**Code and Name:**

**MAT5570 Fractional Differential Equations**

**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 the basic concepts necessary for fractional derivatives and integrals and to solve fractional differential equations using various transformation methods.

**Materials:**

1. Igor Podlubny, *Fractional Differential Equations*, Academic Press, San Diego, 1999
2. Selçuk Bayın, *Mathematical Methods in Science and Engineering*, Wiley Interscience, New Jersey, 2006

**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 | **Special Functions in Fractional Calculus**: Gamma and Beta functions | Face-to-Face |
| 3 | Mittag-Leffler function | Face-to-Face |
| 4 | **Fractional Derivatives and Integrals**: Unified notation | Face-to-Face |
| 5 | Definitions by Grünwald-Letnikov and Riemann-Liouville | Face-to-Face |
| 6 | Definition by Caputo | Face-to-Face |
| 7 | Cauchy's integral formula for fractional derivatives and integrals | Face-to-Face |
| 8 | Properties of fractional derivatives and integrals, Leibniz rule | Face-to-Face |
| 9 | **Midterm Exam** | Face-to-Face |
| 10 | Laplace transform of fractional derivatives | Face-to-Face |
| 11 | Laplace transform for Riemann-Liouville fractional derivatives | Face-to-Face |
| 12 | Laplace transform for Caputo and Grünwald fractional derivatives | Face-to-Face |
| 13 | Solving fractional ordinary differential equations with Laplace transform | Face-to-Face |
| 14 | Solving fractional partial differential equations with Laplace transform | 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 the basic definitions and methods related to fractional derivatives and integrals.
2. Establish connections between mathematics and other disciplines and develop mathematical models.
3. Learn the definitions of derivatives and integrals by Grünwald, Riemann-Liouville, and Caputo.
4. Solve fractional ordinary and partial differential equations using Laplace transforms.
5. Apply mathematical knowledge to other disciplines.

**Special Notes:**

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