UNIVERSITÀ DEGLI STUDI DI BARI ALDO MORO

CONSIGLIO INTERCLASSE IN MATEMATICA

COURSE OF STUDY THREE-YEAR BACHELOR PROGRAMME IN MATHEMATICS

ACADEMIC YEAR 2023-2024

ACADEMIC SUBJECT ALGEBRAIC GEOMETRY

General information	
Programme year	Third
Term	Second semester (February 26, 2024 – May 31, 2024)
European Credit Transfer and Accumulation System credits (ECTS)	7
SSD	MAT/03 – Geometry
Language	Italian
Mode of attendance	Not mandatory

Lecturers		
Name and surname	Donatella Iacono (instructor of record)	Francesco Bastianelli
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Department and office	Department of Mathematics room 11 third floor	Department of Mathematics room 18 second floor
Virtual meeting room		
Web page	https://www.dm.uniba.it/en/members/iacono	https://www.dm.uniba.it/en/members/bastianelli
Office hours		

Work schedule				
	Total	Lectures	Hands-on learning (recitations)	Self-study
Hours	175	56	0	119
ECTS credits	7	7	0	

Learning objectives

	Acquiring knowledge of basic notions in Algebraic Geometry, especially in the theory of curves and algebraic varieties.

Course prerequisites	
	Mathematical knowledge which is usually acquired during the first two years of a degree of L-35; in particular: linear algebra, affine geometry, projective geometry, topology.

Syllabus	
Course contents	**Preliminaries** Projective space and subspaces. Ring, integral domain, unique factorisation domain, ideals, properties, radical, maximal and prime ideals. **Algebraic curves** Recall of affine algebraic curves, projective algebraic curves, regular points, singular points, tangent line and tangent cone to a curve at a point. Resultant of polynomials. Intersection between projective curves and intersection multiplicity at a point. Bézout's theorem and applications. Flexes and Hessian curve. Linear systems of projective curves and Hilbert function. **Affine algebraic varieties** Noetherian rings. Artinian rings. Hilbert's basis Theorem. Affine algebraic varieties. Zariski topology. Hypersurfaces. Relation between varieties and ideals. Different formulations of Hilbert's Zero locus Theorem (Nullstellensatz). Irreducible algebraic varieties. Dimension. Regular and rational functions; regular and rational morphisms and isomorphism. Regular functions ring. Zariski tangent space. Groebner bases (mention). **Projective algebraic varieties** Homogeneous ideals and properties. Projective algebraic varieties. Closure of affine varieties and properties. Projective Hilbert's Zero locus Theorem. Homogeneous coordinates ring and field of rational functions. Regular and rational functions; regular and rational morphisms and isomorphism.
Reference books	W. FULTON, Algebraic Curves, The Benjamin-Cummings, Publ. Comp., Menlo Park, 1969. M. REID, Undergraduate Algebraic Geometry, Cambridge University Press, Cambridge, 1988. E. SERNESI, Geometria 1, Bollati Boringhieri, Torino, 1994.
Additional course materials	More information will be available on lecturer's web page.
Repository	

Expected learning outcomes	
Knowledge and understanding	Acquiring fundamental concepts in affine and projective Algebraic Geometry. Acquiring main proof techniques.
Applying knowledge and understanding	The acquired theoretical knowledge is involved in large part of mathematics such as commutative algebra.
Soft skills	*Making judgements*: Ability to choose suitable techniques and mathematical tools necessary to prove properties dealing with the program topics.
	Communication skills: Acquiring mathematical language and formalism necessary to read and understand textbooks.
	Learning skills: Acquiring suitable learning methods and relating the main concepts occurring in various courses.

Teaching methods	

Assessment	
Assessment methods	Oral exam about the topic of the course, to evaluate the understanding of the themes investigated.
Evaluation criteria	• *Knowledge and understanding*: Quality and accuracy of the techniques and proofs used and abstract reasoning. • *Applying knowledge and understanding*: Accuracy and precision of reasoning • *Making judgements*: Quality and precision of the proofs and techniques used. • *Communication skills*: Quality and accuracy of the acquired knowledge • *Learning skills*: Property and accuracy of the exposition
Grading policy	The final assessment is given in the range 18/30 e lode. The exam is passed if the assessment is greater or equal to 18. It depends on the quality, accuracy and precision showed during the exams.

Further information	