**Code and Name:**

**MAT5980 Soliton Theory and Applications**

**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 concept of solitons formed by wave motion and soliton types arising from the KdV equation.

**Materials:**

1. L. Munteanu, S. Donescu, *Introduction to Soliton Theory: Applications to Mechanics*
2. E. Infeld, G. Rowlands, *Nonlinear Waves, Solitons and Chaos*

**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 | **Partial Differential Equations**: Definition and types | Face-to-Face |
| 3 | **Waves**: Physical concepts and properties | Face-to-Face |
| 4 | **Soliton Waves**: Discovery and historical development | Face-to-Face |
| 5 | Properties and types of soliton waves | Face-to-Face |
| 6 | Compactons: Definition and relationship with soliton waves | Face-to-Face |
| 7 | **Various Equations**: Boussinesq, KdV, and Burgers equations | Face-to-Face |
| 8 | Sine-Gordon and Schrödinger equations | Face-to-Face |
| 9 | **Midterm Exam** | Face-to-Face |
| 10 | Semi-analytical solution methods for nonlinear partial differential equations | Face-to-Face |
| 11 | Variational iteration method | Face-to-Face |
| 12 | Homotopy perturbation and analysis methods | Face-to-Face |
| 13 | Analytical solution methods for nonlinear partial differential equations | Face-to-Face |
| 14 | Introduction to Jacobi elliptic functions and Jacobi elliptic function method | 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. Learn soliton waves, their interactions, and types.
2. Understand different equations and their relationship with solitons.
3. Learn solitons and wave solutions obtained from KdV equations.
4. Learn semi-analytical methods for solving soliton solutions of nonlinear equations.
5. Learn analytical methods for solving soliton solutions of nonlinear equations.

**Special Notes:**

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