Department of Mathematics & Statistics, KFUPM

Math 692 Syllabus (121)

Dr. K. M. Furati

Course Title: Fractional Differential Equations

Course Description: Related special functions and spaces. Definitions of fractional derivatives and integrals. Properties, mapping, and spaces of the fractional integral and differential operators. Transform methods for solving fractional differential equations. Applications.

Prerequisite: Graduate level

Textbook: Podlubny I., Fractional Differential Equations. Academic Press; 1999.

Learning Outcomes: To have basic knowledge on applying fractional calculus tools in research problems. In particular, students will learn analytical techniques for solving basic fractional order differential equations.

Assignment: Homework, exams, literature review and projects.

Webpage http://faculty.kfupm.edu.sa/math/kmfurati

# weeks	Topic	Details	Chapter
2	Special Functions and Symbols	Gamma & Beta functions, Mittag Leffler function	1.1, 1.2
	Spaces of integrable and differentiable functions	Integrable, continuously differentiable, absolutely continuous, fundamental theorem of integral calculus	Notes
4	Fractional Integrals and Fractional Derivatives	Grunwald-Letnikov approach	2.2
		Riemann-Liouville approach	2.3
		Caputo derivatives.	2.4.1
		Erdely-Kober type fractional integrals/derivatives	
		Properties (Formulas 2.202, 2.211, 2.217 only)	2.7
1	Transforms	Laplace, Fourier, and Mellin transforms	2.8-2.10
2	Methods for soving FDE	Successive approximation	Kilbas, Ch. 4
3	Integral transform method	Laplace transform method, Mellin transform method	Ch. 5
2	Fractional heat equation	Laplace transform	handout