**Code and Name:**

**MAT6030 Mathematical Computation Methods**

**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 offers students detailed knowledge about High-Performance Computing (HPC), including:

1. Parallel computing
2. Emerging parallel processor architectures
3. Power-aware computing and communication
4. Developments in Petascale and Optical systems.  
   Additionally, the course covers parallel computation models such as dataflow and demand-driven computation.

**Materials:**

1. G.S. Almasi, A. Gottlieb, *Highly Parallel Computing*
2. I.B. Russak, *Calculus of Variations (Lecture Notes)*
3. David Culler, Jaswinder Pal Singh, *Parallel Computer Architecture: A Hardware/Software Approach*
4. W.J. Dally, B. Towles, *Principles and Practices on Interconnection Networks*, Morgan Kaufmann, 2004

**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 | **Introduction to HPC**: Fundamental concepts | Face-to-Face |
| 3 | **Parallel Computing**: Overview of parallel computing concepts | Face-to-Face |
| 4 | **Programming with CUDA**: Basic features | Face-to-Face |
| 5 | Principles of programming with CUDA | Face-to-Face |
| 6 | **Design in Parallel Computing**: Fundamental design challenges | Face-to-Face |
| 7 | Continued design challenges in parallel computing | Face-to-Face |
| 8 | **Limitations in Parallel Computing**: Key challenges | Face-to-Face |
| 9 | **Midterm Exam** | Face-to-Face |
| 10 | **Power-Aware Computing and Communication**: Techniques and methods | Face-to-Face |
| 11 | **Petascale Computing**: Methods and characteristics | Face-to-Face |
| 12 | Optical systems in parallel computing, quantum computing | Face-to-Face |
| 13 | Developments in nanotechnology and their impact on HPC | Face-to-Face |
| 14 | Trends in nanotechnology and HPC | 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. Quickly recall parallel computing fundamentals and learn parallel processor architectures.
2. Understand current technologies and trends in Petascale and optical systems.
3. Learn power-aware computing and communication techniques.
4. Gain knowledge of Petascale computing and optical systems in HPC.
5. Understand developments in nanotechnology and their impact on HPC.

**Special Notes:**

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