**ABDULLAH GÜL UNIVERSITY**
**GRADUATE SCHOOL OF ENGINEERING & SCIENCE**
**MATERIALS SCIENCE AND MECHANICAL ENGINEERING PROGRAM**
**COURSE DESCRIPTION AND SYLLABUS**

| Course Title | Code | Semester | T+L Hours | Credit | ECTS |
|---|---|---|---|---|---|
| PARALLEL ARCHITECTURES | ECE-582 | SPRING | 3 + 0 | 3 | 10 |

| Prerequisite Courses | - |
|---|---|

| Type | Selective |
|---|---|
| Language | English |
| Coordinator | Asst. Prof. Gülay Yalçın |
| Instructor | Asst. Prof. Gülay Yalçın |
| Adjunt | none |
| Aim | The main objective of the course is to build a strong understanding of the fundamentals of the architecture of parallel computers and the tradeoffs made in their design. Parallel computers are now almost everywhere and different types of parallelisms are exploited in the computer hardware. These parallelisms, such as, multi-core architectures, parallel memory systems, vector architectures, dataflow machines, and interconnection networks will be explained in the class. |
| Learning Outcomes | To give an opportunity to students for<br>1. An ability to understand the tradeoffs in parallel architectures.<br>2. An ability to evaluate the benefits/drawbacks of recent parallel architectures.<br>3. An ability to make a literature survey of very recent studies and to present it in front of an audience with little knowledge.<br>4. An ability to advance the state of the art parallel architectures.<br>5. Having the knowledge about state of the art parallel architectures. |
| Course Content | • Introduction and focus Parallel Computer Architectures<br>• Parallel Programming Models<br>• Multicore Processors<br>• Asymmetric Multicore Processors<br>• Multithreading<br>• Caching in Multithreading<br>• Interconnection Network<br>• Dataflow Architectures<br>• Main Memory Management |

| WEEKLY TOPICS AND PRELIMINARY STUDY | | |
|---|---|---|
| **Week** | **Topic** | **Preliminary Study** |
| 1 | Introduction and Focus of Parallel Computer Architecture | The relevant articles from the literature |
| 2 | Parallel Programming Models | The relevant articles from the literature |
| 3 | Parallel Programming Models (cont.) | The relevant articles from the literature |
| 4 | Multicore Processors | The relevant articles from the literature |
| 5 | Multicore Processors (cont.) | The relevant articles from the literature |
| 6 | Asymmetric Multicore Processors | The relevant articles from the literature |
| 7 | Midterm | The relevant articles from the literature |
| 8 | Multithreading | The relevant articles from the literature |
| 9 | Multithreading (II) | The relevant articles from the literature |
| 10 | Caching in Multicore Systems | The relevant articles from the literature |
| 11 | Caching in Multicore Systems (cont.) | The relevant articles from the literature |
| 12 | Interconnection Network | The relevant articles from the literature |

| 13 | Dataflow Architectures | The relevant articles from the literature |
|----|------------------------|------------------------------------------|
| 14 | Main Memory Management | The relevant articles from the literature |
| 15 | Final Exam | The relevant articles from the literature |

| SOURCES | |
|---------|---|
| **Lecture Notes** | Lecture slides |
| **Other Sources** | **Course Textbook:** "Computer Architecture: A Quantitative Approach" by Hennessy and Patterson, Morgan Kaufmann/Elsevier, 5th Edition<br><br>**Additional Materials:**<br>• David E. Culler and Jaswinder Pal Singh, with Anoop Gupta. Parallel Computer Architecture: A Hardware/Software Approach. Morgan Kaufmann,<br>• Michael J. Quinn. Parallel Programming in C with MPI and OpenMP. McGraw Hill, 2003<br>• Research papers from ISCA, MICRO, ASPLOS, PACT, HPCA conferences. |

| COURSE MATERIALS SHARING | |
|--------------------------|---|
| **Documents** | Lecture notes, slides |
| **Homeworks** | Students will be given 5 homework in the semester |
| **Exams** | 1 Midterm and 1 Final Exam |

| EVALUATION SYSTEM | | |
|-------------------|--------|--------------|
| **SEMESTER STUDY** | **NUMBER** | **CONTRIBUTION** |
| Midterm | 1 | 30 |
| Homework | 5 | 20 |
| Quiz | 2 | 10 |
| **SUB-TOTAL** | | 60 |
| **Contribution of Semester Study** | | 60 |
| **Contribution of Final Exam** | 1 | 40 |
| **TOTAL** | | 100 |

| Course Category | |
|-----------------|---|
| Sciences and Mathematics | 50% |
| Engineering | 50% |
| Social Sciences | 0% |

| RELATIONSHIPS BETWEEN LEARNING OUTCOMES AND PROGRAM QUALIFICATIONS | | | | | |
|---|---|---|---|---|---|
| No Program Qualifications | Contribution Level | | | | |
| | 1 | 2 | 3 | 4 | 5 |
| 1 The skills of using mathematics, science and engineering information in advanced research | | | | | **X** |
| 2 The skills of analyzing, designing and/or implementing an original system that will be able to solve an engineering problem, | | | | | **X** |
| 3 The skills of using the required software, hardware and modern measurement equipments in their field of research, | | | | **X** | |
| 4 The skills of planning independent research and implementing in detail, | | | | **X** | |
| 5 The skills of following literature, listening to and making technical presentation, writing a paper in academic level, | | | | | **X** |
| 6 The skills of innovative and interrogative thinking and finding original solutions | | | | | **X** |

*Increasing from 1 to 5.

| ECTS / WORK LOAD TABLE | | | |
|------------------------|--------|---------------------|-------------------|
| Activities | Number | Duration (Hours) | Total Work Load |

| | | | |
|---|---|---|---|
| Course Length (includes exam weeks: 16x total course hours) | 16 | 3 | 48 |
| Out-of-class Study Time (Pre-study, practice) | 16 | 1 | 16 |
| Internet search, library work, literature search | 16 | 1 | 16 |
| Homework | 5 | 30 | 150 |
| Midterm | 1 | 30 | 30 |
| Final Exam | 1 | 40 | 40 |
| **Total Work Load** | | | 300 |
| **Total Work Load / 30** | | | 300/30 |
| **Course ECTS Credit** | | | 10 |
| | | | |