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

Course #: **Math 690**
Title: Special Topics (PDE's: Applied Functional Analysis Approach)
Textbook:
1. *Nonlinear partial Differential Equations with Applications, Thomas Roubicek, Birkhaser 2005 (First Edition)*

References
2. *Songmu Zheng, Nonlinear Evolution Equations, Chapman &Hall 2004*
3. *Chipot M., Elements of nonlinear analysis*, Birkhuser 2000
4. *Brezis H, Analyse fonctionnelle Theorie et applications,* Second Edition, Dunod, Paris 1999.
5. Lions J.L., *Quelques methodes de resolution des problemes aux limites non lineaires,* Second Edition, Dunod, Paris 2002.

Week#	Chapter	Material
1	1	Quick Review of some Functional Analysis material
2	2	**Operators**: Pseudo-monotone, Monotone, maximal, Hemi-continuous, weakly continuous, example
3	2	Solution of linear elliptic problems problem, Galerkin method
4-5	2 and Supplement	**Solution of nonlinear elliptic problems problem**: Compactness method, Monotonicity method
6-7	3	**Accretive mappings**: Abstract theory – Application to Boundary-value problems
8	7	Special Auxiliary tools.
9-11	Supplement	**Evolution Equations in Hilbert spaces**: Abstract initial-value Problem, Hille-Yosida approximations, Application to Heat and Wave equations.
12-14	8	**Evolution Equations in Banach spaces**: Abstract initial-value Problem, Galerkin method, Application to nonlinear Heat and Wave equations.
15		Catch up and presentations