

# King Fahd University of Petroleum & Minerals

Department of Mathematics and Statistics

(Term 142)

(Dr. S. Messaoudi)

- Course #:** MATH 568
- Title:** Advanced Partial Differential Equations I
- Textbook:** A basic course in Partial Differential Equations by Y. Qing Han, First Edition.
- References:** Partial Differential Equations Methods & Applications by R. McOwen
- Objectives:** This course is intended to strengthen the students background in partial differential equations and prepare them for further studies in the subject. Namely the modern theory of PDE's.
- Catalogue description:** First-Order Equations - Higher Order Equations- The Wave Equation - The Laplace Equation - The Heat Equation - Maximum Principles.

<b>Grading Policy:</b> HW: 30 %, Midterm 1: 35%, Final: 35%.
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<b>Week #</b>	<b>MATERIAL</b>	<b>HW</b>
1	<b>Definitions &amp; Notations</b> : Preliminaries, classification, Initial conditions, Boundary conditions, simple examples	
2-4	<b>First-Order Equations</b> : Linear Equations, Quasilinear Equations, Characteristic method, Examples of Characteristic method, General nonlinear Equations, A Priori estimates, weak solutions	2.1.2, 2.2.1, 2.6, 2.8.
5	<b>Second-Order Equations in Two Variables:</b> Classification, energy estimates	
6-8	<b>The Laplace Equation:</b> Fundamental solutions, Mean Value Property, Maximum Principle, Poisson Equations	
9-11	<b>The Heat equation:</b> Fourier transform, Fundamental solutions, Maximum Principle	
12-14	<b>The Wave Equation:</b> The 1-D wave equation, Higher-order wave equations, Energy estimates	
15	Review and catch up	