**Code and Name:**

**MAT5270 Curves in Lorentz Space**

**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 explain the fundamental concepts of Lorentz geometry, highlight its differences from Riemannian geometry, and familiarize graduate students with its key principles.

**Materials:**

1. J.K. Beem, P.E. Ehrlich, K.L. Easley, *Global Lorentzian Geometry*, Second Edition, Pure and Applied Mathematics
2. B. O’Neill, *Semi-Riemannian Geometry*, Academic Press, 1983

**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 | **Historical Development of Lorentz Geometry**: Comparison with Euclidean geometry | Face-to-Face |
| 3 | **Lorentz Inner Product**: Differences from the Euclidean inner product | Face-to-Face |
| 4 | **Curves in Lorentz Space**: Timelike, spacelike, and null curves | Face-to-Face |
| 5 | **Angles and Rotations in Lorentz Space**: Properties and rotation matrices | Face-to-Face |
| 6 | **Movements and Frenet Vectors in Lorentz Space**: Properties and types of Frenet vectors | Face-to-Face |
| 7 | Frenet vectors of timelike curves in 3D and 4D spaces | Face-to-Face |
| 8 | Frenet vectors of spacelike curves in 3D and 4D spaces | Face-to-Face |
| 9 | **Midterm Exam** | Face-to-Face |
| 10 | Frenet vectors of null curves in 3D and 4D spaces | Face-to-Face |
| 11 | Frenet vectors of timelike and spacelike curves in n-dimensional spaces | Face-to-Face |
| 12 | Frenet vectors of null curves in n-dimensional spaces | Face-to-Face |
| 13 | Characterizations of timelike and spacelike curves | Face-to-Face |
| 14 | Characterizations of null curves | 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. Gain fundamental knowledge of Lorentz geometry.
2. Understand concepts like angles and triangles in Lorentz space.
3. Learn about curves in Lorentz space.
4. Grasp the properties of timelike, spacelike, and null curves in Lorentz space.
5. Understand Frenet equations in Lorentz space.

**Special Notes:**

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