**Code and Name:**

**MAT5640 Advanced Algebra**

**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:**

After reviewing fundamental concepts related to vector spaces and linear transformations, the course focuses on the relationship between linear transformations and matrices in depth. The theory of real and complex coefficient polynomials will be introduced to understand linear transformations better.

**Materials:**

1. Weintraub, S.H., *A Guide to Advanced Linear Algebra*, Mathematical Association of America, 2011
2. Serre, D., *Matrices: Theory and Applications*, Second Edition, Springer, 2010
3. Golan, J.S., *The Linear Algebra a Beginning Graduate Student Ought to Know*, Third Edition, Springer, 2010

**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 | **Vector Spaces**: Subspaces, bases, dimensions | Face-to-Face |
| 3 | **Linear Transformations**: Definitions and nullity | Face-to-Face |
| 4 | **Matrices of Linear Transformations**: Rank and nullity theorem | Face-to-Face |
| 5 | **Elementary Matrices and Invertibility** | Face-to-Face |
| 6 | **Linear Functionals**: Definitions and applications | Face-to-Face |
| 7 | **Dual Spaces**: Definitions and properties | Face-to-Face |
| 8 | **Polynomial Algebra**: Introduction and examples | Face-to-Face |
| 9 | **Midterm Exam** | Face-to-Face |
| 10 | **Polynomial Algebra**: Real and complex coefficient polynomials | Face-to-Face |
| 11 | **Determinants**: Definitions, permutations, and uniqueness properties | Face-to-Face |
| 12 | **Invariant Subspaces**: Definitions and applications | Face-to-Face |
| 13 | **Adjoints and Linear Functionals** | Face-to-Face |
| 14 | **Hermitian Operators**: Definitions and examples | 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 concept and properties of vector spaces.
2. Grasp the relationship between matrices and linear transformations.
3. Learn the concept of dual spaces.
4. Understand polynomial algebra over a field.
5. Comprehend determinants as multilinear alternating functions of matrix rows.

**Special Notes:**

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