**Code and Name:**

**MAT6000 Mathematical Foundations of Artificial Intelligence**

**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:**

This course aims to provide a comprehensive understanding of Artificial Neural Networks (ANNs), their models, and algorithms. Topics include neuron models, perceptrons, adaptive linear elements, least squares algorithms, Multi-Layer Perceptrons (MLPs), Backpropagation algorithms, Radial Basis Function (RBF) networks, self-organizing networks, vector quantization, Support Vector Machines (SVMs), continuous and discrete-time Hopfield networks, classification techniques, and pattern recognition.

**Materials:**

1. S. Haykin, *Neural Networks and Learning Machines*, Pearson Education, 3rd Ed., 2009
2. J.M. Zurada, *Introduction to Artificial Neural Systems*, West Publishing Company, 1992

**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 | **Data Representation**: Methods for data representation and vector quantization | Face-to-Face |
| 3 | Competitive networks and Kohonen’s self-organizing feature maps | Face-to-Face |
| 4 | **Hopfield Networks**: Stability analysis | Face-to-Face |
| 5 | Lyapunov design, associative memory, combinatorial optimization | Face-to-Face |
| 6 | **Artificial Neural Networks**: Signal processing, principal component analysis, data compression | Face-to-Face |
| 7 | Applications in 1D and image signal compression | Face-to-Face |
| 8 | **Pattern Recognition**: Feature extraction using neural networks | Face-to-Face |
| 9 | **Midterm Exam** | Face-to-Face |
| 10 | Classifiers as artificial neural networks, applications in image and speech recognition | Face-to-Face |
| 11 | Control applications and system identification using ANNs | Face-to-Face |
| 12 | MATLAB for pattern recognition and control applications | Face-to-Face |
| 13 | Further applications in MATLAB | Face-to-Face |
| 14 | General evaluation: Models, learning algorithms, 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 data representation and Hopfield networks.
2. Learn pattern recognition applications and feature extraction using ANNs.
3. Understand control applications and system identification using ANNs.
4. Learn pattern recognition and control applications using MATLAB.
5. Gain proficiency in MATLAB applications for ANNs.

**Special Notes:**

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