# FIŞA DISCIPLINEI

## 1. Information regarding the programme

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| 1.1 Higher education institution | **Babeş Bolyai University** |
| 1.2 Faculty | **Faculty of Mathematics and Computer Science** |
| 1.3 Department | **Department of Computer Science** |
| 1.4 Field of study | **Mathematics** |
| 1.5 Study cycle | **Master** |
| 1.6 Study programme / Qualification | **Mathematics** |

## 2. Information regarding the discipline

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| 2.1 Name of the discipline | **Module Theory** | | | | | | |
| 2.2 Course coordinator | **Assoc.Prof.PhD. Simion Breaz** | | | | | | |
| 2.3 Seminar coordinator | **Assoc.Prof.PhD. Simion Breaz** | | | | | | |
| 2.4. Year of study | **1** | 2.5 Semester | **2** | 2.6. Type of evaluation | **E** | 2.7 Type of discipline | **Compulsory** |

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

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|---|---|---|---|---|---|
| 3.1 Hours per week | 2 | 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 |

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| Time allotment: | hours |
| Learning using manual, course support, bibliography, course notes | 30 |
| Additional documentation (in libraries, on electronic platforms, field documentation) | 30 |
| Preparation for seminars/labs, homework, papers, portfolios and essays | 30 |
| Tutorship | 23 |
| Evaluations | 10 |
| Other activities: test | 10 |

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| 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)

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| 4.1. curriculum | |
| 4.2. competencies | |

## 5. Conditions (if necessary)

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| 5.1. for the course | |
| 5.2. for the seminar /lab activities | |

**6. Specific competencies acquired**

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| **Professional competencies** | • *Ability to understand and manipulate advanced concepts, results and theories in the fields of mathematics.*<br>• *Ability to understand scientific papers in the fields of mathematics, to put new problems and to initiate new research.*<br>• *Ability to communicate in a scientific language and to make reports and scientific papers.* |
| **Transversal competencies** | • *Ability to communicate and teach fundamental and advanced knowledge from the fields of mathematics.*<br>• *Ability to use basic and complementary knowledge in pursuing a doctoral program in the fields of Mathematics.*<br>• *Ability for continuous self-perfecting and study.* |

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

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| 7.1 General objective of the discipline | The students will be able to manage notions, results, and techniques related to Module Theory over non-commutative rings |
| 2 Specific objective of the discipline | The stidents will:<br>• understand notions as direct sum, direct product, tensor product;<br>• contruct new objects;<br>• use the injective hull and the projective cover;<br>• use various classes of submodules/supromodules. |

**8. Content**

| 8.1 Course | Teaching methods | Remarks |
|---|---|---|
| 1. Basic notions: rings, modules, submodules, homomorphisms | Exposure: description, explanation, examples, discussion of case studies | |
| 2. Direct sum; Direct summand | Exposure: description, explanation, examples, discussion of case studies | |
| 3. Direct product | Exposure: description, explanation, examples, discussion of case studies | |
| 4. Free and projective modules | Exposure: description, explanation, examples, discussion of case studies | |
| 5. Injective modules | Exposure: description, explanation, examples, discussion of case studies | |
| 6. Semi-simple rings and modules | Exposure: description, | |

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|---|---|---|
| | explanation, examples, discussion of case studies | |
| 7. Finiteness conditions | Exposure: description, explanation, examples, discussion of case studies | |
| 8. Noetherian/artinian modules | Exposure: description, explanation, examples, discussion of case studies | |
| 9. Tensor product. | Exposure: description, explanation, examples, discussion of case studies | |
| 10. Flat modules | Exposure: description, explanation, examples, discussion of case studies | |
| 11. Pure submodules | Exposure: description, explanation, examples, discussion of case studies | |
| 12. Modules over PID | Exposure: description, explanation, examples, discussion of case studies | |
| 13. Rings and modules of fractions | Exposure: description, explanation, examples, discussion of case studies | |
| 14. Nonsingular rings and modules | Exposure: description, explanation, examples, discussion of case studies | |

References

1.Anderson, F.W., Fuller, K.R.: Rings and Categories of Modules, Graduate Texts in Math. Vol. 13, Springer-Verlag, 1992.

2.Lam, T.Y.: Lectures On Modules and Rings, Graduate Texts in Math. Vol. 189, Springer-Verlag, 1999.

3.Lam, T.Y.: A First Course in Noncommutative rings, Graduate Texts in Math. Vol. 131, Springer-Verlag, 1991.

| 8.2 Seminar / laborator | Metode de predare | Observaţii |
|---|---|---|
| 1. Basic notions: rings, modules, submodules, homomorphisms | Exposure: description, explanation, examples, discussion of case studies | |
| 2. Direct sum; Direct summand | Exposure: description, explanation, examples, discussion of case studies | |
| 3. Direct product | Exposure: description, explanation, examples, discussion of case studies | |

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| 4. Free and projective modules | Exposure: description, explanation, examples, discussion of case studies | |
| 5. Injective modules | Exposure: description, explanation, examples, discussion of case studies | |
| 6. Semi-simple rings and modules | Exposure: description, explanation, examples, discussion of case studies | |
| 7. Finiteness conditions | Exposure: description, explanation, examples, discussion of case studies | |
| 8. Noetherian/artinian modules | Exposure: description, explanation, examples, discussion of case studies | |
| 9. Tensor product. | Exposure: description, explanation, examples, discussion of case studies | |
| 10. Flat modules | Exposure: description, explanation, examples, discussion of case studies | |
| 11. Pure submodules | Exposure: description, explanation, examples, discussion of case studies | |
| 12. Modules over PID | Exposure: description, explanation, examples, discussion of case studies | |
| 13. Rings and modules of fractions | Exposure: description, explanation, examples, discussion of case studies | |
| 14. Nonsingular rings and modules | Exposure: description, explanation, examples, discussion of case studies | |
| 1.Anderson, F.W., Fuller, K.R.: Rings and Categories of Modules, Graduate Texts in Math. Vol. 13, Springer-Verlag, 1992.<br>2. Lam, T.Y.: Exercices in Classical Ring Theory, Problem Books in Mathematics, Springer-Verlag, 1995.<br>3. Lam, T.Y.: Exercices in Modules and Rings, Problem Books in Mathematics, Springer-Verlag, 2007. | | |

**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 course respects the standards used by many universities;
The course exists in the studying program of all major universities in Romania and abroad;

**10. Evaluation**

| Type of activity | 10.1 Evaluation criteria | 10.2 Evaluation methods | 10.3 Share in the grade (%) |
|---|---|---|---|
| 10.4 Course | Theoretic notions and results (with proofs), | Test+ Final exam | 50% |
| | Definitions, statements, examples | Final exam | 25% |
| 10.5 Seminar/laborator | Solving specific exercises and problems | Final exam | 25% |
| 10.6 Minimum performance standards | | | |
| • At the final exam the grade should be at least 5 | | | |

| Date | Signature of course coordinator | Signature of seminar coordinator |
|---|---|---|
| 30.04.2014 | conf. Dr. Simion-Sorin Breaz | conf. Dr. Simion-Sorin Breaz |
| Date of approval | | Signature of the head of department |
| ..... | | prof. Dr. Octavian Agratini |