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	Department of Mathematics
1.4 Field of study	Mathematics
1.5 Study cycle	Bachelor
1.6 Study programme / Qualification	Computer Mathematics

2. Information regarding the discipline

2.1 Name of the discipline	Differential Equations						
2.2 Course coordinator	Dr.						
2.3 Seminar coordinator	Dr.						
2.4. Year of study	**II**	2.5 Semester	**1**	2.6. Type of evaluation	**Exam**	2.7 Type of discipline	**compulsory**

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

3.1 Hours per week	5	Of which: 3.2 course	2	3.3 seminar/laboratory	2+1
3.4 Total hours in the curriculum	70	Of which: 3.5 course	28	3.6 seminar/laboratory	28+14
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					22
Tutorship					8
Evaluations					15
Other activities:					-

3.7 Total individual study hours	55
3.8 Total hours per semester	125
3.9 Number of ECTS credits	5

4. Prerequisites (if necessary)

4.1. curriculum	• Mathematical Analysis (I-II)
4.2. competencies	• Mathematical Analysis (I-II), Geometry (I)

5. Conditions (if necessary)

5.1. for the course	• Video projector
5.2. for the seminar /lab activities	• Video projector and lab with Maple

6. Specific competencies acquired

Professional competencies	• Ability to understand and manipulate concepts, results and methods to solve differential equations. • Ability to model and analyze from the mathematical point of view real processes from other sciences, economics, and engineering. • Ability to apply theoretical results to certain concrete problems associated to differential equations • Acquiring specific methods in differential equation theory and its applications
Transversal competencies	• Ability to inform themselves, to work independently or in a team in order to realize studies and to solve different kind of problems. • Ability for continuous self-perfecting and study. • Ability to use advanced and complementary knowledge related to other sciences

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

7.1 General objective of the discipline	• to present the basic concepts and results in differential equations theory
7.2 Specific objective of the discipline	• basic concepts and tools of differential equations which can be effectively solved • main concepts and results concerning the qualitative theory of differential equations • basic problems related to linear differential equations • applications of the multivalued operators theory to mathematical economics and differential inclusions theory

8. Content

8.1 Course	Teaching methods	Remarks
1. Differential equations. Short historical overview. The concept of solution.	**Expositions**: description, explanation, class lectures, dialog-based lectures, lectures with demonstrations, introductive lectures, synthesis lectures. **Conversations**: debate, dialog, introductive conversations, conversations for knowledge consolidation, conversations to systematize and synthesize knowledge **Use of problems**: use of problem questions, problems and problem situations.	
2. Analysis in Banach spaces. Lipschitz mapping	the same as before	
3. Banach's contraction principle and the abstract data dependence theorem	the same as before	

4. Mathematical models governed by differential equations	the same as before	
5. Cauchy problem. Qualitative theory (I)	the same as before	
6. Cauchy problem. Qualitative theory (II)	the same as before	
7. Dynamics generated by differential equations	the same as before	
8. Systems of linear differential equations of first order	the same as before	
9. Systems of differential equations with constant coefficient	the same as before	
10. Dynamical systems generated by differential equations	the same as before	
11. Linear differential equations of n-order	the same as before	
12. Linear differential equations with constant coefficients	the same as before	
13. Stability Theory	the same as before	
14. Research directions in the theory of differential equations	the same as before	

Bibliography

1) 1. R. PRECUP, Ecuatii diferentiale, Risoprint, Cluj-Napoca, 2011.
2. I.A. RUS, Ecuatii diferentiale, ecuatii integrale si sisteme dinamice, Transilvania Press, Cluj, 1996.
3. I.A. RUS , P. PAVEL, Ecuatii diferentiale, Ed. Did. Ped., Bucuresti, 1982.
4. V. BARBU, Ecuatii diferentiale, Ed. Junimea, Iasi, 1985.
5. I.I. VRABIE, Differential Equations, World Scientific, New Jersey, 2011.
6. A. CERNEA, Elemente de teoria ecuaţiilor diferenţiale, Editura Univ. Bucureşti, 2010
7. L. PERKO, Differential Equations and Dynamical Systems, Springer-Verlag, New York, 2001.

8.2 Seminar / laboratory	Teaching methods	Remarks
1. Examples and exercises concerning Lipschitz functions	**Conversations**: debate, dialog, introductive conversations, conversations for knowledge consolidation, conversations to systematize and synthesize knowledge **Use of problems**: use of problem questions, problems and problem situations	
2. Examples and exercises related to differential equations which can be effectively solved (I)	the same as before	
3. Examples and exercises related to differential equations which can be effectively solved (II)	the same as before	
4. Examples and exercises related to differential equations which can be effectively solved (III)	the same as before	
5. Examples and exercises related to differential equations which can be effectively solved (IV)	the same as before	
6. Written test	the same as before	
7. Cauchy problem (I)	the same as before	
8. Cauchy problem (II)	the same as before	
9. Mathematical models governed by differential equations	the same as before	
10. Systems of linear differential equations	the same as before	
11. Dynamical aspects in the theory of differential equations	the same as before	

12. Linear differential equations (I)	the same as before	
13. Linear differential equations (I)	the same as before	
14. Final and synthesis problems	the same as before	

Bibliography

1. R. PRECUP, Ecuatii diferentiale, Risoprint, Cluj-Napoca, 2011.
2. G. MOROSANU, Ecuatii diferentiale. Aplicatii, Ed. Acad., Bucuresti, 1990.
3. G. MICULA, P. PAVEL, Ecuatii diferentiale si integrale prin exercitii si probleme, Ed. Dacia, Cluj, 1989.

8.3 Lab	*Metode de predare*	*Observaţii*
1. Introduction to Maple	**Conversations**: debate, dialog, introductive conversations, conversations for knowledge consolidation, conversations to systematize and synthesize knowledge **Use of problems**: use of problem questions, problems and problem situations	The Lab takes place 2 hours every 2 weeks.
2. Differential equations with Maple (I)	the same as before	
3. Differential equations with Maple (II)	the same as before	
4. Systems of linear equations	the same as before	
5. Second order differential equations	the same as before	
6. Succesive approximations method	the same as before	
7. Final test	the same as before	

Bibliografie

4. R. PRECUP, Ecuatii diferentiale, Risoprint, Cluj-Napoca, 2011.
5. G. MOROSANU, Ecuatii diferentiale. Aplicatii, Ed. Acad., Bucuresti, 1990.
6. G. MICULA, P. PAVEL, Ecuatii diferentiale si integrale prin exercitii si probleme, Ed. Dacia, Cluj, 1989.

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 syllabus of this course is focused on the differential equations theory, as a basis for a better understanding of the partial differential equations and mathematical models. Moreover, the course propose the following three important directions:

1. the understanding of the main concepts and methods in the classical theory of differential equations;

2. the use of Banach's contraction principle in the qualitative theory of differential equations
3. the applications of the differential equations theory to real world problems.

The content of this discipline is in accordance with the curricula of the most important universities in Romania and abroad. This discipline is useful in preparing future teachers and researchers in pure and applied mathematics, as well as those who use mathematical models and advanced methods of study in other areas.

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Share in the grade (%)
10.4 Course	Knowledge of concepts and basic results	Course and home works activities	10%
	Ability to justify by proofs theoretical results	Final Written Test	50%
10.5 Seminar/lab activities	Ability to apply concepts and results acquired during the course in Differential Equations	Written Test Seminar activities Lab activity	20% 10% 10%
	There are valid the official rules of the faculty concerning the attendance of students to teaching activities.		
10.6 Minimum performance standards			
Successful passing of the exam is conditioned by the final grade that has to be at least 5. All university official rules with respect to students attendance of academic activities, as well as to cheating and plagiarism, are valid and enforced.			

Date	Signature of course coordinator	Signature of seminar coordinator
May 1st, 2018	Professor	
Date of approval	Signature of the head of department	
May 2nd, 2018	Professor Octavian Agratini, Ph.D.	