

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	Rings and modules						
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						49
Tutorship						14
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	<ul style="list-style-type: none"> Algebraic structures, Linear algebra
4.2. competencies	<ul style="list-style-type: none">

5. Conditions (if necessary)

5.1. for the course	<ul style="list-style-type: none">
5.2. for the seminar /lab activities	<ul style="list-style-type: none">

6. Specific competencies acquired

Professional competencies	<ul style="list-style-type: none"> • Ability to do symbolic calculations in algebraic structures. • Ability to operate with abstract concepts. • Ability to solve mathematical problems on the topic.
Transversal competencies	<ul style="list-style-type: none"> • Development of abstract thinking. • Capacity of problem solving. • Ability to perform research.

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

7.1 General objective of the discipline	<ul style="list-style-type: none"> • To acquire the basic knowledge on rings and modules.
7.2 Specific objective of the discipline	<ul style="list-style-type: none"> • To acquire specific working techniques.

8. Content

8.1 Course	Teaching methods	Remarks
1. Rings – definitions and examples	Exposition, proof, examples	
2. Modules – definitions and examples	Exposition, proof, examples	
3. Homomorphisms of rings and modules	Exposition, proof, examples	
4. Direct products and direct sums	Exposition, proof, examples	
5. Decomposition of rings	Exposition, proof, examples	
6. Semisimple rings and modules	Exposition, proof, examples	
7. Finiteness conditions for rings and modules	Exposition, proof, examples	
8. Free modules	Exposition, proof, examples	
9. Projective modules	Exposition, proof, examples	
10. Injective modules	Exposition, proof, examples	
11. Tensor products of modules	Exposition, proof, examples	
12. Flat modules and purity	Exposition, proof, examples	
13. Finitely generated modules over PIDs	Exposition, proof, examples	
14. Algebras	Exposition, proof, examples	

Bibliography

1. F.W. Anderson, K.R. Fuller, *Rings and categories of modules*, Springer, 1992.
2. T.Y. Lam, *A first course in noncommutative rings*, Springer, 2001.
3. T.Y. Lam, *Lectures on modules and rings*, Springer, 2009.
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.
6. R. Wisbauer, *Foundations of module and ring theory*, Gordon and Breach, 1991.

8.2 Seminar / laboratory	Teaching methods	Remarks
1. Rings and modules – definitions and examples	Explanation, problematization, examples	2 hours classes
2. Direct products and direct sums	Explanation, problematization, examples	
3. Semisimple rings and modules	Explanation, problematization, examples	

4. Finiteness conditions for rings and modules	Explanation, problematization, examples	
5. Free and projective modules	Explanation, problematization, examples	
6. Injective modules	Explanation, problematization, examples	
7. Tensor product of modules	Explanation, problematization, examples	
Bibliography		
1. F.W. Anderson, K.R. Fuller, <i>Rings and categories of modules</i> , Springer, 1992.		
2. T.Y. Lam, <i>A first course in noncommutative rings</i> , Springer, 2001.		
3. T.Y. Lam, <i>Exercises in classical ring theory</i> , Springer, 2003.		
4. T.Y. Lam, <i>Lectures on modules and rings</i> , Springer, 2009.		
5. C. Nastasescu, <i>Inele, module, categorii</i> (in Romanian), Editura Academiei, Bucuresti, 1976.		
6. R. Wisbauer, <i>Foundations of module and ring theory</i> , Gordon and Breach, 1991.		

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

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| <ul style="list-style-type: none"> The contents is directed towards theory and applications of categories. The topic is present in many master programs from other universities. |
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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

30.04.2020

Signature of course coordinator

Prof.PhD. Septimiu CRIVEI

Signature of seminar coordinator

Prof.PhD. Septimiu CRIVEI

Date of approval

Signature of the head of department

Prof.PhD. Octavian AGRATINI