**Code and Name:**

**MAT5250 Theory of Manifolds**

**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 the concepts of manifolds, Riemannian manifolds, tensors, vector bundles, Riemannian metrics, and differentiable operators, and to prepare students to conduct research in differential geometry.

**Materials:**

1. Abraham, R., Marsden, J.E., Ratiu, T., *Manifolds, Tensor Analysis, and Applications*, Springer, 1988
2. Berger, M., *A Panoramic View of Riemannian Geometry*, Springer, 2007
3. Boothby, W.M., *An Introduction to Differential Manifolds and Riemannian Geometry*, Academic Press, 1986
4. Şahin, B., *Differential Geometry of Manifolds*, Nobel Akademik Yayıncılık, 2012
5. Do Carmo, M.P., *Riemannian Geometry*, Birkhäuser, 1992

**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 and Basic Structures**: Tensors | Face-to-Face |
| 3 | **Manifolds and Basic Structures**: Manifolds | Face-to-Face |
| 4 | **Manifolds and Basic Structures**: Vector bundles | Face-to-Face |
| 5 | **Affine Connections on Manifolds** | Face-to-Face |
| 6 | **Integration on Manifolds** | Face-to-Face |
| 7 | **Riemannian Manifolds**: Riemannian metric | Face-to-Face |
| 8 | **Riemannian Manifolds**: Curvatures and differentiable operators | Face-to-Face |
| 9 | **Midterm Exam** | Face-to-Face |
| 10 | **Riemannian Submersions**: Distributions | Face-to-Face |
| 11 | **Riemannian Submersions**: O'Neill tensors | Face-to-Face |
| 12 | **Covariant Derivatives of Fundamental Tensors** | Face-to-Face |
| 13 | Applications involving covariant derivatives of fundamental tensors | Face-to-Face |
| 14 | **Harmonic Transformations**: Differentiable structures along transformations | 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 the materials related to manifolds in differential geometry.
2. Understand concepts and theories related to manifolds using scientific methods.
3. Grasp the fundamental concepts of Riemannian manifolds.
4. Learn the basic concepts of Riemannian submanifolds.
5. Understand curvature concepts and differentiable operators.

**Special Notes:**

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