**Code and Name:**

**MAT5290 Theory of Dual Numbers**

**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 master's and doctoral students working in geometry about dual number systems, dual-variable functions, spherical motions, and spatial motions, which have applications in astronomy and engineering.

**Materials:**

1. H.H. Hacısalihoğlu, *Geometry of Motion and Quaternions*, Gazi University Press, 1983
2. H.H. Hacısalihoğlu, *Transformations and Geometries in High-Dimensional Spaces*, Ankara University Press
3. H.R. Müller, *Lectures on Kinematics*, Ankara University Press
4. W. Blaschke, *Zur Bewegungsgeometrie auf der Kugel*, Heidelberg Academy

**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 | **Basic Concepts**: Dual number systems and rings | Face-to-Face |
| 3 | **D-Module**: Ring of dual numbers | Face-to-Face |
| 4 | **D-Module**: Space of dual vectors | Face-to-Face |
| 5 | **D-Module**: Inner product and norm of dual vectors | Face-to-Face |
| 6 | **D-Module**: E-Study transformations | Face-to-Face |
| 7 | **D-Module**: Dual angles, exterior, and mixed products in D-Module | Face-to-Face |
| 8 | **D-Module**: Linear dependence and independence of dual vectors | Face-to-Face |
| 9 | **Midterm Exam** | Face-to-Face |
| 10 | **Theory of Dual Variable Functions**: Sequences of dual numbers | Face-to-Face |
| 11 | **Theory of Dual Variable Functions**: Functions of a single dual variable | Face-to-Face |
| 12 | **Theory of Dual Variable Functions**: Series of analytic dual functions | Face-to-Face |
| 13 | **Theory of Dual Variable Functions**: Power series expansions of analytic dual functions | Face-to-Face |
| 14 | **Theory of Dual Variable Functions**: Dual integrals | 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. Define concepts related to the ring of dual numbers.
2. Prove and interpret theorems related to the ring of dual numbers.
3. Compare the dual number system with the real and complex number systems.
4. Define basic concepts in D-Module.
5. Define functions of dual variables.

**Special Notes:**

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