COURSE DESCRIPTION

Analytic Geometry

Academic year 2026-2027

1. Programme-related data

1.1. Higher Education Institution	Babeș-Bolyai University
1.2. Faculty	Mathematics and Computer Science
1.3. Department	Mathematics
1.4. Field	Mathematics
1.5. Level of study	Bachelor
1.6. Degree programme / Qualification	Mathematics and Computer Science (English)
1.7. Form of education	Full-time

2. Course-related data

2.1. Course title	**Analytic Geometry**			Course code	**MLE0013**
2.2. Course coordinator	Lector dr. George-Cătălin Țurcaș				
2.3. Seminar coordinator	Lector dr. George-Cătălin Țurcaș				
2.4. Year of study	1	2.5. Semester	1	2.6. Type of assessment	Exam
2.7. Course status	Compulsory			2.8. Course type	Core subject

3. Total estimated time (hours per semester of teaching activities)

3.1. Number of hours per week	**4**	of which: 3.2. course	**2**	3.3. seminar/ laboratory/ project	**2**
3.4. Total of hours in the curriculum	56	of which: 3.5. course	28	3.6. seminar/ laboratory	**28**
Time allocation for individual study (IS) and self-taught activities (ST)					**hours**
Learning from textbooks, course materials, bibliography, and notes (IS)					24
Additional research in the library, on subject-specific electronic platforms, and on-site					10
Preparing seminars/ laboratories/ projects, assignments, reports, portfolios, and essays					30
Tutoring (professional guidance)					14
Examinations					6
Other activities					10
3.7. Total hours of individual study (IS) and self-taught activities (ST)				**94**	
3.8. Total hours per semester				**150**	
3.9. Number of credits				**6**	

4. Prerequisites (where applicable)

4.1. curriculum-related	None assumed
4.2 skills-related	Basic knowledge of algebra, trigonometry and elementary geometry

5. Specific conditions (where applicable)

5.1. course-related	Board and projector
5.2. seminar/laboratory-related	Board and (ideally) projector

6.1. Competencies resulting from the completion of the degree programme *(as referred to in the curriculum)*[1]

[1] The professional and/or transversal skills targeted by the subject for which the course description is prepared will be copied from the curriculum of the degree programme. For each competency, the complete entry, including the competency code, will be copied with the exact wording that appears in the curriculum, without any changes.

Professional competencies	
Competency code	**Competency**
CP2	perform analytical mathematical calculations
CP6	think abstractly
CP8	study relationships between quantities
Transversal competencies	
Competency code	**Competency**
CT4	Solve problems
CT5	Think analytically
CT1	Interpret mathematical information

6.2. Learning outcomes relevant to the degree programme (as referred to in the curriculum)[2]

Learning outcomes targeted by the subject		
Competency code	**Knowledge and comprehension**	**Specific academic skills**
CP2	11. The student/graduate indicates and recognizes the concepts involved in the requirements of exercises and problems formulated in the curriculum disciplines.	11. The student/graduate uses numerical methods and software packages to solve constructed mathematical models and interprets the obtained mathematical results from the perspective of the practical problem being modeled.
CP6	4. The student/graduate defines the basic concepts from advanced mathematics disciplines in the curriculum.	4. The student/graduate answers questions and correctly and rigorously formulates the statements of mathematical assertions (lemmas, propositions, theorems) from the disciplines in the curriculum.
CP8	3. The student/graduate formulates observations and differentiates notions, properties, and assertions from the core disciplines of mathematics through examples and counterexamples.	8. The student/graduate identifies and applies suitable techniques to solve exercises and problems from the major disciplines of mathematics.
CT4	2. The student/graduate compares and distinguishes related notions and their properties from the core disciplines of mathematics.	2. The student/graduate recognizes and analyzes the necessary and/or sufficient conditions in the statements of mathematical assertions and specifies their role in the proof.
CT5	2. The student/graduate compares and distinguishes related notions and their properties from the core disciplines of mathematics.	5. The student/graduate reproduces and analyzes the hypotheses and conclusions of mathematical assertions and discusses how these connect within the proof.
CT1	4. The student/graduate defines the basic concepts from advanced mathematics disciplines in the curriculum.	4. The student/graduate answers questions and correctly and rigorously formulates the statements of mathematical assertions (lemmas, propositions, theorems) from the disciplines in the curriculum.

7. Subject-specific learning outcomes

If no competency is copied from either of the two categories, the row corresponding to that category is deleted from the table.

[2] The learning outcomes relevant for the degree programme and targeted by the subject for which the course description is prepared will be listed. The entries, copied without any changes from the Curriculum by subject type (Core Subject/Specialisation Subject/Complementary Subject), are listed under the corresponding competency.

Knowledge and comprehension
1. Understand the fundamental concepts, methods, and representations of analytic geometry in the plane and in space.
2. Understand the relation between geometric objects and their algebraic or coordinate descriptions.
3. Understand the main properties of lines, planes, conics, and quadratic surfaces.
4. Understand the role of analytic methods in studying geometric configurations and solving geometric problems.
Specific academic skills
1. Solve problems involving points, vectors, lines, planes, distances, angles, and intersections using analytic methods.
2. Determine and use equations of geometric objects in Cartesian coordinates.
3. Formulate rigorous arguments and interpret geometric results in analytic form.

8. Contents

8.1. Course	**Teaching and learning methods**	**Remarks[3]**
Vector algebra and coordinates (3 lectures)	Lecture, description, examples using multimedia tools	
The straight line in the plane (1 lecture)	Lecture, description, examples using multimedia tools	
The line and plane in space (2 lectures)	Lecture, description, examples using multimedia tools	
Isometries and affine transformations in the plane (2 lectures)	Lecture, description, examples using multimedia tools	
Conic sections. Reduction to the canonical equation (3 lectures)	Lecture, description, examples using multimedia tools	
Quadric surfaces on the canonical equations (1 lecture)	Lecture, description, examples using multimedia tools	
Generated surfaces (1 lecture)	Lecture, description, examples using multimedia tools	
Isometries and affine transformations in space (1 lecture)	Lecture, description, examples using multimedia tools	
Bibliography		
Bibliography 1. D. Andrica, L. Topan - Analytic Geometry, Cluj University Press, 2004 2. M. Audin - Geometry, Springer, 2003 3. P. A. Blaga – Geometrie liniară: cu un ochi către grafica pe calculator, Presa Universitară Clujeană, 2022. 4. P.A. Blaga – Geometrie si grafica I (lecture notes available on the author website) 5. P. A. Blaga - Lectures on Classical Differential Geometry, Risoprint, 2005 6. M. P. Deisenroth, A. A. Faisal, C. S. Ong - *Mathematics for Machine Learning,* Cambridge University Press, 2020. 7. C. Pintea - Geometrie. Elemente de geometrie analitica. Elemente de Geometrie diferențială a curbelor și suprafețelor, Cluj University Press, 2001. 8. D. Moulton – Geometry. Lecture notes from the Michaelmas Term 2021, University of Oxford (available on https://courses.maths.ox.ac) 9. M. Reid, B. Szendroi- *Geometry and Topology,* Cambridge University Press, 2005.		
8.2. Seminar/ laboratory	**Teaching and learning methods**	**Remarks**
Vector algebra and coordinates (3 seminars)	Examples, dialogue, explanation, demonstration, problem-solving	
The straight line in the plane (1 seminar)	Examples, dialogue, explanation, demonstration, problem-solving	

[3] For example, organisational aspects, recommendations for students, specific aspects relating to the course/seminar, such as inviting experts in the field, etc.

The line and plane in space (2 seminars)	Examples, dialogue, explanation, demonstration, problem-solving	
Isometries and affine transformations in the plane (2 seminars)	Examples, dialogue, explanation, demonstration, problem-solving	
Conic sections. Reduction to the canonical equation (3 seminars)	Examples, dialogue, explanation, demonstration, problem-solving	
Quadric surfaces (1 seminar)	Examples, dialogue, explanation, demonstration, problem-solving	
Generated surfaces (1 seminar)	Examples, dialogue, explanation, demonstration, problem-solving	
Isometries and affine transformations in space (1 seminars)	Examples, dialogue, explanation, demonstration, problem-solving	

Bibliography

1. D. Andrica, L. Topan - Analytic Geometry, Cluj University Press, 2004
2. C. Blaga, P. Blaga – Geometrie analitică: culegere de probleme, Presa Universitară Clujeană, 2024.
3. D. Brannan, M. Esplen – Geometry, Cambridge University Press, Second Edition 2011
4. F. Rado - Culegere de probleme de geometrie, Lito UBB, 1979
5. D. Kletenik - Problems in Analytic Geometry, Arhiant, 2019
6. G. Simmons – Calculus with Analytic Geometry, McGraw-Hill Education, 1995
7. D. Moulton – Geometry. Problem sets from the Michaelmas Term 2021, University of Oxford (available on https://courses.maths.ox.ac)

9. Evaluation

Type of activity	9.1 Evaluation criteria[4]	9.2 Evaluation methods[5]	9.3 Percentage in the final grade
9.4. Course	Knowledge of fundamental concepts and results; problem solving ability	Midterm test	40%
		Final exam	50%
9.5. Seminar/ laboratory	Problem-solving ability based on learned concepts and theorems; Ability to synthesize mathematical content and effectively communicate it through clear presentations	Solving problems at the board; Homework	10%
9.6 Minimum standard for passing			
The arithmetic average of the grades obtained in the midterm test and the final exam should be greater than or equal to 5.			

10. SDG labels (Sustainable Development Goals)[6]

	○	Sustainable Development Generic Label

[4] The evaluation criteria must directly reflect the learning outcomes targeted at the level of the degree programme respectively at the level of the subject. More specifically, the learning outcomes set out in the expected learning outcomes are assessed.

[5] Both final evaluation methods and ongoing evaluation strategies should be established.

[6] Select a single label which, according to the *Implementation of SDG labels in the academic process*, best matches the subject. If the subject addresses sustainable development in a generic manner (i.e. by presenting/introducing the general framework of sustainable development, etc.), then the Sustainable Development generic label may be applied. If none of the labels describe the subject, select the last option: *"No label applies."*

								
○	○	○	○	○	○	○	○	X
								No label applies
○	○	○	○	○	○	○	○	○

Date of entry:
15.04.2026

Signature of course coordinator

Lector univ. dr. George Țurcaș

Signature of seminar coordinator

Lector univ. dr. George Țurcaș

Date of approval in the department:
24.04.2025

Signature of the head of department

Prof. dr. Andrei Mărcuș