King Fahd University of Petroleum and Minerals

Mathematics Department

MATH 371 Syllabus, Term 222

Coordinator: Dr. Suliman Al-Homidan and Dr. Said Algarni

Course Code: Math 371 - **Introduction to Numerical Computing - Credit Hours: 2-2-3**

Textbook: "Numerical Analysis" by Richard L. Burden, J. Douglas Faires 10th Edition (2016)

Reference: "Numerical Methods for Engineers", Steven C. Chapra and Raymond P. Canale. (6th Edition).

The Course Objective: The objective of the course is to:
1. Introduce students to the field of Numerical Methods.
2. Use computing software for hands on knowledge.

The Course Content: 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.

Computer Usage: Computer software is an integral part of this course and mainly we shall use MATLAB as the computational platform.

The Course Learning Outcome: After completion of the course, the students should be able to:
1. Formulate Taylor Series to approximate functions, errors, and their upper bounds.
2. Devise algorithms to locate approximated roots of equations and numerically solve linear systems of equations.
3. Analyze engineering data using the least squares method.
4. Use polynomials to interpolate collected precise engineering data or approximate function.
5. Program algorithms to compute the derivative and the integral of a given function, estimate the approximation error involved and upper bound, and interpret engineering ordinary differential equations.
6. Identify relationships among methods, algorithms, and computer errors.
7. Apply numerical and computer programming tools to solve common engineering problems

The Course Grading Policy:

	Date	**Materials**	
Major Exam I	TBA	1.1 – 3.3	**20%** (80 points)
Major Exam II	TBA	3.5, 8.1, 4.1– 5.2	**20%** (80 points)
Final Exam	TBA	Comprehensive	**30%** (120 points)
Classwork	Quizzes and class activity		**10%** (40 points) Subjective bounds [70%, 75%]
	Homeworks		**5%** (20 points)
	MATLAB Assignments		**15%** (60 points) Subjective bounds [70%, 75%]

Notes on the exam:

- Student is not allowed to enter the exam hall without either KFUPM ID or Saudi/Iqama ID.
- Students are not allowed to carry mobile phones and smart watches to the exam halls

Exam Questions: The questions of the exams are based on the examples, homework problems, and exercises in the textbook.

Misconduct in Exams: Cheating or any attempt of cheating by use of illegal activities, techniques and forms of fraud will result in a grade of **F** in the course along with reporting the incident to the university higher administration. Cheating in exams includes (but is not limited to) receiving help from anyone or any other outside source, and unauthorized use of the book, course notes, calculators, phones, or websites.

Missing an Exam:

> "Missing an Exam: In case a student misses an exam (Exam I, Exam II, or the Final Exam) for a legitimate reason (such as medical emergencies), he must bring an official excuse from Students Affairs. Otherwise, he will get zero in the missed exam."

Attendance: Students are expected to attend all lecture and lab classes.

➢ If a student misses a class, he is responsible for any announcement made in that class.

➢ Students need to strictly adhere to the attendance policy of the university.

➢ DN-Grade will be assigned to the eligible students (accumulates 20% unexcused absences) after their instructors have warned them twice.

Academic Integrity: All KFUPM policies regarding ethics apply to this course. See the Undergraduate Bulletin.

Weekly Coverage of Course Material

Week	Date	Sec.	Topic
1	Jan.15	1.1 1.2	Review of Calculus: Taylor Polynomials and Series Round-off Errors and Computer Arithmetic: (Skip Binary Machine Numbers)
2	Jan. 22	1.3 2.1	Algorithms and Convergence:(Def. 1.17, Def. 1.18 and Def. 1.19 - Algorithms to be covered in the Lab) The Bisection Method
3	Jan. 29	2.2 2.3	Fixed-Point Iteration Newton's Method and its Extensions (Newton's method and Secant method only)
4	Feb. 05	3.1	Interpolation and the Lagrange Polynomials (up-to Example 3)
5	Feb. 12	3.3	Divided Differences (up-to Example 1)
6	Feb. 19	3.5	Cubic Spline Interpolation (up-to Example 4)
7	Feb. 26	8.1	Discrete Least Squares Approximation (Polynomial of degree one and two)
8	Mar. 05	4.1	Numerical Differentiation (**Skip** five-point formulas and Round-off Instability)
9	Mar. 12	4.3 4.4	Elements of Numerical Integration (up-to Definition 4.1) Composite Numerical Integration (up-to Example 2 and skip Composite Midpoint rule)
10	Mar. 19	5.1 5.2	The Elementary Theory of IVPs Euler's Methods (**Skip** Lemma 5.7, Lemma 5.8, and Theorem 5.10)
11	Mar. 26	5.4 6.1	Runge-Kutta Methods (Midpoint Method and Runge-Kutta Method of order 4) Linear systems of Equation
12	Apr. 02	6.2	Pivoting Strategies (Partial Pivoting only)
13	Apr. 09	6.5	Matrix Factorization
14	Apr. 30	7.3	The Jacobi and Gauss-Seidel Iterative Techniques (up-to Example 3)
15	May 07	11.3	Finite-Difference Methods for Linear Problems (up-to Example 1)

Note: No proof of theorems.
Final Exam (Comprehensive): Follow the registrar final schedule on his webpage.