**Code and Name:**

**MAT5740 Harmonic Analysis**

**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 provide knowledge about potential functions, Legendre coefficients, Laplace coefficients, solid spherical harmonics, and surface spherical harmonics.

**Materials:**

1. Elias M. Stein, *Harmonic Analysis*, 1993
2. Anton Deitmar, *A First Course in Harmonic Analysis*, 2005

**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 | **Potential Functions**: Definitions and properties | Face-to-Face |
| 3 | **Coefficients**: Legendre and Laplace coefficients | Face-to-Face |
| 4 | **Harmonics**: Solid spherical harmonics | Face-to-Face |
| 5 | **Harmonics**: Kelvin's theorem, surface spherical harmonics | Face-to-Face |
| 6 | **Hypergeometric Functions**: Definitions and properties | Face-to-Face |
| 7 | **Legendre Polynomials**: Expansions and applications | Face-to-Face |
| 8 | Laplace integrals of the first and second kind for Legendre polynomials | Face-to-Face |
| 9 | **Midterm Exam** | Face-to-Face |
| 10 | **Legendre Polynomials**: Christoffel sum formula | Face-to-Face |
| 11 | **Legendre Polynomials**: Second-kind polynomials and recurrence relations | Face-to-Face |
| 12 | **Legendre Polynomials**: Solutions of the generalized Legendre equation | Face-to-Face |
| 13 | **Harmonic Functions**: Sectoral harmonics, homogeneous differential operators | Face-to-Face |
| 14 | **Harmonic Functions**: Homogeneous polyharmonic functions | 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 potential functions, Legendre coefficients, and Laplace coefficients.
2. Learn solid spherical harmonics, Kelvin's theorem, and surface spherical harmonics.
3. Understand hypergeometric functions and expansions of Legendre polynomials.
4. Learn Laplace integrals of the first and second kind for Legendre polynomials.
5. Understand Christoffel sum formula and second-kind Legendre polynomials.

**Special Notes:**

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