Department of Mathematics, KFUPM

Math 571 Syllabus (2024-2025, semester II)

Instructor: Khaled M. Furati

Course Title: Numerical analysis of Ordinary Differential Equations

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

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

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

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.

Assessment: Assignments 35%, Project 10%, Midterm Exam 25%, Final Exam 30%

WK	Date	Topics
1	Jan 12-16	Preliminaries and IVP
2	Jan 19-23	One-step methods
3	Jan 26-30	
4	Feb 02-06	Runge-Kutta methods
5	Feb 09-13	
6	Feb 16-20	
Feb 23: Foundation Day		
7	Feb 25-27	Linear multistep methods
8	Mar 02-06	
9	Mar 09-13	
10	Mar 16-20	Stiff problems
Mar 23 - Apr 03: Eid break		
11	Apr 06-10	Stiff problems
12	Apr 13-17	Boundary value problem methods
13	Apr 20-24	
14	Apr 27-May 01	Project presentations
15	May 04-08	Review