 14-18	Secant method, multiple roots, modified Newton's method	3+2
4	September 21-25	Rate of convergence (error analysis), Newton's method for solving nonlinear systems.	3+2
		Hajj Vacation	
5	October 12-16	Systems of Linear Equations, Gaussian elimination	3+2
6	October 19-23	Gaussian elimination with partial pivoting, LU-decomposition.	3+2
7	October 26-30	Iterative methods: Jacobi and Gauss-Seidel methods.	3+2
8	November 2-6	Error analysis for solving Linear system	3+2
9	November 9-13	Interpolation and Polynomial Approximations Lagrange interpolation formula	3+2
10	November 16-20	Divided differences, Newton's interpolation formula. Error in polynomial interpolation	3+2
11	November 23-27	Numerical Differentiation; First derivative: two-point formulas (forward and backward) and three-point formulas (forward, central and backward).	3+2
12	30 Nov.- 4 Dec.	Second derivative: the central difference formula and error estimates.	3+2
13	December 7-11	Numerical Integration; Trapezoidal and Simpson's rules and error bounds.	3+2
14	December 14-18	Numerical solutions of ODE's; Taylor's methods	3+2
15	December 21-25	Revision	3+2
16		**Final Exam**	

Homework assignments:

Chapter	Exercices
CHAPTER 2	2.1, 2.2, 2.4, 2.5, 2.6, 2.7, 2.8, 2.10.
CHAPTER 3	3.1, 3.2, 3.3, 3.4, 3.6, 3.7.
CHAPTER 4	4.1, 4.2, 4.3
CHAPTER 5	5.1, 5.2, 5.3, 5.5, 5.6.
CHAPTER 6	6.1, 6.2, 6.3.

Grading

First midterm 25%
Second midterm 25%
Homework assignments and quizzes 10%
Final Exam 40%
Total 100%
First midterm will be on ……., (7 - 8:30) PM.
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