COURSE DESCRIPTION FORM	
Course Code and Name	CENG451 ADVANCED COMPUTER ARCHITECTURE (TECH. ELECT.)
Course Semester	7
Catalogue Data of the Course (*Course Content*)	Quantitative design and analysis, memory hierarchy, DRAM and virtual memory, pipelining, datapath and control design, data and control hazards, instruction-level parallelism, data level parallelism, dynamic scheduling of instructions, branch prediction and speculative execution, multiprocessors, thread-level parallelism, SIMD and GPU architectures, warehouse-scale computers.
Course Textbooks	1. Hennessy, J.L., Patterson, D.A., "Computer Architecture a Quantitative Approach 6/e", Morgan Kaufmann, 2019.
Supplementary Textbooks	1. Dubois, Annavaram and Stenström: “Parallel Computer Organization and Design” Cam-bridge University Press, 2012. 2. John Cheng, Max Grossman, Ty McKercher: “Professional CUDA C Programming”. John Wiley & Sons, Inc, 2014.
Credit (*ECTS*)	6
Prerequisites for the Course (*Attendance Requirements*)	Attendance is mandatory
Course Type	Technical Elective
Language of Instruction	English
Course Objectives	To teach the quantitative design and analysis, memory hierarchy, DRAM and virtual memory, pipelining, datapath and control design, data and control hazards, instruction-level parallelism, data-level parallelism, dynamic scheduling of instructions, branch prediction and speculative execution, multiprocessors, thread-level parallelism, SIMD and GPU architectures, warehouse scale computers.
Course Learning Outcomes	1. Explains quantitative design and analysis. 2. Defines memory hierarchy, DRAM and virtual memory structure. 3. Explains the pipelining operation. 4. Explains bus and control design criteria. 5. Explains instruction-level parallellism. 6. Explains data-level parallellism. 7. Explains dynamic scheduling of instructions, branch prediction and speculative execution. 8. Defines multiprocessor systems. 9. Explains thread-level parallelism. 10. Explains SIMD and GPU architectures. 11. Explains the running of warehouse scale computers.
Instruction Method *(Face-to-face, Distance education etc.)*	Face-to-face
Weekly Schedule of the Course	Week 1: Quantitative Design and Analysis Week 2: Memory Hierarchy Week 3: DRAM and Virtual Memory Week 4: Pipelining Week 5: Datapath and Control Design Week 6: Data and Control Hazards Week 7: Instruction Level Parallelism Week 8: Data Level Parallelism Week 9: Dynamic scheduling of instructions Week 10: Branch Prediction and Speculation Week 11: Multiprocessors Week 12: Thread-level Parallelism Week 13: SIMD and GPU Architectures Week 14: Warehouse-Scale Computers
Teaching Activities *(The time spent for the activities listed here will*	Weekly theoretical course hours: 3 Reading activities Internet search and library work

determine the amount of credit required)	Making a report Midterm and revision for midterm Final exam and revision for final exam

Assessment Criteria

	Number(s)	Weight (%)
Midterm exam	1	35
Assignment	4	25
Application	-	-
Project	-	-
Practice	-	-
Quiz	-	-
Final exam	1	40
Total	6	100

Workload of the Course

Activity	Number of Weeks	Duration (Weekly Hour)	End of Semester Total Workload
Weekly theoretical course hours	14	3	42
Weekly practical course hours	-	-	-
Reading activities	14	2	28
Internet search and library work	14	2	28
Designing and implementing materials	-	-	-
Making a report	4	4	16
Preparing and making presentations	-	-	-
Midterm and revision for midterm	1	12	12
Final exam and revision for final exam	1	24	24
Total workload			36
Total workload/ 25			6
Course Credit (ECTS)			6

Contribution Level between Course Outcomes and Program Outcomes

No	Program Outcomes	1	2	3	4	5
1	Knowledge of mathematics, science, basic engineering, computing, and computer engineering; ability to use this knowledge in solving complex engineering problems.			X		
2	Ability to define, formulate and analyze complex engineering problems using basic science, mathematics and engineering knowledge and considering the UN Sustainable Development Goals relevant to the problems addressed.					X
3	Ability to design creative solutions to complex engineering problems; ability to design complex systems, processes, devices, software, algorithms or products to meet current and future requirements, considering realistic constraints and conditions.					X
4	Ability to select, use and develop appropriate techniques, resources and modern engineering and informatics tools, including estimation and modeling, for the analysis and solution of complex engineering problems while being aware of their limitations.					X
5	Ability to use research methods to examine complex				X	

		engineering problems or research topics in computer engineering, including reviewing the literature, designing experiments, conducting experiments, collecting data, analyzing and interpreting results.					
	6	Knowledge of the effects of engineering practices and the standards used in these practices on society, health and safety, economy, sustainability and environment within the scope of the UN Sustainable Development Goals; awareness of the consequences of engineering solutions in the fields of information security and law.					
	7	Acting in accordance with engineering professional principles and knowledge on ethical responsibility; awareness of acting impartially, without discrimination on any issue, and being inclusive of diversity.					
	8	Ability to work effectively individually and as a team member or leader in intradisciplinary and multidisciplinary teams (face-to-face, remote, or hybrid).					
	9	Ability to conduct effective verbal and written communication on technical issues in Turkish or English, prepare reports, make effective presentations and prepare software documentation, considering the various differences of the target audience (such as education, language, profession).					
	10	Knowledge of business practices such as project, risk and change management and economic feasibility analysis; awareness of entrepreneurship and innovation.					
	11	Lifelong learning skill that includes the ability to learn independently and continuously, to adapt to new and developing scientific practices and technologies, and to think inquisitively about technological changes.					

Lecturer(s) and Contact Information	Lecturer's First/Last Name: Prof. Dr. M. Ali AKCAYOL E-mail address: akcayol@gazi.edu.tr