FLORIDA ATLANTIC UNIVERSITY™

Graduate Programs—NEW COURSE PROPOSAL

UGPC APPROVAL _____
UFS APPROVAL _____
SCNS SUBMITTAL _____
CONFIRMED _____
BANNER POSTED _____
ONLINE _____
MISC _____

DEPARTMENT NAME:
MATHEMATICAL SCIENCES

COLLEGE OF:
CHARLES E. SCHMIDT COLLEG E OF SCIENCE

RECOMMENDED COURSE IDENTIFICATION:

PREFIX _____MAA_____ **COURSE NUMBER** ___6507_____ **LAB CODE** (L or C) _____

(*TO OBTAIN A COURSE NUMBER, CONTACT ERUDOLPH@FAU.EDU*)

COMPLETE COURSE TITLE

INTRODUCTION TO FUNCTIONAL ANALYSIS

EFFECTIVE DATE
(first term course will be offered)
_____

CREDITS:
3

TEXTBOOK INFORMATION:
FUNCTIONAL ANALYSIS, SOBOLEV SPACES AND PARTIAL DIFFERENTIAL EQUATIONS BY HAIM BREZIS, SPRINGER 2010

GRADING (*SELECT ONLY ONE GRADING OPTION*): **REGULAR** ___X__ **PASS/FAIL** _____ **SATISFACTORY/UNSATISFACTORY** _____

COURSE DESCRIPTION, NO MORE THAN 3 LINES:
Introduction to the theory of functional analysis. Normed linear spaces, Hilbert spaces, Hahn-Banach Theorem, Open Mapping Theorem, Uniform Boundedness Principle, weak convergence, bounded linear operators. Applications to partial differential equations.

PREREQUISITES W/MINIMUM GRADE:*
MAS 5145 LINEAR ALGEBRA (MINIMUM GRADE C) AND MAA 5228 AND MAA 5229 INTRODUCTORY ANALYSIS 1 AND 2 (MINIMUM GRADE C)

COREQUISITES:
NONE

OTHER REGISTRATION CONTROLS (MAJOR, COLLEGE, LEVEL):

PREREQUISITES, COREQUISITES & REGISTRATION CONTROLS SHOWN ABOVE WILL BE ENFORCED FOR ALL COURSE SECTIONS.
**DEFAULT MINIMUM GRADE IS D-.*

MINIMUM QUALIFICATIONS NEEDED TO TEACH THIS COURSE:
PH. D IN MATHEMATICS

Other departments, colleges that might be affected by the new course must be consulted. List entities that have been consulted and attach written comments from each.

Mario Milman, milman@fau.edu, (561) 297-3342_____
Faculty Contact, Email, Complete Phone Number

SIGNATURES

Approved by:	*Date:*
Department Chair: _____	_____
College Curriculum Chair: _____	_____
College Dean: _____	_____
UGPC Chair: _____	_____
Dean of the Graduate College: _____	_____

SUPPORTING MATERIALS

Syllabus—must include all details as shown in the UGPC Guidelines.

Written Consent—required from all departments affected.

Go to: *http://graduate.fau.edu/gpc/* to download this form and guidelines to fill out the form.

Email this form and syllabus to diamond@fau.edu and *eqirjo@fau.edu* one week ***before*** the University Graduate Programs Committee meeting so that materials may be viewed on the UGPC website by committee members prior to the meeting.

Course Syllabus for Introduction to Functional Analysis

1. **Course title/number, number of credit hours**
   Introduction to Functional Analysis, MAA 6507, 3 credit hours

2. **Course prerequisites**
   a. MAS 5145 Linear Algebra (Minimum Grade C)
   b. MAA 5228 and MAA 5229 Introductory Analysis 1 and 2 (Minimum Grade C)

3. **Course logistics**
   a. Term –Spring 2011
   b. Notation if online course – N/A
   c. Class location and time (if classroom-based course) – To be determined

4. **Instructor contact information**
   a. Instructor's name – Mario Milman
   b. Office address – Science & Engineering Bldg, SE43, Room 264
   c. Office hours – To be determined
   d. Contact telephone number – office (561) 297-3342, fax (561) 297-2436
   e. E-mail address – milman@fau.edu

5. **TA contact information (if applicable)**
   N/A

6. **Course description**
   Introduction to the theory of functional analysis. Normed linear spaces, Hilbert spaces, Hahn-Banach Theorem, Open Mapping Theorem, Uniform Boundedness Principle, weak convergence, bounded linear operators. Applications to partial differential equations.

7. **Course objectives/student learning outcomes**
   The course introduces the student to the basic concepts of the theory of functional analysis. Students completing the course will have seen the three major theorems and techniques to apply them. They will have a good overview of this important area of mathematics and be ready for a more advanced, research oriented, course. Being an introductory course, most of the emphasis is on linear operators. Functional Analysis thrives through its connections to different parts of Analysis. A second objective of the course is to make the student aware of some of those connections and applications. As many examples as possible will be discussed including applications to partial differential equations.

8. **Course evaluation method**
   There will be graded homework assignments accounting for 30% of the student's cumulative performance, a midterm exam accounting for 30% of the student's cumulative performance, and a final exam that accounts for 40% of the cumulative performance. The overall grade in the course is derived from the cumulative performance according to the following table.

9. **Course grading scale (optional)**

Cumulative Performance	Grade
>94%	A
>90% - 94%	A-
>87% - 90%	B+
>83% - 87%	B
>80% - 83%	B-
>75% - 80%	C+

>65% - 75%	C
>60% - 65%	C-
>57% - 60%	D+
>53% - 57%	D
>50% - 53%	D-
<50%	F

10. Policy on makeup tests, late work, and incompletes

If a student cannot attend an exam or hand in a homework project on time due to circumstances beyond their control then the instructor may assign appropriate make-up work. Students will not be penalized for absences due to participation in University-approved activities, including athletic or scholastics teams, musical and theatrical performances, and debate activities. These students will be allowed to make up missed work without any reduction in the student's final course grade. Reasonable accommodation will also be made for students participating in a religious observance. Also, note that grades of Incomplete ("I") are reserved for students who are passing a course but have not completed all the required work because of exceptional circumstances. A grade of "I" will only be given under certain conditions and in accordance with the academic policies and regulations put forward in FAU's University Catalog. The student must show exceptional circumstances why requirements cannot be met. A request for an incomplete grade has to be made in writing with supporting documentation, where appropriate.

11. Special course requirements (if applicable)

N/A

12. Classroom etiquette policy (if applicable)

University policy on the use of electronic devices states: "In order to enhance and maintain a productive atmosphere for education, personal communication devices, such as cellular telephones and pagers, are to be disabled in class sessions."

13. Disability policy statement

In compliance with the Americans with Disabilities Act (ADA), students who require special accommodation due to a disability to properly execute coursework must register with the Office for Students with Disabilities (OSD) -- in Boca Raton, SU 133 (561-297-3880); in Davie, MOD 1 (954-236-1222); in Jupiter, SR 117 (561-799-8585); or at the Treasure Coast, CO 128 (772-873-3305) – and follow all OSD procedures.

14. Honor Code policy statement

Students at Florida Atlantic University are expected to maintain the highest ethical standards. Academic dishonesty is considered a serious breach of these ethical standards, because it interferes with the university mission to provide a high quality education in which no student enjoys an unfair advantage over any other. Academic dishonesty is also destructive of the university community, which is grounded in a system of mutual trust and places high value on personal integrity and individual responsibility. Harsh penalties are associated with academic dishonesty. For more information, see University Regulation 4.001 at http://www.fau.edu/regulations/chapter4/4.001 Honor_Code.pdf.

15. Required texts/readings

Functional Analysis, Sobolev Spaces and Partial Differential Equations by Haim Brezis, Springer, 2010.

16. Supplementary/recommended readings

a. *Functional Analysis* by Peter Lax, Wiley, 2002.

b. *Functional Analysis* by G. Bachman and L. Narici, Dover, 1998.

c. *Elements of the Theory of Functions and Functional Analysis*, by A.N. Kolmogorov and S.V. Fomin, Dover, 1999.

d. *Functional Analysis* by Walter Rudin, McGraw-Hill, 1991.

17. Course topical outline

- Metric/normed spaces (ca. 1 week)
- Hilbert Spaces (ca. 2 weeks)
- Duality, Hahn-Banach theorem. Linear Programming. (ca. 2 weeks)
- Basic Principles of Functional Analysis (Category Theory, Open Mapping, Uniform Boundedness, Closed Graph) (ca. 2 weeks)
- Duality/Separability/Reflexivity. Lebesgue Spaces. Spaces of Continuous Functions. Theorems of Arzela Ascoli, Kolmogorov, Kakutani. (ca. 2 week)
- Weak Convergence. Banach-Alaglou. Convexity. Extreme points. Theorem of Krein-Milman (ca. 2 weeks)
- Bounded operators. Compact Operators. Examples. Integral Operators. Interpolation theorem of Riez-Thorin. (ca. 1 week)
- Banach Algebras. Spectral Theory (ca. 2 weeks)
- Applications to PDEs (ca. 2 weeks)