**Code and Name:**

**MAT5530 Finite Difference Method and Stability 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 introduce Sturm-Liouville difference equations, teach their spectral properties, and explore their applications.

**Materials:**

1. Hüseyin Bereketoğlu, Vildan Kutay, *Difference Equations*
2. W.G. Kelley, A.C. Peterson, *Difference Equations: An Introduction with Applications*
3. R.P. Agarwal, *Difference Equations and Inequalities*, Marcel Decker, New York, 1993

**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 | **Second-Order Self-Adjoint Linear Equations**: Definitions and properties | Face-to-Face |
| 3 | **Lagrange Identity**: Definitions and applications | Face-to-Face |
| 4 | **Green's Formula**: Theorems and properties | Face-to-Face |
| 5 | Applications of Green's formula | Face-to-Face |
| 6 | **Liouville's Formula**: Definitions and properties | Face-to-Face |
| 7 | **Sturm Separation Theorem**: Definitions and features | Face-to-Face |
| 8 | **Sturm-Liouville Problems for Difference Equations**: Theorems and applications | Face-to-Face |
| 9 | **Midterm Exam** | Face-to-Face |
| 10 | **Sturm-Liouville Problems**: Orthogonality of eigenfunctions | Face-to-Face |
| 11 | **Sturm-Liouville Problems**: Fundamental theorems | Face-to-Face |
| 12 | **Sturm-Liouville Problems**: Reality of eigenvalues | Face-to-Face |
| 13 | Applications of Sturm-Liouville theory for difference equations | Face-to-Face |
| 14 | **Wronskian**: Definitions and properties | 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. Develop advanced skills in solving difference equations.
2. Apply Lagrange’s formula to difference equations.
3. Apply Green’s formula to difference equations.
4. Analyze Sturm-Liouville theory for difference equations.
5. Derive spectral data.

**Special Notes:**

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