SYLLABUS

1. Information regarding the programme

1.1 Higher education institution	Babeş-Bolyai University
1.2 Faculty	Faculty of Mathematics and Computer Science
1.3 Department	Department of Mathematics
1.4 Field of study	Mathematics
1.5 Study cycle	Bachelor
1.6 Study programme / Qualification	Mathematics and Computer Science

2. Information regarding the discipline

2.1 Name of the discipline (ro)	Geometrie 2 Geometrie 2						
2.2 Course coordinator			Lect. Dr. Iulian Simion				
2.3 Seminar coordinator			Lect. Dr. Iulian Simion				
2.4 Year of study	1	2.5 Semester	2	2.6. Type of evaluation	VP	2.7 Type of discipline	Compulsory
2.8 Disciplinei code		MLE0015					

3. Total estimated time (hours/semester of didactic activities)

3.1 Hours per week	4	Of which: 3.2 course	2	3.3 seminar	2
3.4 Total hours in the curriculum	56	Of which: 3.5 course	28	3.6 seminar	28
Time allotment:					hours
Learning using manual, course support, bibliography, course notes					20
Additional documentation (in libraries, on electronic platforms, field documentation)					20
Preparation for seminars/labs, homework, papers, portfolios and essays					35
Tutorship					15
Evaluations					3
Other activities:					1
3.7 Total individual study hours	94				
3.8 Total hours per semester	150				
3.9 Number of ECTS credits	6				

4. Prerequisites (if necessary)

4.1 curriculum	• Basic knowledege in algebra and calculus • A first course on analytic geometry
4.2 competencies	

5. Conditions (if necessary)

5.1 for the course	

5.2 for the seminar /lab activities	

6. Specific competencies acquired

Professional competencies	¬ C1.1 Idetifying the notions, describing the theories and using the specific language ¬ C2.3 Applying the adequate analytical theoretical methods to a given problem
Transversal competencies	¬ CT1. Applying some rules of precise and efficient work, showing a responsible attitude regarding the the scientific domain and teaching training for an optimal and creative development of the personal potential in specific situations, respecting the deontological norms.

7. Objectives of the discipline (outcome of the acquired competencies)

7.1 General objective of the discipline	Basic notions and methods în the context of affine geometry
7.2 Specific objective of the discipline	Affine transformations Classification of quadrics Projective transformations

8. Content

8.1 Course	Teaching methods	Remarks
1-2. Affine spaces • Geometric vectors • Vector space structure • Cartesian coordinate frames • Changing coordinates • Affine subspaces • Hyperplanes	Exposition, proofs, examples	Two lectures
3-4. Euclidean spaces • Scalar product • Gram matrix	Exposition, proofs, examples	Two lectures

• Orthonormal frames • Gram-Schmidt process • Applications • Spectral Theorem		
5. Orientation • Box product • Cross product • Properties • Applications	Exposition, proofs, examples	
6. Affine maps • Parallel projections and reflections • Orthogonal projections and reflections	Exposition, proofs, examples	
7. Isometries • Rotations in dimension 2 and 3 • Displacements • Classification of isometries in dimension 2 and 3	Exposition, proofs, examples	
8. Hyperquadrics • Reducing to canonical form • Isometric classification of quadrics • Affine classification of quadrics	Exposition, proofs, examples	
9-10. Quadratic surfaces • Ellipsoid, Cone, Hyperboloid, Paraboloid • Canonical equation • Tangent planes	Exposition, proofs, examples	Two lectures
11-12. Projective Geometry • Projective line, plane and space • Projective transformations	Exposition, proofs, examples	Two lectures
13-14. Quaternions • Algebraic description • Quaternions and rotations	Exposition, proofs, examples	Two lectures
Bibliography [1] I. Simion, Geometry – material de curs, 2024. [2] P.A. Blaga, Geometrie – material de curs, 2019. [3] M. Troyanov, Cours de géométrie, Lausanne, 2011. [4] E. Sernesi, Linear Algebra. A geometric Approach (Translated by J. Montaldi), 2009.		
8.2 Seminar	Teaching methods	Remarks
1-2. Affine spaces • Geometric vectors • Vector space structure • Cartesian coordinate frames • Changing coordinates • Affine subspaces • Hyperplanes	Dialog, problem solving	Two tutorials

3-4. Euclidean spaces • Scalar product • Gram matrix • Orthonormal frames • Gram-Schmidt process • Applications • Spectral Theorem	Dialog, problem solving	Two tutorials
5. Orientation • Box product • Cross product • Properties • Applications	Dialog, problem solving	
6. Affine maps • Parallel projections and reflections • Orthogonal projections and reflections	Dialog, problem solving	
7. Isometries • Rotations in dimension 2 and 3 • Displacements • Classification of isometries in dimension 2 and 3	Dialog, problem solving	
8. Hyperquadrics • Reducing to canonical form • Isometric classification of quadrics • Affine classification of quadrics	Dialog, problem solving	
9-10. Quadratic surfaces • Ellipsoid, Cone, Hyperboloid, Paraboloid • Canonical equation • Tangent planes	Dialog, problem solving	Two tutorials
11-12. Projective Geometry • Projective line, plane and space • Projective transformations	Dialog, problem solving	Two tutorials
13-14. Quaternions • Algebraic description • Quaternions and rotations	Dialog, problem solving	Two tutorials
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9. Corroborating the content of the discipline with the expectations of the epistemic community, professional associations and representative employers within the field of the program

- The material of this course serves other courses
- - a deeper understanding of linear algebra
- - affine transformations are necessary examples for a group theory course
- - quadrics are necessary examples in analysis courses
- - coordinate changes, projections, affine and projective transformations are necessary for computer graphics
- - Building on a previous geometry course, classification results are presented
- Applications of the theory are presented wherever appropriate

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Share in the grade (%)
10.4 Course	Critical grasp of the learned material, ability to use what was learned	Two written partial exams at the middle and at the end of the semester	40% and 60% respectively
10.5 Seminar	Ability to use the theory for solving problems	Points during the tutorial for active participation	Can lead up to one extra point for the final grade
10.6 Minimum performance standards			
75% attendance at the Seminar At least grade 5 for the final grade (excluding the bonus points obtained during the tutorials).			

Date	Signature of course coordinator	Signature of seminar coordinator
21. February 2024	Lect. Dr. Iulian Simion	Lect. Dr. Iulian Simion

Date of approval	Signature of the head of department
.....	Prof. Dr. Andrei Mărcuş