**SYLLABUS**

**1. Information regarding the programme**

| | |
|---|---|
| 1.1 Higher education institution | Babes-Bolyai University |
| 1.2 Faculty | Faculty of Matematics and Computer Science |
| 1.3 Department | Departament of Matematics |
| 1.4 Field of study | Matematics |
| 1.5 Study cycle | Bachelor |
| 1.6 Study programme / Qualification | Matematics-Computer Science |

**2. Information regarding the discipline**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2.1 Name of the discipline | Algebra 2 (Basic Algebraic Structures) | | | | | | |
| 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 | **DF** |

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

| | | | | | |
|---|---|---|---|---|---|
| 3.1 Hours per week | 4 | Of which: 3.2 course | 2 | 3.3 seminar/laboratory | 2 |
| 3.4 Total hours in the curriculum | 56 | Of which: 3.5 course | 28 | 3.6 seminar/laboratory | 28 |
| Time allotment: | | | | | hours |
| Learning using manual, course support, bibliography, course notes | | | | | 28 |
| Additional documentation (in libraries, on electronic platforms, field documentation) | | | | | 20 |
| Preparation for seminars/labs, homework, papers, portfolios and essays | | | | | 28 |
| Tutorship | | | | | 14 |
| Evaluations | | | | | 4 |
| Other activities: ..... | | | | | - |
| 3.7 Total individual study hours | | 94 | | | |
| 3.8 Total hours per semester | 150 | | | | |
| 3.9 Number of ECTS credits | 6 | | | | |

**4. Prerequisites** (if necessary)

| | |
|---|---|
| 4.1. curriculum | |
| 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** | C1.1 Idetifying the notions, describing the theories and using the specific language<br><br>C2.3 Applying the adequate analytical theoretical methods to a given problem. |
| **Transversal competencies** | CT1. Applying some rules of precise and efficient work, showing a responsible attitude regarding the the scientific domain and teaching training for an optimal and creative development of the personal potential in specific situations, respecting the deontological norms. |

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

| | |
|---|---|
| 7.1 General objective of the discipline | □ To introduce some basic notion and results regarding algebraic structures. |
| 7.2 Specific objective of the discipline | □ To introduce some basics of group theory and ring theory. |

**8. Content**

| 8.1 Course | Teaching methods | Remarks |
|---|---|---|
| 1. Groups | □ Interactive exposure<br>□ Explanation<br>□ Conversation<br>□ Didactical demonstration | |
| 2. Subgroups. Generated subgroup. Subgroup lattice | □ Interactive exposure<br>□ Explanation<br>□ Conversation<br>□ Didactical demonstration | |
| 3. Group homomorphisms | □ Interactive exposure<br>□ Explanation<br>□ Conversation<br>□ Didactical demonstration | |
| 4. Cyclic groups. Order of an element | □ Interactive exposure<br>□ Explanation<br>□ Conversation<br>□ Didactical demonstration | |
| 5. Equivalence relations induced by a subgroup | □ Interactive exposure<br>□ Explanation<br>□ Conversation<br>□ Didactical demonstration | |
| 6. Normal subgroups. Factor group | □ Interactive exposure<br>□ Explanation<br>□ Conversation<br>□ Didactical demonstration | |

| | | |
|---|---|---|
| 7. Isomorphism theorems for groups | □ Interactive exposure<br>□ Explanation<br>□ Conversation<br>□ Didactical demonstration | |
| 8. Permutation groups. Special groups | □ Interactive exposure<br>□ Explanation<br>□ Conversation<br>□ Didactical demonstration | |
| 9. Rings and fields | □ Interactive exposure<br>□ Explanation<br>□ Conversation<br>□ Didactical demonstration | |
| 10. Subrings and subfields | □ Interactive exposure<br>□ Explanation<br>□ Conversation<br>□ Didactical demonstration | |
| 11. Ring homomorphisms | □ Interactive exposure<br>□ Explanation<br>□ Conversation<br>□ Didactical demonstration | |
| 12. Ideals. Factor ring | □ Interactive exposure<br>□ Explanation<br>□ Conversation<br>□ Didactical demonstration | |
| 13. Special rings | □ Interactive exposure<br>□ Explanation<br>□ Conversation<br>□ Didactical demonstration | |
| 14. Rings of polynomials | □ Interactive exposure<br>□ Explanation<br>□ Conversation<br>□ Didactical demonstration | |

Bibliography

1. I.D. ION, N. RADU, Algebra (ed.4), Editura Didactica si Pedagogica, 1990.

2. S. CRIVEI, Basic Abstract Algebra, Ed. Casa Cartii de Stiinta, Cluj-Napoca, 2002, 2003.

3. W.J. GILBERT, W.K. NICHOLSON, Modern Algebra with Applications, John Wiley, 2004.

4. I. PURDEA, I. POP, Algebra, Editura GIL, Zalau, 2003.

5. J. ROTMAN, Advanced Modern Algebra, Prentice Hall, New Jersey, 2002.

| 8.2 Seminar / laboratory | Teaching methods | Remarks |
|---|---|---|
| 1. Groups | □ Interactive exposure<br>□ Explanation<br>□ Conversation<br>□ Didactical demonstration | |
| 2. Subgroups. Generated subgroup. Subgroup lattice | □ Interactive exposure | |

| | | |
|---|---|---|
| | ☐ Explanation<br>☐ Conversation<br>☐ Didactical demonstration | |
| 3. Group homomorphisms | ☐ Interactive exposure<br>☐ Explanation<br>☐ Conversation<br>☐ Didactical demonstration | |
| 4. Cyclic groups. Order of an element | ☐ Interactive exposure<br>☐ Explanation<br>☐ Conversation<br>☐ Didactical demonstration | |
| 5. Equivalence relations induced by a subgroup | ☐ Interactive exposure<br>☐ Explanation<br>☐ Conversation<br>☐ Didactical demonstration | |
| 6. Normal subgroups. Factor group | ☐ Interactive exposure<br>☐ Explanation<br>☐ Conversation<br>☐ Didactical demonstration | |
| 7. Isomorphism theorems for groups | ☐ Interactive exposure<br>☐ Explanation<br>☐ Conversation<br>☐ Didactical demonstration | |
| 8. Permutation groups. Special groups | ☐ Interactive exposure<br>☐ Explanation<br>☐ Conversation<br>☐ Didactical demonstration | |
| 9. Rings and fields | ☐ Interactive exposure<br>☐ Explanation<br>☐ Conversation<br>☐ Didactical demonstration | |
| 10. Subrings and subfields | ☐ Interactive exposure<br>☐ Explanation<br>☐ Conversation<br>☐ Didactical demonstration | |
| 11. Ring homomorphisms | ☐ Interactive exposure<br>☐ Explanation<br>☐ Conversation<br>☐ Didactical demonstration | |
| 12. Ideals. Factor ring | ☐ Interactive exposure<br>☐ Explanation<br>☐ Conversation<br>☐ Didactical demonstration | |
| 13. Special rings | ☐ Interactive exposure<br>☐ Explanation<br>☐ Conversation<br>☐ Didactical demonstration | |
| 14. Rings of polynomials | ☐ Interactive exposure | |

| | | |
|---|---|---|
| | □ Explanation<br>□ Conversation<br>□ Didactical demonstration | |

Bibliography

1. G. CALUGAREANU, P. HAMBURG, Exercises in basic ring theory, Kluwer, Dordrecht, 1998.

2. I.D. ION, C. NITA, D. POPESCU, N. RADU, Probleme de algebra, Editura Didactica si Pedagogica, Bucuresti, 1981.

3. I. PURDEA, C. PELEA, Probleme de algebra, EIKON, Cluj-Napoca, 2008.

**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 presents notions which often appear in other undergraduate courses.
- □ The course offers a sufficiently general background for some highschool algebra topics and the opportunity to develop some problem solving skills useful for further teaching activities.

**10. Evaluation**

| | | | |
|---|---|---|---|
| 10.4 Course | Knowledge of concepts, results, examples | Midterm exam, final exam | 1/3 of the grade |
| 10.5 Seminar/laborator | Problem solving | Midterm exam, final exam | 2/3 of the grade |
| 10.6 Minimum performance standards | | | |
| The final grade must be at least 5. | | | |

| Date | Signature of course coordinator | Signature of seminar coordinator |
|---|---|---|
| 22.04.2022 | Prof. PhD. Septimiu Crivei | Prof. PhD. Septimiu Crivei |

Date of approval

Signature of the head of department

Prof.PhD. Octavian AGRATINI