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	**Advanced Mathematics**

2. Information regarding the discipline

2.1 Name of the discipline	**Category theory**						
2.2 Course coordinator	**Prof.PhD. Septimiu Crivei**						
2.3 Seminar coordinator	**Prof.PhD. Septimiu Crivei**						
2.4. Year of study	**1**	2.5 Semester	**2**	2.6. Type of evaluation	**E**	2.7 Type of discipline	**DS**

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					42
Tutorship					21
Evaluations					14
Other activities:					
3.7 Total individual study hours		133			
3.8 Total hours per semester	175				
3.9 Number of ECTS credits	7				

4. Prerequisites (if necessary)

4.1. curriculum	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	▪ Ability to operate with abstract concepts. ▪ Ability to apply the acquired knowledge to subdomains of mathematics.
Transversal competencies	▪ Development of abstract thinking. ▪ Ability to perform research.

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

7.1 General objective of the discipline	▪ To acquire the basic knowledge on category theory.
7.2 Specific objective of the discipline	▪ To acquire specific working techniques.

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 on 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. Equivalence 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	

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* (in Romanian), Editura Academiei, Bucuresti, 1976.
5. I. Purdea, *Tratat de algebra moderna*, vol. II (in Romanian), Editura Academiei, Bucuresti, 1982.

8.2 Seminar / laboratory	Teaching methods	Remarks
1. Categories - definition and examples	Explanation, problematization, examples	

2. Special objects and morphisms	Explanation, problematization, examples	
3. Constructions on categories	Explanation, problematization, examples	
4. Products and coproducts	Explanation, problematization, examples	
5. Equalizers and coequalizers	Explanation, problematization, examples	
6. Pullbacks and pushouts	Explanation, problematization, examples	
7. Limits and colimits	Explanation, problematization, examples	
8. Natural transformations	Explanation, problematization, examples	
9. Equivalence of categories	Explanation, problematization, examples	
10. Yoneda Lemma	Explanation, problematization, examples	
11. Adjoint functors	Explanation, problematization, examples	
12. Grothendieck categories	Explanation, problematization, examples	
13. Abelian categories	Explanation, problematization, examples	
14. Exact categories	Explanation, problematization, examples	

Bibliography

1. S. Awodey, *Category theory*, Oxford University Press, 2010.
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5. I. Purdea, *Tratat de algebra moderna*, vol. II (in Romanian), 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

- The contents is directed towards theory and applications of categories. The topic is present in many master programs from other universities.

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Share in the grade (%)
10.4 Course	Use of basic concepts, examples	Project, presentation.	50
10.5 Seminar/lab activities	Problem solving	Assignments, presentation.	50
10.6 Minimum performance standards			
- Grade 5			

Date	Signature of course coordinator	Signature of seminar coordinator
28.04.2021	Prof.PhD. Septimiu CRIVEI	Prof.PhD. Septimiu CRIVEI

Date of approval

Signature of the head of department

Prof.PhD. Octavian AGRATINI