UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Matematica e Informatica
ACADEMIC YEAR	2019/2020
MASTER'S DEGREE (MSC)	MATHEMATICS
SUBJECT	NON-COMMUTATIVE ALGEBRA
TYPE OF EDUCATIONAL ACTIVITY	C
AMBIT	20947-Attività formative affini o integrative
CODE	01171
SCIENTIFIC SECTOR(S)	MAT/02
HEAD PROFESSOR(S)	DI BARTOLO ALFONSO Ricercatore Univ. di PALERMO
OTHER PROFESSOR(S)	
CREDITS	6
INDIVIDUAL STUDY (Hrs)	94
COURSE ACTIVITY (Hrs)	56
PROPAEDEUTICAL SUBJECTS	
MUTUALIZATION	
YEAR	2
TERM (SEMESTER)	2° semester
ATTENDANCE	Not mandatory
EVALUATION	Out of 30
TEACHER OFFICE HOURS	**DI BARTOLO ALFONSO** Thursday 15:00 17:00 Studio n. 107, sito al primo piano del Dipartimento di Matematica e Informatica, via Archirafi n. 34, Palermo.

DOCENTE: Prof. ALFONSO DI BARTOLO

PREREQUISITES	Linear algebra
LEARNING OUTCOMES	Knowledge and understanding in the framework of the theory of algebras and the theory of groups, based on the knowledge acquired in the first degree. They will allow to apply original ideas based on the systematic understanding of the theory of algebras and representations of groups. Ability of reading and understanding advanced mathematical texts and research articles related to recent fields of research. Ability to produce original mathematical writing in the framework of the research in mathematics. Applying knowledge and understanding. Ability of understanding and solving by himself problems related to areas wider than the field of noncommutative algebra. The acquired knowledge is verified through an active participation of the student in the class. Making judgements To be able to evaluate by himself the implications given by the knowledge acquired, to analyze in a critical way different texts and to construct and develop logical arguments. Communication To be able to state and prove in a correct way the main results presented in the course. Lifelong learning skills To be able to understand the content of courses in mathematics, by mean of the knowledge acquired in the course. To be able to develop an open mind that will allow the student to get involved into research in mathematics.
ASSESSMENT METHODS	The assessment method consists in an oral exam aimed to verify that the student has acquired the skills and the disciplinary knowledge provided by the course. The assessment is expressed in thirtieths. The students following the course have the possibility of taking an intermediate test. The valuation of the test is part of the final assessment. Description of evaluation methods - Excellent Rating: 30-30 cum laude vote. Outcome: excellent knowledge of the topics, excellent properties of language, good analytical ability, the student is able to apply knowledge to solve problems proposed. - Very good Rating: 26-29 vote. Outcome: Good mastery of the subjects, full language ability, the student is able to apply knowledge to solve problems proposed. - Good Rating: 24-25 vote. Outcome: Basic knowledge of the main topics, discrete properties of language, with limited ability to independently apply the knowledge to the solution of the proposed problems. - Satisfactory Rating: 21-23 vote. Outcome: the student does not have full command of the main teaching subjects but has the knowledge, satisfactory properties of language, exiguous ability to independently apply the knowledge gained. - Sufficient Rating: 18-20 vote. Outcome: minimum basic knowledge of the main teaching and technical language issues, very little to independently apply the knowledge gained. - Insufficient rating. Outcome: the student does not have an acceptable knowledge of the contents of the topics covered in the course.
EDUCATIONAL OBJECTIVES	To present the mail aspects of the theory of Lie algebras by giving the students various tools and methodologies.
TEACHING METHODS	Lessons and excercise sessions
SUGGESTED BIBLIOGRAPHY	Testo di riferimento K.Erdmann, M.J.Wildon, "Introduction to Lie Algebras" , Springer, 2006. Testo consigliato J.E.Humphreys, "Introduction to Lie Algebras and Representation Theory", v.9 of Graduate Texts in Mathematics, Springer, Dover, New York, 1978 (reprinted 1994).

SYLLABUS

Hrs	Frontal teaching
8	Abstract algebras, free algebras linear algebras. Lie algebras. Lineal Lie algebras. Classical Lie algebras. Derivations. Structure constants. Ideals, simple Lie algebras. The center of a Lie algebra. The derived Lie algebra. Direct sum of Lie algebras. Homomorphisms. Representations of a Lie algebra. Witt algebra. Nilpotent Lie algerbas. Structural properties of nilpotent Lie algebras. The maximal nilpotent ideal. Outer derivations.
8	Engel theorem. Nilpotency criterion for finite dimensional Lie algebras.Soluble Lie algebras. Structural properties of soluble Lie algebras. The radical. Semisimple Lie algebras. Lie theorem. Description of finite dimensional semisimple Lie algebras over an algebraically closed field. Kiling form. First and second Cartan criterion.
8	Description of semisimple Lie algebras. Abstract Jordan decomposition. Complex semisimple Lie algebras and decomposition in root spaces.
8	Cartan subalgebras. Subalgebas isomorphic to sl(2, C). Root strings and eigenvalues. Cartan subalgebras and inner products. Root systems. Bases of a root system. Cartan matrices and Dynkin dyagrams. Simple Lie algebras over the complex field.

Hrs	Practice
6	Examples and exercises on abstract Lie algebras, linear Lie algebras, nilpotent Lie algebras. Lie algebras of dimension at most three.
6	Exemples and exercises on soluble Lie algebras, sesisimple Lie algebras, the Killing form.
6	Examples and exercises on Jordan decomposition and decomposition in root spaces.
6	Exemples and exercises on root spaces, bases, Cartan matrices and Dynkin diagrams.