**Code and Name:**

**MAT5580 Applications of 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
3. K.B. Oldham, J. Spanier, *The Fractional Calculus*, Academic Press, New York, 1974

**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 | **Fractional Derivatives and Integrals**: Fourier transform of fractional integrals | Face-to-Face |
| 3 | Fourier transform of fractional derivatives | Face-to-Face |
| 4 | Solving fractional differential equations using Fourier transforms | Face-to-Face |
| 5 | Mellin transform of fractional derivatives | Face-to-Face |
| 6 | Solving fractional differential equations using Mellin transforms | Face-to-Face |
| 7 | Power series method | Face-to-Face |
| 8 | Solving fractional differential equations using power series methods | Face-to-Face |
| 9 | **Midterm Exam** | Face-to-Face |
| 10 | Existence and uniqueness theorems | Face-to-Face |
| 11 | Fractional Green's functions | Face-to-Face |
| 12 | Numerical solutions for fractional differential equations | Face-to-Face |
| 13 | Continued numerical solutions for fractional differential equations | Face-to-Face |
| 14 | Final applications and semester projects | 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 fundamental definitions and methods related to fractional derivatives and integrals.
2. Establish connections between mathematics and other disciplines and develop mathematical models.
3. Solve fractional differential equations using Fourier transforms.
4. Solve fractional differential equations using Mellin transforms.
5. Apply mathematical knowledge to other disciplines.

**Special Notes:**

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