**Code and Name:**

**MAT5670 Applied Linear 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:**

To introduce fundamental concepts of linear and multilinear algebra and demonstrate their applications in all areas of mathematics.

**Materials:**

1. S.H. Weintraub, *A Guide to Advanced Linear Algebra*, Mathematical Association of America, 2011
2. D. Serre, *Matrices: Theory and Applications*, Second Edition, Springer, 2010
3. J.S. Golan, *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 | **Vector Spaces and Linear Transformations**: Dual spaces, quotient spaces, direct sums and products, coordinates | Face-to-Face |
| 2 | Continued discussions on vector spaces and linear transformations | Face-to-Face |
| 3 | **Determinants**: Basis change, similarity, properties | Face-to-Face |
| 4 | **Eigenvalues, Eigenvectors, and Diagonalization** | Face-to-Face |
| 5 | **Modules Over Principal Ideal Domains**: Applications to finitely generated abelian groups and canonical forms of linear transformations | Face-to-Face |
| 6 | **Rational and Jordan Canonical Forms**: Definitions and properties | Face-to-Face |
| 7 | **Geometry of Inner Product Spaces**: Euclidean and unitary spaces | Face-to-Face |
| 8 | **Orthogonal and Unitary Operators**: Hermitian operators | Face-to-Face |
| 9 | **Midterm Exam** | Face-to-Face |
| 10 | **Multilinear Algebra**: Bilinear forms, symmetric bilinear forms, quadratic forms | Face-to-Face |
| 11 | **Tensor Products of Vector Spaces**: Tensor algebra, symmetric algebra, exterior algebra | Face-to-Face |
| 12 | **Affine and Projective Geometry**: Applications to computer graphics and CAD | Face-to-Face |
| 13 | **Quadrics**: Hyperbolic geometry | Face-to-Face |
| 14 | **Matrix Exponentials and Differential Equations**: Matrix groups, group representations, Wedderburn-Artin theorem | 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. Learn rational and Jordan canonical forms of linear transformations.
2. Use multilinear algebra, bilinear forms, and quadratic forms.
3. Understand orthogonal, unitary, and Hermitian operators in inner product spaces.
4. Learn tensor products of vector spaces and quadrics.
5. Understand matrix exponentials and differential equations.

**Special Notes:**

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