**Code and Name:**

**MAT5080 Sobolev Spaces and Their Properties**

**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:**

This course aims to provide general knowledge about the fundamentals and examples of Sobolev spaces.

**Materials:**

1. *Introduction to Hilbert Spaces*, L. Debnath, Piotr Mikusinski
2. *A First Course in Sobolev Spaces*, G. Leini

**Student Responsibilities:**

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

**Weekly Lesson Plan:**

| **Week** | **Topic** | **Methodology** |
| --- | --- | --- |
| 1 | **Introduction to the Course**: Objectives, content, resources, and importance of outcomes | Face-to-Face |
| 2 | **Introduction to Sobolev Spaces**: Monotone functions, continuity, derivatives, and absolute continuity | Face-to-Face |
| 3 | **Introduction to Sobolev Spaces**: Chain rule, singular functions, Sobolev functions | Face-to-Face |
| 4 | **Introduction to Sobolev Spaces**: Multivariable absolute continuity | Face-to-Face |
| 5 | **Sobolev Spaces**: Concept and fundamental theorems | Face-to-Face |
| 6 | **Sobolev Spaces**: Density of smooth functions | Face-to-Face |
| 7 | **Sobolev Spaces**: Duals and weak convergence | Face-to-Face |
| 8 | **Sobolev Spaces**: Lipschitz functions and Poincaré inequality | Face-to-Face |
| 9 | **Midterm Exam** | Face-to-Face |
| 10 | **Sobolev Spaces**: Functions of bounded variation | Face-to-Face |
| 11 | **Sobolev Spaces**: Bounded point variation on lines | Face-to-Face |
| 12 | **Sobolev Spaces**: Density of smooth sets | Face-to-Face |
| 13 | **Sobolev Spaces**: Besov spaces | Face-to-Face |
| 14 | **Sobolev Spaces**: Trace concept in Sobolev spaces | 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 monotone functions and absolute continuity.
2. Understand Sobolev functions and multivariable absolute continuity.
3. Grasp the concept of Sobolev spaces.
4. Learn duals, weak convergence, Lipschitz functions, and Poincaré inequality.
5. Understand Besov spaces.

**Special Notes:**

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