UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Matematica e Informatica		
ACADEMIC YEAR	2016/2017		
MASTER'S DEGREE (MSC)	MATHEMATICS		
INTEGRATED COURSE	SUPERIOR ANALYSIS		
CODE	07799		
MODULES	Yes		
NUMBER OF MODULES	2		
SCIENTIFIC SECTOR(S)	MAT/05		
HEAD PROFESSOR(S)	TRAPANI CAMILLO	Professore Ordinario	Univ. di PALERMO
OTHER PROFESSOR(S)	AVERNA DIEGO TRAPANI CAMILLO	Professore Associato Professore Ordinario	Univ. di PALERMO Univ. di PALERMO
CREDITS	12		
PROPAEDEUTICAL SUBJECTS			
MUTUALIZATION			
YEAR	1		
TERM (SEMESTER)	1° semester		
ATTENDANCE	Not mandatory		
EVALUATION	Out of 30		
TEACHER OFFICE HOURS	**AVERNA DIEGO** Thursday 10:30 12:30 Studio del docente (stanza n.102 del DMI) **TRAPANI CAMILLO** Wednesday 14:30 16:30 Studio del docente: Dipartimento di Matematica e Informatica, Via Archirafi 34, 1° Piano, Ufficio 115b		

DOCENTE: Prof. CAMILLO TRAPANI

PREREQUISITES	Differential and integral calculus in one or more variables; Lebesgue measure and integral; Basic aspects of the theory of functions of complex variables.
LEARNING OUTCOMES	Knowledge and understanding: Acquisition and ability 'to use the ideas and methodologies of the spaces with inner product and normed spaces, Banach algebras and C *-algebras, the series of Neumann, the spectrum and spectral radius, algebra functions, the C *-algebra of bounded operators. Acquisition of advanced tools for the understanding of recent research articles in Functional analysis and Non-commutative Analysis . Ability to use their own specific languages of these disciplines and produce personal and original scripts in research mathematics and its applications. Applying knowledge and understanding: Ability to recognize, and organize autonomously, the necessary elements for a deep study of a recent research article in Functional Analysis and Analysis Non-commutative. Ability to formalize mathematically problems and develop proofs using techniques inspired by consolidated mathematical literature . The verification of the ability 'as acquired is done through active participation of the student to the resolution of problems and issues. Making judgments The student should be able to evaluate the implications and the results contained in a recent research article in Functional Analysis and Analysis Non-commutative. The full understanding of the fundamental concepts and key techniques introduced in the course allow 'the student to acquire the ability' to critically analyze scientific texts and to be able to evaluate the content and implications of the results in a recent research article in Functional Analysis Analysis and non-commutative. Communication skills: Ability to clearly present the main topics of the course. Capacity to expose the results contained in a recent research article in a functional analysis or in non-commutative analysis analysis. In order to check communication skills students will be involved in seminar activities. Learning skills: Ability to upgrade knowledges with the reading of scientific publications. Capacity 'to follow, using the knowledge acquired in the course, both advanced courses and research seminars in the field Functional Analysis or Non-commuative Analysis.
ASSESSMENT METHODS	Final assessment will be based on written tests and in the discussion of a topic in oral form. The purpose is to assess, not only the knowledges of the candidate and his ability to apply them, but also the possession of an appropriate language and the reached degree ofmathematical rigor The final assessment, properly graded, will be made on the basis of following conditions: a) Basic knowledge of the topics proposed and limited capacity to apply them independently; sufficient capacity to carry out a rigorous reasoning and sufficient command of the language (18-21 rating); b) Fairly good knowledge of the topics proposed and sufficient capacity to apply them independently; fairly good ability to complete a rigorous reasoning and good appropriate language (22-25 rating); c) Good knowledge of the topics proposed and fairly good capacity to apply them independently; good ability to complete a rigorous reasoning; good command of the appropriate language (26-28 rating); d)Very good and extensive knowledge of the topics proposed; ability to apply them with mathematical rigor and independently; possess of very good communication skills(29-30L rating).
TEACHING METHODS	The achievement of learning outcomes will be reached through lectures, exercises, homework. The sudents will be also asked to give short seminars on topics of related to the lectures or on complementary arguments. At the end of the first module there will be a written verification test. In the second module in-course tests will be scheduled. The final exam consists of the discussion of the written tests and in a short seminar.

MODULE
NON COMMUTATIVE ANALYSIS

Prof. CAMILLO TRAPANI

SUGGESTED BIBLIOGRAPHY

G. K. Pedersen, Analysis Now, Springer, 1988
M. Reed, B. Simon, Functional Analysis, Academic press, 1981
C. Trapani, Teoria degli Operatori, dispensa on-line

AMBIT	50398-Formazione teorica avanzata
INDIVIDUAL STUDY (Hrs)	98
COURSE ACTIVITY (Hrs)	52

EDUCATIONAL OBJECTIVES OF THE MODULE

Acquisition of concepts and methods of non-commutative analysis (Banach algebras and C * -algebras) and of the fundamental aspects of the theory of operators in Hilbert spaces; development of the capacity to apply them in other areas of mathematics.

SYLLABUS

Hrs	Frontal teaching
8	Banach algebras and C* -algebras, Ideals and quotients. Invertible elements. Neumann series. Spectrum and spectral radius. Mazur theorem.
8	Characters and maximal ideals. Algebras of functions. Gelfand transform. Characterization of commutative C * -algebras.
4	Representations, positive functionals, Gelfand-Naimark theorem
7	The C*-algebra of bounded operators. Symmetric and unitary operators; projections. Spectrum of an operator and its classification.
6	Compact operators. Riesz-Schauder theorem. Canonical form of compact operators
7	Unbounded operators and their spectra

Hrs	Practice
12	Examples, exercises and additional proofs on the arguments

MODULE
FUNCTIONAL ANALYSIS

Prof. DIEGO AVERNA

SUGGESTED BIBLIOGRAPHY

D.Averna, Analisi Funzionale - Spazi di Hilbert, Dispensa.
D.Averna, Analisi Funzionale - Spazi di Hilbert (esempi, esercizi e dimostrazioni che sono indicati e non risolti nella dispensa), Dispensa.
D.Averna, Analisi Funzionale - Spazi di Banach, Dispensa.
S.M.Buccellato, Spazi di Sobolev e formulazione variazionale dei problemi ai limiti, Dispensa.
H.Brezis, Analisi Funzionale, Liguori Editrice (1986).

AMBIT	50398-Formazione teorica avanzata
INDIVIDUAL STUDY (Hrs)	98
COURSE ACTIVITY (Hrs)	52

EDUCATIONAL OBJECTIVES OF THE MODULE

Illustrate the fundamental concepts of Hilbert spaces, Banach spaces, Sobolev spaces and variational formulation of the boundary value problems (notes).

SYLLABUS

Hrs	Frontal teaching
8	HILBERT SPACES: Pre-Hilbert Spaces - The Hilbert space l^2 - The Hilbert space L^2.
6	GEOMETRY HILBERT SPACES: Subspaces - Orthogonal subspaces - Bases - Isomorphism.
8	LINEAR BOUNDED OPERATORS: Linear and bounded applications - Linear operators - Bilinear forms - Adjoint operators - Projection operators.
13	BANACH SPACES: Normed linear spaces - Linear operators - Linear functional - Operators and linear functionals on finite-dimensional spaces - Spaces normed of operators - Dual space - The theorem of Hahn-Banach - Reflexive spaces - Theorem category and uniformly bounded - Strong and weak convergence.
5	SOBOLEV SPACES AND VARIATIONAL FORMULATION OF BOUNDARY VALUE PROBLEMS: The Sobolev space W^{1,p}(I) and H^1(I): = W^{1,2}(I) and derivative in a generalized sense. Norm of W^{1,p}(I) and the internal product of H^1(I). The Sobolev space W^{m,p}(I) and H^m(I). The Sobolev space W_0^{1,p}(I) and H_0^1(I). Boundary value problems: Dirichlet condition, Inhomogeneous Dirichlet condition, Homogeneous Neumann condition, Mixed boundary condition.

Hrs	Practice
12	Examples, exercises and demonstrations on the arguments.