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	Master
1.6 Study programme / Qualification	**Master of Advanced Mathematics**

2. Information regarding the discipline

2.1 Name of the discipline	**Qualitative theory of ordinary differential equations**						
2.2 Course coordinator	**Conf. dr. Adriana Buică**						
2.3 Seminar coordinator	**Conf. dr. Adriana Buică**						
2.4. Year of study	**1**	2.5 Semester	**1**	2.6. Type of evaluation	**E**	2.7 Type of discipline	**DF**

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

3.1 Hours per week	3	Of which: 3.2 course	2	3.3 seminar/laboratory	1
3.4 Total hours in the curriculum	42	Of which: 3.5 course	28	3.6 seminar/laboratory	14

Time allotment:	hours
Learning using manual, course support, bibliography, course notes	28
Additional documentation (in libraries, on electronic platforms, field documentation)	28
Preparation for seminars/labs, homework, papers, portfolios and essays	35
Tutorship	28
Evaluations	4
Other activities:	-

3.7 Total individual study hours	133
3.8 Total hours per semester	175
3.9 Number of ECTS credits	8

4. Prerequisites (if necessary)

4.1. curriculum	• Mathematical Analysis; Differential Equations
4.2. competencies	• Logical thinking, as well mathematical notions and properties from the above mentioned fields (at introductory level).

5. Conditions (if necessary)

5.1. for the course	• blackboard
5.2. for the seminar /lab activities	• blackboard

6. Specific competencies acquired

Professional competencies	• Ability to understand and manipulate advanced concepts, results and theories in the fields of mathematics.
Transversal competencies	• Ability to inform themselves, to work independently or in a team in order to realize studies and to solve complex problems. • Ability for continuous self-perfecting and study.

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

7.1 General objective of the discipline	• To be familiar with the important problems in the qualitative theory of differential equations: dependence of solutions on data and parameters, approximation, stability, first integrals.
7.2 Specific objective of the discipline	• To be able to prove the main results • To be able to apply the main results in examples and physical models • To have an intuition on the variety of problems that can appear in studying the differential equations

8. Content

8.1 Course	Teaching methods	Remarks
1. First order scalar nonlinear differential equations revisited. I	Interactive exposure Explanation Conversation Demonstration	
2. First order scalar nonlinear differential equations revisited. II	Interactive exposure Explanation Conversation Demonstration	
3. The Cauchy problem. Local existence. Peano theorem. Uniqueness.	Interactive exposure Explanation Conversation Demonstration	
4. The Cauchy problem. Saturated solutions. Global solutions. Regularity of solutions.	Interactive exposure Explanation Conversation Demonstration	
5. Continuous dependence on data and parameters.	Interactive exposure Explanation Conversation Demonstration	
6. Differentiability with respect to data and parameters.	Interactive exposure Explanation Conversation Demonstration	
7. Approximation: power series method and the	Interactive exposure	

successive approximations method.	Explanation Conversation Demonstration	
8. Approximation: the method of polygonal lines (Euler).	Interactive exposure Explanation Conversation Demonstration	
9. Stability of linear systems with constant coefficients.	Interactive exposure Explanation Conversation Demonstration	
10. Stability of equilibria of nonlinear systems: the linearization method.	Interactive exposure Explanation Conversation Demonstration	
11. Stability of equilibria of nonlinear systems: the Liapunov functions method.	Interactive exposure Explanation Conversation Demonstration	
12. Stability of dissipative systems.	Interactive exposure Explanation Conversation Demonstration	
13. Invariant manifolds.	Interactive exposure Explanation Conversation Demonstration	
14. First integrals for differential systems.	Interactive exposure Explanation Conversation Demonstration	
Bibliography 1. C. Chicone, Ordinary differential equations with applications, Springer, 2006. 2. J.K. Hale, Ordinary differential equations, Krieger, 1980. 3. M.W. Hirsch, S. Smale, R.L. Devaney, Differential equations, dynamical systems, and an introduction to chaos, Elsevier, 2013. 4. I.I. Vrabie, Differential equations, World Scientific, 2004.		
8.2 Seminar / laboratory	Teaching methods	Remarks
1. Various problems and exercises on the theme of the same week lecture.	Explanation Conversation	
2. Various problems and exercises on the theme of the same week lecture.	Explanation Conversation	
3. Various problems and exercises on the theme of the same week lecture.	Explanation Conversation	
4. Various problems and exercises on the theme of the same week lecture.	Explanation Conversation	
5. Various problems and exercises on the theme of the same week lecture.	Explanation Conversation	
6. Various problems and exercises on the theme of the same week lecture.	Explanation Conversation	
7. Various problems and exercises on the theme of the same week lecture.	Explanation Conversation	
8. Various problems and exercises on the theme of the same week lecture.	Explanation Conversation	
9. Various problems and exercises on the theme	Explanation	

of the same week lecture.	Conversation	
10. Various problems and exercises on the theme of the same week lecture.	Explanation Conversation	
11. Various problems and exercises on the theme of the same week lecture.	Explanation Conversation	
12. Various problems and exercises on the theme of the same week lecture.	Explanation Conversation	
13. Various problems and exercises on the theme of the same week lecture.	Explanation Conversation	
14. Various problems and exercises on the theme of the same week lecture.	Explanation Conversation	

Bibliography

1. C. Chicone, Ordinary differential equations with applications, Springer, 2006.
2. J.K. Hale, Ordinary differential equations, Krieger, 1980.
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4. I.I. Vrabie, Differential equations, World Scientific, 2004.

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 content of this discipline is synchronized with the curriculum of most of the important universities from our country and from abroad where the applied mathematics plays an important role.

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Share in the grade (%)
10.4 Course	To know the notions and their properties by examples or counterexamples. To be able to prove and use the main theoretical results.	Exam	60%
	To develop a specific subject by reading the bibliography.	Report	20%
10.5 Seminar/lab activities	Solving problems skills	Evaluation of the homeworks	20%
	Active participation in the classroom		
10.6 Minimum performance standards			
➢ The minimum passing grade is 5.			

Date	Signature of course coordinator	Signature of seminar coordinator
11-04-2016	Conf. dr. Adriana Buică	Conf. dr. Adriana Buică

Date of approval	Signature of the head of department
18-04-2016	Prof. dr. Octavian Agratini