**Code and Name:**

**MAT5040 Fundamentals of Geometry**

**Unit:**

Institute of Science, Department of Mathematics

**Details:**

* **Term:** 2023-2024 Spring
* **Status:** Mandatory
* **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 express algebraic, topological, differentiable, and metric structures and the transformations between them; to address curves and surfaces at a graduate level; to discuss algebraic and analytical concepts on differentiable manifolds.

**Materials:**

1. Arif Sabuncuoğlu, *Linear Algebra*, Nobel Publishing, 2017.
2. Arif Sabuncuoğlu, *Differential Geometry*, Nobel Publishing, 2014.
3. Alfred Gray, *Modern Differential Geometry of Curves and Surfaces with Mathematica*, Chapman and Hall/CRC, 2006.
4. Hasan Hilmi Hacısalihoğlu, *Linear Algebra*, Dicle University Faculty of Science Publishing, 1975.
5. Andrew Pressley, *Elementary Differential Geometry*, Springer, 2010.

**Student Responsibilities:**

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

**Weekly Lesson Plan:**

| **Week** | **Topic** | **Methodology** |
| --- | --- | --- |
| 1 | **Introduction**: Objectives, content, resources, and importance | Face-to-Face |
| 2 | **Matrices and Linear Systems**: Matrix operations, types, determinants, inverse matrices | Face-to-Face |
| 3 | **Algebraic Structures**: Vector spaces, linear independence, theorem of algebra | Face-to-Face |
| 4 | **Inner Product Spaces**: Linear transformations, dual spaces, adjoint transformations | Face-to-Face |
| 5 | **Eigenvalues and Eigenvectors**: Cayley-Hamilton theorem | Face-to-Face |
| 6 | **Topological Structures and Curves**: Topological, metric, and Hausdorff spaces | Face-to-Face |
| 7 | **Curves**: Arc length, parameter changes, closed curves | Face-to-Face |
| 8 | **Plane Curvature**: Frenet formulas for space curves | Face-to-Face |
| 9 | **Midterm Exam** | Face-to-Face |
| 10 | **Special Curves**: Jordan curve theorem, inequality theorems | Face-to-Face |
| 11 | **Surfaces**: Tangent spaces, regular surfaces | Face-to-Face |
| 12 | **Surface Tangent Vectors**: Basis vectors, orientability | Face-to-Face |
| 13 | **Fundamental Forms**: Curvature, lengths, and areas | Face-to-Face |
| 14 | **Differentiable Manifolds**: Operators, connections | 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 transformations and invariants between structures.
2. Apply linear algebra and analysis techniques in geometry.
3. Learn local and global properties of curves and surfaces.
4. Grasp generalized algebraic concepts on differentiable manifolds.
5. Comprehend analytical concepts on differentiable manifolds.

**Special Notes:**

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