COURSE INFORMATION					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
ADVANCED COMPUTER ARCHITECTURES	CSE 533	2	3 + 0	3	10

Prerequisites	

Language of Instruction	English
Course Level	Graduate
Course Type	Compulsory
Course Coordinator	
Instructors	Gürhan Küçük
Assistants	
Goals	The aim of this course is to provide students with knowledge and abilities to design and to implement microarchitectural techniques in contemporary processors.
Content	Performance, energy/power and complexity, instruction set principles, pipelining and pipeline hazards, instruction level parallelism, overcoming pipeline hazards, static and dynamic instruction scheduling mechanisms, speculative and out-of-order execution, superscalar, superpipelined processors, memory-hierarchy design, VLIW, CMP, SMT, dataflow, multicluster architectures.

Course Learning Outcomes	**Program Learning Outcomes**	**Teaching Methods**	**Assessment Methods**
1. Knowledge of performance, power/energy and complexity metrics on the evaluation of different architectures. Knowledge of theoretical background on these metrics.	1,2,3	1,2	A,C
2. Knowledge of instruction set architecture and RISC and CISC.	1,2,3	1,2	A,C
3. Knowledge of instruction pipelines and pipeline hazards.	1,2,3	1,2	A,C
4. Knowledge and ability to apply static and dynamic instruction scheduling mechanisms to overcome pipeline hazards.	1,2,3	1,2	A,C

5. Knowledge and ability to use modern simulators for the design of new architectures and for the modifications on the existing architectures.	1,2,4	1,2	B,D
6. Knowledge of memory hierarchy and organization.	1,2,3	1,2	A,C
7. Knowledge of various architectures and ability to compare their cons and pros.	1,2	1,2	A,C
8. Ability to conduct experiments, gather data, analyze and interpret results for investigating engineering solutions to computer architecture problems.	1,2,3,4	1,2	B,D
9. Ability to understand a published work, to investigate its cons and pros and to present.	1,2,4	1,2	A,C

Teaching Methods:	1: Lecture, 2: Question-Answer, 3: Lab
Assessment Methods:	A: Testing, B: Experiment, C: Homework, D: Term Project

COURSE CONTENT

Week	Topics	Study Materials
1	Introduction, Measuring and Reporting Performance, Power and Complexity	
2	Instruction Set Principles, MIPS ISA	
3	Basic Pipeline Theory, Pipeline Hazards, Handling Multicycle Operations	
4	Reducing and Removing Pipeline Hazards	
5	Dynamic Branch Prediction	
6	Instruction Level Parallelism, Static Instruction Scheduling	
7	Dynamic Instruction Scheduling	
8	Midterm Examination	
9	Superscalar Processors, precise interrupts in out-of-order processors, Register Renaming	
10	Instruction Queue, Reorder Buffer, Load/Store Queue, Architectural and Physical Register Files	
11	Memory Systems, Caches, SRAMs, DRAMs, virtual memory, TLBs	
12	Various Architectures, VLIW, EPIC, Multicluster, SMT, CMP, Many-Integrated-Core	
13	Paper Presentation	
14	Project Demos & Term Papers	

RECOMMENDED SOURCES	
Textbook	J. Hennessy & D. Patterson, **Computer Architecture: A Quantitative Approach,** 5th Ed., Morgan Kaufmann
Additional Resources	Lecture Notes: http://cse.yeditepe.edu.tr/v2/en/academic/course-pages J. Shen and M. Lipasti, **Modern Processor Design: Fundamentals of Superscalar Processors**, McGraw-Hill, 2004

MATERIAL SHARING	
Documents	
Assignments	
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	1	39
Quizzes		
Assignment	5	15
Term Project	1	31
Paper Presentation	1	15
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		35
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		65
Total		**100**

COURSE CATEGORY	Expertise/Field Courses

COURSE'S CONTRIBUTION TO PROGRAM						
No	Program Learning Outcomes	Contribution				
		1	2	3	4	5
1	Knowledge in the advanced computer architecture field					**X**

2	Knowledge in advanced system design for computer engineering					**X**
3	Knowledge in the theoretical topics of computer science		**X**			
4	Ability to comprehend, analyse and critique academic publications and conduct scholarly research at the frontiers of computer engineering					**X**
5	Ability and knowledge in the fields of Next-Generation and contemporary computer networks					

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (Excluding the exam week: 13x Total course hours)	13	3	39
Hours for off-the-classroom study (Pre-study, practice)	14	6	84
Mid-terms	1	3	3
Homework	5	3	15
Term Project	1	75	75
Final examination	1	24	24
Total Work Load			240
Total Work Load / 25 (h)			9,6
ECTS Credit of the Course			10