King Fahd University of Petroleum & Minerals
Department of Mathematics
Math 576 – Syllabus
Semester 211

Dr. Rachid Ait-Haddou (aithaddou@kfupm.edu.sa)

Course Number	MATH 576
Course Title	Applied Numerical Methods I
Course Main Objectives	1. Introduce the fundamental concepts in the numerical solution to differential equations. 2. Discuss various numerical methods. 3. Implement numerical methods to specific applications.
Course Leaning Outcomes	**By the end of this course, students will be able to:** 1- Apply numerical methods for solving differential equations. 2- Describe mathematical algorithms for solving differential equations. 3- Analyze numerical solutions based on accuracy and stability. 4- Implement the algorithms of the numerical methods using suitable software 5- Work individually or within a team
Catalog Course Description	This course introduces implementable numerical methods for solving initial value problems, stability and convergence. One-step, multistep, and Runge-Kutta methods. Shooting and bisection methods. Finite difference methods and applications to equilibrium and non-equilibrium models including steady-state, heat, and wave problems.
Pre-Requisites	Graduate Standing

TEXTBOOK:

Numerical Analysis: Mathematics of Scientific Computing by Kincai and Cheney, (Third Edition) Brooks/Cole Publishing, (**2002**)

REFERENCES:

1. Numerical Methods for Ordinary Differential Equations, (Third Edition) by John C. Butcher (**2014**)
2. Introductory Finite Difference For DPES by Causon, D. M., and C. G. Mingham. Bookboon, (**2010**).
3. Applied Numerical Methods With Matlab: For Engineers And Scientists, (Fourth Edition) by Steven, C.C., (**2018**).

ASSESSEMENT:

- Quizzes: 10%
- Assignments: 30%
- Major Exam: 30%
- Final Exam: 30% (Comprehensive)

OFFICE HOURS: Monday and Wednesday 10:00 am-- 12:00 am (or by Appointment)

COURSE OUTLINE

Topics and Associated number of Lectures

Part	Topics	Lectures
1	**Introduction**	
	- Introduction to differential equations	3
	- Taylor's series method	
2	**Initial value problems.**	13
	- Euler's methods	
	- Runge-Kutta methods	
	- Stiff differential equations	
	- Multistep methods	
	- Adams multistep methods	
	- Convergence and stability	
3	**Steady-State and Time Dependent Problems**	14
	- Shooting method	
	- Bisection method	
	- Finite difference methods for	
	- Elliptic equation in one and two dimensions	
	- Diffusion (including Heat) equation	
	- Wave equation	
	Total Number of Lectures	30