**Code and Name:**

**MAT5820 Applied Curve Theory in Differential Geometry**

**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 teach manifolds, their applications, Lie groups, and their applications in physics.

**Materials:**

1. V.G. Ivancevic, T.T. Ivancevic, *Applied Differential Geometry*, 2007
2. I.A. Taimanov, *Lectures on Differential Geometry*, 2008
3. G. Farin, *Curves and Surfaces for Computer-Aided Geometric Design: A Practical Guide*, Academic Press, 1990

**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 Related Concepts**: Atlas, topological manifolds, differentiable and Riemannian manifolds | Face-to-Face |
| 3 | **Lie Groups**: Applications in Lagrangian mechanics and physics | Face-to-Face |
| 4 | **Tensors**: Definitions, Euclidean tensors, tensor product, covariant derivative, covariant mechanics applications | Face-to-Face |
| 5 | Covariant mechanics: Riemann curvature tensor, differential forms, covariant multiplication rule | Face-to-Face |
| 6 | **Applied Manifold Geometry**: Smooth transformations between smooth manifolds | Face-to-Face |
| 7 | **Tensor Fields on Smooth Manifolds**: Tensor bundles, vector fields, and their flows | Face-to-Face |
| 8 | **Differential Forms on Smooth Manifolds**: 1-forms and k-forms | Face-to-Face |
| 9 | **Midterm Exam** | Face-to-Face |
| 10 | **Lie Derivatives on Smooth Manifolds**: Definition and applications of Lie groups on manifolds | Face-to-Face |
| 11 | **Classical Lie Theory**: Lie algebras associated with Lie groups, simple and semi-simple Lie groups | Face-to-Face |
| 12 | **Lie Symmetry Groups**: Generalized Lie symmetries | Face-to-Face |
| 13 | **Riemannian Manifolds and Applications**: Riemannian metric, geodesics, Riemann curvature | Face-to-Face |
| 14 | **Global Riemannian Geometry**: Gauss-Bonnet formulas, Ricci flows | 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 manifolds and their applications.
2. Learn Lie groups and their applications in physics.
3. Understand the Riemann curvature tensor, differential forms, and covariant multiplication rules.
4. Learn applied manifold geometry and tensor fields on smooth manifolds.
5. Understand classical Lie theory, Lie symmetry groups, and global Riemannian geometry.

**Special Notes:**

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