King Fahd University of Petroleum & Minerals

Department of Mathematics

MATH 571 Syllabus, **Term 252**

Dr. Manal Alotaibi

Course Code:

Math 571 **Numerical analysis of Ordinary Differential Equations**

Textbook:

Numerical Methods for Ordinary Differential Equations, Butcher, 3rd ed, 2016

Reference:

- Numerical solution of ODEs, Suli, 2022
- Numerical methods for ODEs, Griffiths & Higham, 2010
- Numerical solution of ODEs, Atkinson, 2009

Course Description:

Theory and implementation of numerical methods for initial and boundary value problems in ordinary differential equations. One-step, linear multi-step, Runge-Kutta, and extrapolation methods; convergence, stability, error estimates, and practical implementation, Study and analysis of shooting, finite difference and projection methods for boundary value problems for ordinary differential equations.

Prerequisite: Graduate standing

Learning Outcomes:

1. Define the fundamental concepts of numerical methods for ODEs.
2. Explain the merits and limitations of each numerical method.
3. Use numerical methods for solving ordinary differential equations.
4. Analyze numerical methods based on their accuracy and stability.
5. Develop algorithms that describe the steps of numerical methods.
6. Implement algorithms for solving ODEs using suitable software.

The Course Grading Policy:

Midterm Exam	25%
Project	10%
Assignments	35%
Final Exam	30%

Missing an Exam: In case a student misses an exam for a legitimate reason (such as medical emergencies), he/she must bring an official excuse from Students Affairs. Otherwise, he/she will get a score of zero in the missed exam.

The Usage of Mobiles in Class: Students are not allowed to use mobiles for any purpose during class time. Students who want to use electronic devices to take notes must take permission from their instructor. Violations of these rules will result in a penalty decided by the instructor.

Weekly Coverage of Course Material

Week	Date	Topic
1	Jan. 11-15	Preliminaries and IVP
2	Jan. 18-22	One-step methods
3	Jan. 25-29	
4	Feb. 1-5	Runge-Kutta methods
5	Feb. 8-12	
6	Feb. 15-19	
Sunday, February 22: Saudi Founding Day Holiday		
7	Feb. 23-26	Linear multistep methods
8	Mar. 1-5	
9	Mar. 8-12	
March 15-26: Eid Al-Fitr Holidays		
10	Mar. 29 – April 2	Stiff problems
11	April 5-9	
12	April 12-16	Boundary value problem methods
13	April 19-23	
14	April 26-30	Project presentations
15	May 3-7	**Review**