

SYLLABUS

1. Information regarding the programme

1.1 Higher education institution	Babeş-Bolyai University of Cluj-Napoca
1.2 Faculty	Faculty of Mathematics and Computer Science
1.3 Department	Doctoral School in Mathematics and Computer Science
1.4 Field of study	Mathematics
1.5 Study cycle	Doctoral studies
1.6 Study programme	TRAINING PROGRAM BASED ON ADVANCED ACADEMIC STUDIES

2. Information regarding the discipline

2.1 Name of the discipline	Special Chapters of Category Theory						
2.2 Course coordinator	Prof. Dr. Septimiu Crivei						
2.3 Seminar coordinator	Prof. Dr. Septimiu Crivei						
2.4. Year of study	1	2.5 Semester	1	2.6. Type of evaluation	E	2.7 Type of discipline	DS/Optional

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 sem
3.4 Total hours in the curriculum	36	Of which: 3.5 course	24	3.6 seminar/laboratory	12
Time allotment:	hours				
Learning using manual, course support, bibliography, course notes	48				
Additional documentation (in libraries, on electronic platforms, field documentation)	48				
Preparation for seminars/labs, homework, papers, portfolios and essays	36				
Tutorship	36				
Evaluations	46				
Other activities:					
3.7 Total individual study hours	214				
3.8 Total hours per semester	250				
3.9 Number of ECTS credits	10				

4. Prerequisites (if necessary)

4.1. curriculum	Basic algebraic structures
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	<ul style="list-style-type: none"> ● ability to perform symbolic calculus in various structures ● ability to operate with abstract concepts ● ability to solve mathematical problems based on learned concepts
Transversal competencies	<ul style="list-style-type: none"> ● abstract thinking ● ability to apply mathematics in other scientific fields ● ability to perform research

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

7.1 General objective of the discipline	Study of important knowledge on Category Theory
7.2 Specific objective of the discipline	Acquiring specific working techniques from Category Theory

8. Content

8.1 Course	Teaching methods	Remarks
1. Categories – definition and examples	Exposition, proof, examples	
2. Special objects and morphisms	Exposition, proof, examples	
3. Constructions in categories	Exposition, proof, examples	
4. Products and coproducts	Exposition, proof, examples	
5. Equalizers and coequalizers	Exposition, proof, examples	
6. Pullbacks and pushouts	Exposition, proof, examples	
7. Limits and colimits	Exposition, proof, examples	
8. Natural transformations	Exposition, proof, examples	
9. Equivalences of categories	Exposition, proof, examples	
10. Yoneda Lemma	Exposition, proof, examples	
11. Adjoint functors	Exposition, proof, examples	
12. Grothendieck categories	Exposition, proof, examples	
13. Abelian categories	Exposition, proof, examples	
14. Exact categories	Exposition, proof, examples	
8.2 Seminar	Teaching methods	Remarks
1. Categories – definition and examples	Explanation, examples	
2. Special objects and morphisms	Explanation, examples	
3. Constructions in categories	Explanation, examples	
4. Products and coproducts	Explanation, examples	
5. Equalizers and coequalizers	Explanation, examples	
6. Pullbacks and pushouts	Explanation, examples	
7. Limits and colimits	Explanation, examples	
8. Natural transformations	Explanation, examples	
9. Equivalences of categories	Explanation, examples	
10. Yoneda Lemma	Explanation, examples	

11. Adjoint functors	Explanation, examples	
12. Grothendieck categories	Explanation, examples	
13. Abelian categories	Explanation, examples	
14. Exact categories	Explanation, examples	
Bibliography		
1. S. Awodey, Category theory, Oxford University Press, 2010.		
2. S. Mac Lane, Categories for the working mathematician, Springer, 1998.		
3. B. Mitchell, Theory of categories, Academic Press, New York, London, 1965.		
4. C. Nastasescu, Inele, module, categorii, Editura Academiei, Bucuresti, 1976.		
5. I. Purdea, Tratat de algebra moderna, vol. II, Editura Academiei, Bucuresti, 1982.		

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

Content of the discipline is directed towards theory and applications of categories. This topic is present in many doctoral programs of other universities.

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Share in the grade (%)
10.4 Course	Using basic concepts, examples	Test, project	25%
10.5 Seminar	Problem solving	Presentation, assignments	75%
10.6 Minimum performance standards			
Grade 5.			

Date	Signature of course coordinator	Signature of seminar coordinator
30.06.2021	Prof. Dr. Septimiu Crivei	Prof. Dr. Septimiu Crivei

Date of approval	Signature of the head of doctoral school
07.07.2021	Prof. dr. Gabriela Czibula 