



## Programme of Module "Advanced Algebra 2"

- Code: DT0123
- Type of course unit: Compulsory (Master Degree in Mathematics curriculum Generale)
- Level of course unit: Postgraduate Degrees
- Semester: 2

Number of ects credits: (Master Degree in Mathematics) 6 (workload 150 hours)

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1	<b>Course objectives</b>	To provide a good understanding of the theory of Lie algebras giving a particular emphasis to the classification of simple Lie algebras.
2	<b>Course content and learning outcomes (dublin descriptors)</b>	<p>Topics of the module include:</p> <ul style="list-style-type: none"> <li>• Abstract: The course covers the basics of the theory of Lie algebras in characteristic 0 and their representations.</li> <li>• Extended program: Lie algebras, linear Lie algebras, derivation algebras. Ideals, homomorphisms, representations. Automorphisms. Solvability and nilpotence, Engel's theorem. Semisimple Lie algebras. Theorems of Lie and Cartan, Killing's form, complete reducibility. Representations of <math>sl(2, F)</math>. Decomposition and root spaces. Axiomatic of root spaces. The Weil group. Classification of root spaces. Construction and abstract theory. Isomorphism Theorems. Cartan subalgebras. Conjugacy theorems. Universal enveloping algebras and the theorem of Poincaré Birkoff Witt. Simple algebras. Basic theory of the representations of Lie algebras.</li> </ul>
3	<b>Course prerequisites</b>	A basic knowledge of algebra taught in the first cycle, i.e. groups, rings, fields, polynomials. Knowledge of linear algebra (vector spaces and matrix algebra)
4	<b>Teaching methods and language</b>	<p>Lectures to be attended in class</p> <p><b>Language:</b> English</p> <p><b>Reference textbooks</b></p> <ul style="list-style-type: none"> <li>• James E. Humphreys, <i>Introduction to Lie Algebras and Representation Theory</i>. Springer. (vol. GTM no. 9) 1978.</li> </ul>
5	<b>Assessment methods</b>	Oral examination