King Fahd University of Petroleum and Minerals
Department of Mathematical Sciences
Math 470 Syllabus
(Dr. S. Messaoudi)

Course #: MATH 470
Title: Partial Differential Equations
Textbook: Beginning Partial Differential Equations by P. O'Neil
Objectives: This course is an introduction to P.D.E.'s. It mainly exposes the students to some physical equations and to practical methods of solutions. The material of the course covers linear and nonlinear first order equations and linear higher order equations.

Week #	MATERIAL
1	Introduction, Linear first order PDE's, Characteristics
2	Quasilinear first order equations, the Cauchy problem, Characteristic method, General solutions
3	Second order PDE's in two variables: Classification by characteristics, Canonical forms, Second order Cauchy problem
4	The wave equation in 1D: The Cauchy problem and d'Alembert's formula, Domain of dependence and range of influence, Well-Posedness.
5	The wave equation in half-line, Homogeneous and nonhomogeneous IBVP, Fourier's method
6	The wave equation in 3D: Spherical means, Poisson's formula The wave equation in 2D: Hadamard's method of descent
7	The heat equation: Initial and boundary conditions Maximum principle, Existence and uniqueness
8	Solutions for IBVP: Bounded and unbounded intervals
9	The nonhomogeneous heat equation
10	The Laplace equation: Setting of the problem, Harmonic functions
11	Representation theorems in 2D and 3D, MVP and maximum principles. Well-Posednesss for Dirichlet problem
12	Dirichlet problem for a rectangle, Dirichlet problem for a disk. Poisson's integral representation for a disk
13	Green's function for Dirichlet problem, Green's function for a sphere, Method of images
14	Neumann problem: for rectangle and for a disk
15	Review and catch-up