**Code and Name:**

**MAT5880 Differential Topology**

**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 describe the geometric methods of differential topology and relate the properties of topological manifolds to the properties of geometric manifolds.

**Materials:**

1. Morris W. Hirsch, *Differential Topology*, Springer, 1976
2. T. Bröcker, K. Jänich, *Introduction to Differential Topology*, Cambridge University Press, 1982
3. Joel W. Robbin, Dietmar A. Salamon, *Introduction to Differential Topology*, 2018

**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 | **Manifolds, Submanifolds, and Differential Structures**: Basic definitions and concepts | Face-to-Face |
| 3 | Differentiable maps, tangent bundles, tangent spaces | Face-to-Face |
| 4 | Embeddings and immersions, manifolds with boundaries | Face-to-Face |
| 5 | Weak and strong topologies in differentiable function spaces, approximations | Face-to-Face |
| 6 | Approximations on manifolds with boundaries and manifold pairs | Face-to-Face |
| 7 | Morse-Sard theorem and transversality | Face-to-Face |
| 8 | Applications and problem-solving | Face-to-Face |
| 9 | **Midterm Exam** | Face-to-Face |
| 10 | Vector bundles, constructions with vector bundles, tubular neighborhoods | Face-to-Face |
| 11 | Degrees of mappings, intersection numbers, and Euler characteristic | Face-to-Face |
| 12 | Morse functions, differential equations, and smooth level surfaces | Face-to-Face |
| 13 | Cobordism, transversality, and Thom homomorphism | Face-to-Face |
| 14 | Models of surfaces and characterizations of spheres | 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 manifolds, submanifolds, and differential structures.
2. Understand differentiable mappings, tangent bundles, and tangent spaces.
3. Learn embeddings, immersions, and manifolds with boundaries.
4. Understand weak and strong topologies in differentiable function spaces and approximations.
5. Learn mappings, Euler characteristic definitions, and their properties.

**Special Notes:**

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