King Fahd University of Petroleum and Minerals
Department of Mathematics & Statistics

MATH 566 Syllabus (Semester I, 201)
Dr. N. Tatar

Course Title: Fractional Differential Equations

Course Description:
Special functions (Gamma, Mittag-Leffler, and wright), Riemann fractional integral, Riemann-Liouville and Caputo fractional derivatives, composition rules, embeddings, equivalence with integral equations, well posedness for Cauchy type problems, successive approximation method, Laplace and Mellin transform methods

Textbook:
A. A. Kilbas, H. M. Srivastava and J. J. Trujillo, "Theory and Applications of Fractional Differential Equations", 2006

Other references:
Igor Podlubny, Fractional Differential Equations, Vol. 198 in Mathematics and Science and Engineering, Academic Press, 1999.
S. G. Samko, A. A. Kilbas and O.I. Marichev, Fractional Integrals and Derivatives: Theory and Applications, Gordon and Breach Science Publishers, 1993

Learning Outcomes:
- Use the properties of the Gamma function and Mittag-Leffler functions
- Use the properties of fractional integrals and fractional derivatives
- State the well-posedness for some fractional differential problems
- Describe the appropriate underlying spaces
- Link FDE's to their corresponding Volterra integral equations
- Use transforms to solve linear fractional differential equations

Grading:

Assessment 1:	15%
Midterm Exam:	15%
Assessment 3:	15%
Homework Assignments:	15%
Presentations:	15%
Final Exam:	25%

Week Sections Material

Week	Sections	Material
1		Overview
2	**1.1** **1.4** **1.5** **1.8** **1.10**	Preliminaries: Spaces of continuous functions, special functions, transforms
3		The Abel integral equation (solvability in L1)
4-5	**2.1**	Riemann-Liouville fractional integral and fractional derivative
6-7	**2.4**	Caputo fractional derivative Grunwald fractional derivative
8-9	**3.3.1** **3.3.2** **3.3.3** **3.3.5**	Fractional differential problems with RL derivative
10-11	**3.5.1** **3.5.3**	Fractional differential problems with Caputo derivative
12-13	**4.1.1** **4.1.2** **4.1.3**	Explicit solving of FDEs
14-15	**5.3.1** **5.3.2**	Laplace transform