**Code and Name:**

**MAT5650 Theory of Rings and Modules**

**Unit:**

Institute of Science, Department of Mathematics

**Details:**

* **Term:** 2023-2024 Spring
* **Status:** Elective
* **Class Level:** 1
* **Credit Hours:** 3-0-0-3
* **ECTS:** 6
* **Language:** Turkish

**Course Instructors:**

* **Course Coordinator:** ...
* **Assistant Instructor:** ...
  + **Phone:** ...
  + **Email:** ...@firat.edu.tr
  + **Social Accounts:** ...

**Weekly Schedule**

| **Monday** | **Tuesday** | **Wednesday** | **Thursday** | **Friday** | **Saturday** |
| --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |

**Teaching Method:**  
Each weekly hour will include at least 45 minutes of face-to-face teaching.

**Location:**

* **In-person (YY):** Classroom (To be announced)
* **Remote (UE):** -

**Objective:**

To advance undergraduate-level knowledge of algebra to a higher level by exploring the theory of rings and modules.

**Materials:**

1. D.G. Northcott, *An Introduction to Homological Algebra*, Cambridge University Press, 1972
2. D.W. Sharpe & P. Vamos, *Injective Modules*, Cambridge University Press, 1971
3. H. Matsumura, *Commutative Ring Theory*, Cambridge University Press, 1994

**Student Responsibilities:**

Students are required to attend at least 70% of the classes.

**Weekly Lesson Plan:**

| **Week** | **Topic** | **Methodology** |
| --- | --- | --- |
| 1 | Introduction to the course and key concepts | Face-to-Face |
| 2 | **Modules and Homomorphisms**: Definitions and properties | Face-to-Face |
| 3 | **Submodules**: Properties and examples | Face-to-Face |
| 4 | **Modules and Homomorphisms**: Commutative diagrams and exact sequences | Face-to-Face |
| 5 | **Tensor Products of Modules**: Definitions and properties | Face-to-Face |
| 6 | **Flat Modules**: Definitions and properties | Face-to-Face |
| 7 | **Flat Modules**: Tensor products of flat modules | Face-to-Face |
| 8 | **Projective Modules**: Definitions and properties | Face-to-Face |
| 9 | **Midterm Exam** | Face-to-Face |
| 10 | **Projective and Free Modules**: Conditions for being flat modules | Face-to-Face |
| 11 | **Injective Modules**: Definitions and properties | Face-to-Face |
| 12 | **Divisible Modules**: Definitions and examples | Face-to-Face |
| 13 | **Essential Extensions of Modules** | Face-to-Face |
| 14 | **Injective Hull of Modules** | Face-to-Face |

**Assessment and Evaluation:**

| **Method** | **Quantity** | **Weight** |
| --- | --- | --- |
| **Midterm Exam** | 1 | 50% |
| **Quizzes** | None | - |
| **Assignments** | Pre- and post-midterm activities | - |
| **Projects** | None | - |
| **Final Exam** | 1 | 50% |

**Learning Outcomes:**

1. Understand the fundamental properties of rings and modules.
2. Learn homomorphisms and commutative diagrams.
3. Understand flat modules and their tensor products.
4. Comprehend the existence and uniqueness of tensor product structures for two modules.
5. Learn injective modules and their properties.

**Special Notes:**

* **UE:** Remote Education
* **YY:** Face-to-Face Education