



## Course Syllabus: Contemporary Topics in Analysis - AMCS 394A

<b>Division</b>	Computer, Electrical and Mathematical Sciences & Engineering
<b>Course Number</b>	AMCS 394A
<b>Course Title</b>	Contemporary Topics in Analysis
<b>Academic Semester</b>	Fall
<b>Academic Year</b>	2018/2019
<b>Semester Start Date</b>	08/26/2018
<b>Semester End Date</b>	12/11/2018
<b>Class Schedule</b> (Days & Time)	09:00 AM - 10:30 AM   Mon Thu

Instructor(s)				
Name	Email	Phone	Office Location	Office Hours
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Teaching Assistant(s)	
Name	Email

Course Information	
<b>Comprehensive Course Description</b>	<p>The objective of this course is to review certain topics in Real or in Functional Analysis that are widely use in the modern theory of Partial Differential Equations. Of interest is to present both the Real or Functional Analytic ideas, but also the way these ideas are applied with respect to specific problems in Partial Differential Equations.</p> <p>\section{Course Description}</p> <p>\begin{itemize}</p> <p>\item{(a)} Linear Functionals, Function Spaces, Approximation Theory</p> <p>\item{(b)} Hahn Banach theorem, Conjugate functions, Duality.</p> <p>\item{(c)} Direct methods in Calculus of Variations.</p> <p>\item{(d)} Weak topologies, Space of Radon measures, Weak convergence, Young measures, Propagation of oscillations, Defect measures and concentration measures Weak-strong uniqueness theorems for hyperbolic conservation laws.</p> <p>\item{(e)} Compensated compactness, application to reductions of Young measures for systems of two conservation laws.</p> <p>\end{itemize}</p>
<b>Course Description from Program Guide</b>	
<b>Goals and Objectives</b>	Acquire some of the the real and functional analysis tools that are needed in the study of nonlinear partial differential equations.
<b>Required Knowledge</b>	Lebesgue integration, Measure Theory

<b>Reference Texts</b>	<p>There will be used material from the following references:</p> <p>\begin{itemize}</p> <p>\item[] H. Brezis, Elements de la theorie des fonctions at de l'Analyse Fonctionelle \\ (french version) or (english version) \\ H. Brezis, Functional Analysis, Sobolev Spaces and Partial Differential Equations, Universitext, Springer.</p> <p>\item[] L.C. Evans, Partial Differential Equations, AMS, Ch. 8, pp. 456-520.</p> <p>\item[] L.C. Evans, Weak Convergence Methods for Nonlinear PDE, CBMS Regional Conference Series, Vol. 74, AMS.</p> <p>\item[] J. Ball, Proceedings paper on the construction of Young measures</p> <p>\item[] L. Tartar, Compensated Compactness,</p> <p>\item[] H. Attouch, G. Buttazzo, G. Michaille, Variational Analysis in Sobolev and BV Spaces, MPS-SIAM Series in Optimization, SIAM, Philadelphia, 2006.</p> <p>\end{itemize}</p>
<b>Method of evaluation</b>	100.00% - Scientific review article presentation
<b>Nature of the assignments</b>	Students will be asked to read a paper or book chapter and to do one or two presentations in class (as needed). They will be evaluated on the basis of their presentation
<b>Course Policies</b>	Attendance is mandatory
<b>Additional Information</b>	

## Tentative Course Schedule

*(Time, topic/emphasis & resources)*

Week	Lectures	Topic
1	Mon 08/27/2018 Thu 08/30/2018	Function Spaces, Approximation Theory, Compactness in $L^p$
2	Mon 09/03/2018 Thu 09/06/2018	Function Spaces, Approximation Theory, Compactness in $L^p$
3	Mon 09/10/2018 Thu 09/13/2018	Hahn-Banach theorems, Conjugate convex functions, Fenchel-Rockafeller theorem.
4	Mon 09/17/2018 Thu 09/20/2018	Hahn-Banach theorems, Conjugate convex functions, Fenchel-Rockafeller theorem.
5	Mon 09/24/2018 Thu 09/27/2018	Hahn-Banach theorems, Conjugate convex functions, Fenchel-Rockafeller theorem.
6	Mon 10/01/2018 Thu 10/04/2018	Calculus of Variations, Euler-Lagrange equations, null-Lagrangeans, polyconvexity
7	Mon 10/08/2018 Thu 10/11/2018	Calculus of Variations, Euler-Lagrange equations, null-Lagrangeans, polyconvexity
8	Mon 10/15/2018 Thu 10/18/2018	Weak Convergence, Compactness and weak topology, Metrizable and weak topology.
9	Mon 10/22/2018 Thu 10/25/2018	Weak Convergence, Compactness and weak topology, Metrizable and weak topology.
10	Mon 10/29/2018 Thu 11/01/2018	Presentation by students
11	Mon 11/05/2018 Thu 11/08/2018	Young measures, Defect and Concentration measures, Compensated Compactness
12	Mon 11/12/2018 Thu 11/15/2018	Young measures, Defect and Concentration measures, Compensated Compactness
13	Mon 11/19/2018 Thu 11/22/2018	Presentation by students
14	Mon 11/26/2018 Thu 11/29/2018	Application to cancellation of oscillations for Hyperbolic Systems, Kinetic formulation of conservation laws
15	Mon 12/03/2018 Thu 12/06/2018	Presentation by students
16	Mon 12/10/2018	
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### Note

The instructor reserves the right to make changes to this syllabus as necessary.