King Fahd University of Petroleum and Minerals
Department of Mathematics
SYLLABUS. Semester I: 2021-2022 **(211)**

Instructor: Dr. A. Bonfoh
Course: **MATH 667:** Advanced Partial Differential Equations II

Objectives: This course prepares students to be able to solve some linear systems of PDEs. The course extends the knowledge acquired in Math568 where only equations were solved and not systems. An introduction to the Galerkin method to solve nonlinear PDEs will be also covered.

Course Description: Classification of first order systems. Hyperbolic systems, method of characteristics. Applications to gas dynamics. Dispersive waves; application to water waves. Potential theory, single and double layers, existence theory for Dirichlet and Neumann problems.

Prerequisite: MATH568.

Credit: 3 credit hours
References:
1. E.F. Toro, *Riemann Solvers and Numerical Methods for Fluid Dynamics*, Springer-Verlag Berlin Heidelberg 2009
2. J.C. Robinson, *Infinite-dimensional Dynamical systems*, Cambridge University Press, Cambridge, 2001

Week			Topics	
1-7		Part 1	Some nonlinear analysis tools Nonlinear Reaction-Diffusion equation (NRDE) The Basis for the Galerkin Expansion Weak solutions of the NRDE Strong solutions of the NRDE Nonlinear damped wave equation	
8-13		Part 2	Characteristic method for quasilinear systems Classification of systems of PDEs Characteristic method for hyperbolic systems: *application to Gas dynamics and water waves* Potential theory: *single and double layers, existence theory for Dirichlet and Neumann problems*	
14-15		Part 3	Presentation of projects	

Grading:

Midterm	25%
Homework assignments	30%
Presentation	20%
Final Exam	25%