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 ALGEBRA 2

General information	
Programme year	Third
Term	First semester (September 25, 2023 – December 22, 2024)
European Credit Transfer and Accumulation System credits (ECTS)	7
SSD	MAT/02 – Algebra
Language	Italian
Mode of attendance	Not mandatory

Lecturer	
Name and surname	Roberto La Scala
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Department and office	Department of Mathematics, room 28 second floor
Virtual meeting room	Microsoft Teams: Algebra 2, code fc3ithr
Web page	https://www.dm.uniba.it/it/members/lascala
Office hours	Mon. Wed. Fri. 12:00 – 13:00, in presence or online (by appointment)

Work schedule	Total	Lectures	Hands-on learning (recitations)	Self-study
Hours	175	40	30	105
ECTS credits	7	5	2	

Learning objectives	
	Knowledge and application of the basic tools of modern algebra, such as groups, rings and fields theory.

Course prerequisites	
	The knowledge that is typically acquired in the first two years of a degree of L-35 class. In particular: arithmetic, basic algebraic structures and linear algebra.

Syllabus	
Course contents	Examples of groups. Definitions and first results in the theory of groups. Product and intersection of groups. Direct and semidirect product. Group isomorphism theorems. Examples of group actions. Conjugation classes of the symmetric group. Fundamental theorems for group actions. Homomorphisms and presentations. Sylow theorems. Structure of a finite abelian group. Classification of groups of low order. Examples of commutative and non-commutative rings. Units and zero-divisors. Ring isomorphisms theorems. Finite rings. Chinese remainder theorem. Integral domains, division rings and fields. Fraction field. Prime and

	maximal ideals. Prime and irreducible elements. Euclidean domains. Gauss integers. Principal ideal domains. Unique factorization domains. The characteristic of a field. Frobenius endomorphism. Field extensions. Degree multiplication rule. Algebraic and transcendent extensions. Transitivity of algebraic extensions. Algebraic closure. Splitting fields. Cyclotomic polynomials. The splitting field is unique. Algebraic closed fields. Primitive element theorem. Finite fields. The multiplicative group of a finite field.
Reference books	Herstein, Algebra, Editori Riuniti Jacobson, Basic Algebra I, Dover Books on Mathematics Piacentini-Cattaneo, Algebra, Zanichelli
Additional course materials	Lecture notes freely available on Internet J.S. Milne, Group Theory, www.jmilne.org/math J.S. Milne, Fields and Galois Theory, www.jmilne.org/math
Repository	Microsoft Teams

Expected learning outcomes	
Knowledge and understanding	Knowledge of fundamental concepts in modern algebra. Knowledge of basic mathematical proof techniques.
Applying knowledge and understanding	Ability to apply the acquired knowledge to different mathematical disciplines and their applications.
Soft skills	*Making judgements*: Evaluation of the correctness of the logical reasoning used in a proof. Ability to identify appropriate algebraic structures and tools to tackle complex problems.
	Communication skills: Knowledge of the mathematical language and formalism, necessary for the consultation and understanding of the texts, the presentation of acquired theory, the description, analysis and solution of concrete problems.
	Learning skills: Acquisition of an adequate study method, supported by the consultation of the texts and by the resolution of exercises and questions proposed periodically during the course.

Teaching methods	
	Lectures and exercise sessions.

Assessment	
Assessment methods	Oral final exam
Evaluation criteria	• *Knowledge and understanding*: • *Applying knowledge and understanding*: • *Making judgement*: • *Communication skills*: • *Learning skills*:
Grading policy	Final evaluation expressed in 30th and exam passed with at least 18 over 30.

Further information	
	Attendance at lectures and tutorials is strongly recommended.