SYLLABUS

1. Information regarding the programme

1.1 Higher education institution	**Babes-Bolyai University Cluj-Napoca**
1.2 Faculty	**Faculty of Mathematics and Computer Science**
1.3 Department	**Mathematics**
1.4 Field of study	**Mathematics**
1.5 Study cycle	**Bachelor**
1.6 Study programme / Qualification	**Mathematics and Computer Science (English)**

2. Information regarding the discipline

2.1 Name of the discipline (en) (ro)	**Geometrie 3** **Differential Geometry of Curves and Surfaces** **Geometria diferențială a curbelor și suprafețelor**						
2.2 Course coordinator	**Assoc. Prof. Cornel PINTEA**						
2.3 Seminar coordinator	**Assoc. Prof. Cornel PINTEA**						
2.4. Year of study	**2**	2.5 Semester	**3**	2.6. Type of evaluation	**VP**	2.7 Type of discipline	**Compulsory**
2.8 Code of the discipline	MLE0016						

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

3.1 Hours per week	4	Of which: 3.2 course	4	3.3 seminar/laboratory	4
3.4 Total hours in the curriculum	56	Of which: 3.5 course	28	3.6 seminar/laboratory	28
Time allotment:	hours				
Learning using manual, course support, bibliography, course notes	20				
Additional documentation (in libraries, on electronic platforms, field documentation)	15				
Preparation for seminars/labs, homework, papers, portfolios and essays	15				
Tutorship	10				
Evaluations	9				
Other activities:					
3.7 Total individual study hours	69				
3.8 Total hours per semester	125				
3.9 Number of ECTS credits	5				

4. **Prerequisites** (if necessary)

4.1. curriculum	Calculus, Linear algebra, basic differential equations
4.2. competencies	Competences in logical reasoning and use of the curriculum knowledge specified above

5. Conditions (if necessary)

5.1. for the course	• The course room is equipped with blackboard and video projector. Presence at courses within the set schedule is highly recommended
5.2. for the seminar /lab activities	• The seminar room with blackboard and video projector. The attendance at the seminar within the set timetable is highly recommended. The study of the previous seminars and courses is also recommended

6. Specific competencies acquired

Professional competencies	C1.1 The ability to identify concepts, theories and use of specific description language C2.1 The ability to identify basic concepts used in the description of specific phenomena and processes C4.5 The ability to produce a mathematical model for a certain problem.
Transversal competencies	CT1. Applying rigorous and efficient work rules, displaying a responsible attitude towards the scientific ar respect to the basic principles and norms of professional ethics

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

7.1 General objective of the discipline	• Ability to distinguish the objects of differential geometry of curves and surfaces in different contexts. • To get hold of the fundamental theoretical results of differential geometry of curves and surfaces. • The correct use of the terminology specific to differential geometry • The ability to use the algorithms of differential geometry and the differential geometric concepts in problem solving	
7.2 Specific objective of the discipline	• The students are expected to acquire the ability to recognize the objects of geometry of curves and surfaces in different contexts such as other courses studied by themselves which require such knowledge.	

	• The students are expected to cultivate their abilities acquired within the course of geometry of curves and surfaces in order to connect and apply them within some other courses studied by themselves which require such knowledge. • To use the knowledge acquired within the couse of geometry of curves and surfaces in order to apply them in real life problems which lend oneself to analytic approaches. • Communication abilities	

8. **Content**

8.1 Course	Teaching methods	Remarks
1) Parametrized differentiable curves. Thetangent line, the normal plane and the osculating plane. The tangent and normal lines to a plane curve	Lecture, description, exemplifications by using multimedia tools	
2) Equivalent parametrized differentiable curves. The Frenet trihedron and the Frenet formulas	Lecture, description, exemplifications by using multimedia tools	
3) Formulas for the curvature and torsion	Lecture, description, exemplifications by using multimedia tools	
4) The fundamental theorem of the space parametrized differentiable curves. The signed curvature of plane parametrized differentiable curves	Lecture, description, exemplifications by using multimedia tool	
5) The fundamental theorem of plane parametrized differentiable curves. The local behaviour of the parametrized differentiable curves.	Lecture, description, exemplifications by using multimedia tools	
6) Regular curves. The first two preimage theorems. The contact problem of two curves.	Lecture, description, exemplifications by using multimedia tools	
7) The contact between a plane curve and a straight line. The contact between a plane curve and a circle.	Lecture, description, exemplifications by using multimedia tools	
8) Surfaces. Parametrized differentiable surfaces. The tangent plane and the normal line to a surface at a point. Regular surfaces. Regular traces of regular parametrized differentiable surfaces. The third preimage theorem.	Lecture, description, explanation, examples	
9) Holiday	Lecture, description, explanation, examples	
10) Differentiable functions on regular	Lecture, description,	

surfaces. The tangent vector space of a regular surface and the tangent (differential) map of a differentiable function.	explanation, examples	
11) The first fundamental form. Orientable regular surfaces. The Gauss map and the second fundamental form.	Lecture, description, explanation, examples	
12) The normal curvature. Asymptotic lines on a surface. The principal curvatures of a surface.The mean curvature and the Gauss curvature. The Egregium theorem	Lecture, description, explanation, examples	
13) The covariant derivative of the vector fields. The geodesic curvature of a naturally parametrized differentiable curve.	Lecture, description, explanation, examples	
14) The Darboux Frame. The Darboux formulae The geodesic torsion. Geodesic lines.	Lecture, description, explanation, examples	

Bibliography

1. BLAGA A. PAUL, Paul Blaga, Lectures on Classical Differential Geometry, Editura RISOPRINT, Cluj-Napoca, 2005
2. do CARMO MANFREDO P., Differential geometry of curves and surfaces, Prentince-Hall, Inc., Englewood Cliffs, New Jersey, 1976.
3. ENGHIȘ P., ȚARINĂ M., Curs de Geometrie Diferențială, Cluj-Napoca, 1985
4. FEDENKO A. Recueil d'exercices de geometrie differentielle, Ed. MIR, Moscou 1982
5. MURGULESCU E., col., Geometrie analitică si diferențială, Editura Didactică si Pedagogică, București, 1965.
6. MURGULESCU E., col., Geometrie analitică in spațiu si geometrie diferențială, Culegere de probleme, vol. 2 Ed. Didactică si Pedagogică, București.
7. PINTEA C., Geometrie. Elemente de geometrie analitica. Elemenete de geometrie diferentiala a curbelor si suprafetelor, Presa Universitara Clujeana, 2001.
8. TEODORESCU I.D., Geometrie Superioară, Ed. Didactică si Pedagogică, București , 1970
9. TEODORESCU I.D., TEODORESCU S.D., Culegere de probleme de Geometrie Superioară, Ed. Didactică și Pedagogică, București, 1975.

8.2 Seminar / laboratory	Teaching methods	Remarks
1) The equations of the cycloid, epicycloid and hypocycloid.	Description, explanation, independent and/or team study	

2) problems involving the tangent and the normal lines of plane curves.	Description, explanation, independent and/or team study	
3) problems involving the curvature and the torsion of space curves.	Description, explanation, independent and/or team study	
4) problems involving the curvature and the torsion of space curves.	Description, explanation, independent and/or team study	
5) problems on how to determine plane curves with prescribed curvature.	Description, explanation, independent and/or team study	
6) Examples of regular curves. The equations of their tangent lines and normal lines or planes.	Description, explanation, independent and/or team study	
7) The tangent plane and the normal line to some particular parametrized differentiable surfaces at a point.	Description, explanation, independent and/or team study	
8) Examples of regular surfaces.The equations oftheir tangent planes and normal lines.	Description, explanation, independent and/or team study	
9) Holiday	Description, explanation, independent and/or team study	
10) The coeficients of the first fundamental form associated to some particular surfaces.	Description, explanation, independent and/or team study	
11) Computation of the mean curvature, Gauss curvature and principal curvature for some particular surfaces.	Description, explanation, independent and/or team study	
12) Examples of minimal surfaces.	Description, explanation, independent and/or team study	
13. The geodesic curvatures of particular parametrized differentiable curves	Description, explanation, independent and/or team study	
14. Revision of the types of problems studied during the semester		

Bibliography

1. BLAGA A. PAUL, Paul Blaga, Lectures on Classical Differential Geometry, Editura RISOPRINT, Cluj-Napoca, 2005
2. do CARMO MANFREDO P., Differential geometry of curves and surfaces, Prentince-Hall, Inc., Englewood Cliffs, New Jersey, 1976.
3. ENGHIȘ P., ȚARINĂ M., Curs de Geometrie Diferențială, Cluj-Napoca, 1985
4. FEDENKO A. Recueil d'exercices de geometrie differentielle, Ed. MIR, Moscou 1982
5. MURGULESCU E., col., Geometrie analitică si diferențială, Editura Didactică si Pedagogică, București, 1965.

6. MURGULESCU E., col., Geometrie analitică in spațiu si geometrie diferențială, Culegere de probleme, vol. 2 Ed. Didactică si Pedagogică, București.

7. PINTEA C., Geometrie. Elemente de geometrie analitica. Elemenete de geometrie diferentiala a curbelor si suprafetelor, Presa Universitara Clujeana, 2001.

8. TEODORESCU I.D., Geometrie Superioară, Ed. Didactică si Pedagogică, București , 1970

9. TEODORESCU I.D., TEODORESCU S.D., Culegere de probleme de Geometrie Superioară, Ed. Didactică și Pedagogică, București, 1975.

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

- Generally speaking, Geometry, and the theory of surfaces in particular, may help individuals to build a logical thinking based on intuition. This may help to understand other mathematical fields or even other sciences. Also, geometry cultivate the practical skils, from a theoretical point of view, which are necessary in real life problems.
- The course exists in the studying programs of all major universities in Romania and abroad. The content of the course is suitable to build a strong mathematical background.

10. **Evaluation**

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Share in the grade (%)
10.4 Course	The completitude and correctness of the knowledge, the degree of assimilation of the specific language	Written final exam consisting in theoretical questions alongside applications and problems.	
10.5 Seminar/lab activities	The ability to use the assimilated knowledge in problem solving, originality	A grade for the student's activity within the tutorial during the whole semester. This might include a grade for the homeworks and/or a grade for a midterm quiz.	
The final grade will be computed according to the following formula: max{0.4xF+0.6E,E}, where F=max{0.5x(Q+T),Q} and Q=the grade at the midterm exam, T=2x(no. points obtained for your activity at tutorials) E=the grade obtained at the final exam If F<5, then the midterm exam might be repeated during the final exam. For a correctly solved problem at the tutorial one gets 2, 3 or 5 points, taking into account the complexity degree of the problem. If F<5 or the final grade is <5, then the exam is failed			
10.6 Minimum performance standards			
➢ At least grade 5 (from a scale of 1 to 10) at the final exam and the grade for tutorial component.			

Date	Signature of course coordinator	Signature of seminar coordinator
April 30, 2018	Assoc. Prof. Cornel Pintea	Assoc. Pr. Cornel Pintea

Date of approval	Signature of the head of department
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