| Course Description | |
|---|---|
| Course Code | YS 414 |
| Course Name | PARALLEL COMPUTER ARCHITECTURE |
| Prerequisite Courses | |
| Language of the Course | The English |
| Course Coordinator | |
| Instructor(s) | |
| Course Assistants | |
| The aim of the course | This course looks at the design of current multicore systems with an eye toward how those designs are likely to evolve over the next decade. |
| Course Content | The content is divided into several parts: a review of fundamental concepts in computer architecture, basic multiprocessor designs for the message passing and shared memory programming models, interconnection networks, an essential component in chip multiprocessors and scalable parallel computer systems, last years' recent transition towards chip multiprocessors (also known as "multicores"), including GPGPU, how to correctly support parallel algorithms in shared memory hardware (atomicity, coherence and consistency). |

| Weekly Course Content | |
|---|---|
| Week 1 | Introduction, Basic concepts, Trends, Performance metrics |
| Week 2 | OoO, Caches, Vector Architectures |
| Week 3 | Multiprocessor systems (I) |
| Week 4 | Multiprocessor systems (II) |
| Week 5 | Core Multithreading |
| Week 6 | Chip Multiprocessors |
| Week 7 | GPGPU |
| Week 8 | Midterm exam |
| Week 9 | GPGPU |
| Week 10 | Message Passing Hardware |
| Week 11 | Message Passing Hardware |
| Week12 | Synchronization + Coherence |
| Week 13 | Memory Consistency Models |
| Week 14 | Exam preparation |
| Week 15 | Final exam |

| Course Learning Outcomes | |
|---|---|
| 1 | Knowledge and understanding<br>• describe current approaches to parallel computing<br>• explain the design principles of the hardware support for the shared memory and message passing programming models<br>• describe the implementation of different models of thread-level parallelism, such as core multithreading, chip multiprocessors, many-cores or GPGPU |
| 2 | Competence and skills<br>• implement synchronization methods for shared memory and message passing parallel computers<br>• design scalable parallel software and analyze its performance |
| 3 | Judgement and approach<br>• analyze the trade-offs of different approaches to parallel computing in terms of function, performance and cost |
| 4 | - |
| 5 | - |
| 6 | - |

| Contribution of the Course to Program Qualifications | | Contribution Level |
|---|---|---|
| 01 | The student will have the ability to apply analytical approach, mathematics and science knowledge in software and engineering issues. | 4 |
| 02 | The student will have the ability to identify, define, formulate and solve a problem in software and computer systems. | 5 |
| 03 | The student will have gains scientific research skills in software and engineering problems, has the ability to design a system, part or process. | 4 |
| 04 | The student will have the ability to use the design capability, techniques and tools required for engineering applications. | 2 |
| 05 | The student will have the ability to design, implement and interpret experimental work and software projects by analyzing the results. | 4 |
| 06 | The student will have the ability to work between disciplines and teamwork. | 5 |
| 07 | The student will have the ability to work in international environments and adapt to different cultures. | 4 |
| 08 | The student will have verbal and written communication skills in Turkish and English. | 5 |
| 09 | The student will have the awareness of the necessity of lifelong learning and the ability to realize it. | 3 |
| 10 | The student will gain knowledge of legal issues with the awareness of professional and ethical responsibility. | 3 |
| 11 | The student will have managerial skills (leadership, organization, time and risk management, quality awareness, efficiency, etc.). | 5 |
| 12 | The student will have the ability to participate in social activities, to acquire regular sports habits and to use time in the best way. | 5 |
| 13 | The student will have the ability to find unusual ways and produce projects. | 3 |
| 14 | The student will have professional self-confidence, being an entrepreneur and taking initiative. | 3 |
| 15 | It is sensitive about the problems of the age and looks after the national interests. | 4 |

| ECTS WORKLOAD | Number | Duration (hours) | Number*Duration |
|---|---|---|---|
| Face to face education | 14 | 2 | 28 |
| Out-of-class study time (pre-study, reinforcement) | 14 | 1 | 14 |
| Homeworks | 5 | 2 | 10 |
| Presentation / Seminar preparation | 0 | 0 | 0 |
| Quizzes | 0 | 0 | 0 |
| Preparation for midterm exams | 1 | 10 | 10 |
| midterm exams | 1 | 2 | 2 |
| Project (Semester assignment) | 0 | 0 | 0 |
| Lab | 0 | 0 | 0 |
| field work | 0 | 0 | 0 |
| Preparation for the final exam | 1 | 12 | 12 |
| Semester final exam | 1 | 2 | 2 |
| Research | 5 | 2 | 10 |
| **TOTAL WORKLOAD** | | | **88** |
| **ECTS** | | | **3** |

| Evaluation | | |
|---|---|---|
| SEMESTER EVALUATION | **Number** | **Contribution Percentage** |
| Midterm | 1 | 65 |
| Quiz | 0 | 0 |

| | | |
|---|---|---|
| Homework | 5 | 35 |
| **SEMESTER TOTAL** | | **100** |
| Contribution rate of mid-term evaluations to success | | 40 |
| Contribution rate of the final exam to success | | 60 |
| **GRAND TOTAL** | | **100** |

| **RESOURCES** | |
|---|---|
| Textbook | |
| Helpful Resources | |