**Code and Name:**

**MAT5470 Eigenvalue Problems and Green's Functions**

**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 graduate students to the fundamental concepts of eigenvalue problems and Green's functions, and to teach the theoretical solution of ordinary and partial differential equations using Green's function.

**Materials:**

1. Tyn Myint-U, *Linear Partial Differential Equations for Scientists and Engineers*, Birkhauser, Boston, 2007
2. Selçuk Bayın, *Mathematical Methods in Science and Engineering*, Istanbul, 2004
3. Abdullah Altın, *Applied Mathematics*, Gazi Publishing, Ankara, 2011

**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 | **Eigenvalue Problems**: Sturm-Liouville problems, eigenfunctions | Face-to-Face |
| 3 | **Eigenvalue Problems**: Bessel functions, singular Sturm-Liouville problems | Face-to-Face |
| 4 | **Eigenvalue Problems**: Boundary value problems for ODEs and Green's function construction | Face-to-Face |
| 5 | **Green's Function**: Inhomogeneous boundary conditions, generalized Green's functions | Face-to-Face |
| 6 | **Green's Function**: Applications in eigenvalue problems | Face-to-Face |
| 7 | **Green's Function**: 1D Helmholtz equation | Face-to-Face |
| 8 | **Green's Function**: For PDEs, delta function, symmetry, and continuity theorems | Face-to-Face |
| 9 | **Midterm Exam** | Face-to-Face |
| 10 | **Green's Function**: Dirichlet problems for Laplace and Helmholtz operators | Face-to-Face |
| 11 | **Green's Function**: Applications to Helmholtz equations and eigenfunctions | Face-to-Face |
| 12 | **Green's Function**: Method of images, eigenfunction methods | Face-to-Face |
| 13 | **Green's Function**: Higher-dimensional problems and 3D Green's functions for Poisson and Schrödinger equations | Face-to-Face |
| 14 | **Green's Function**: Neumann problems and applications | 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 eigenvalues and eigenfunctions for Sturm-Liouville problems.
2. Learn to construct Green's functions for ODEs and PDEs.
3. Solve Dirichlet problems for Laplace and Helmholtz operators using Green's functions.
4. Develop mathematical models for physical phenomena.
5. Apply mathematical knowledge to other disciplines and acquire a foundation for academic research.

**Special Notes:**

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