**Code and Name:**

**MAT6070 Dynamical Systems and Stability Theory**

**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 understand the general concepts, definitions, and types of dynamical systems, including one- and two-dimensional systems and nonlinear systems, and to study stability analysis.

**Materials:**

1. N.P. Bhatia, G.P. Szegö, *Stability Theory of Dynamical Systems*, Springer-Verlag, 1970
2. J.L. Willems, *Stability Theory of Dynamical Systems*, Wiley Interscience, 1970
3. E.R. Scheinerman, *Invitation to Dynamical Systems*, Prentice Hall, 1996

**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 | **Definitions**: Dynamical systems modeled by differential equations, linear and nonlinear systems | Face-to-Face |
| 3 | **Dynamical Systems**: Definitions, fundamental concepts, and examples | Face-to-Face |
| 4 | **Stability Types**: Asymptotic stability, marginal stability, linear stability | Face-to-Face |
| 5 | Linearization methods and their importance | Face-to-Face |
| 6 | Examples of dynamical systems and linearization | Face-to-Face |
| 7 | Modeling with linear differential equations, stability analysis of linear systems | Face-to-Face |
| 8 | One-dimensional continuous linear systems | Face-to-Face |
| 9 | **Midterm Exam** | Face-to-Face |
| 10 | **Linear Dynamical Systems**: Simple critical points | Face-to-Face |
| 11 | **Periodic Solutions**: Analysis and properties | Face-to-Face |
| 12 | **Linear Homogeneous Equations**: Behavior of solutions | Face-to-Face |
| 13 | **Linear Non-Homogeneous Equations**: Behavior of solutions | Face-to-Face |
| 14 | Examples of mathematical models | 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 the basic concepts of dynamical systems.
2. Learn the definitions and types of dynamical systems.
3. Understand one- and two-dimensional linear system types and properties.
4. Grasp nonlinear systems.
5. Learn stability theory.

**Special Notes:**

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