COURSE NUMBER AND TITLE: EE 5376 Computer Architecture - I

COURSE DESCRIPTION/COURSE OVERVIEW: Computer Architecture - I course covers advanced topics in computer architecture focusing on multicore, graphics-processor unit (GPU), and heterogeneous SOC multiprocessor architectures and their implementation issues (architect's perspective). The objective of the course is to provide in-depth coverage of current and emerging trends in computer architecture focusing on performance and the hardware/software interface. The course emphasis is on analyzing fundamental issues in architecture design that are critical in state-of-the-art computing systems and their impact on application performance. The course starts with principles and fundamentals of design, performance, pipelining and caching metrics in traditional systems. As the course progresses more advanced topics and range of levels are explored from microarchitecture, compiler optimization, parallel programming, run-time optimization, performance analysis & tuning, fault tolerance, security constraints and power-aware computing techniques in the emerging systems. Students will be exposed to many exciting open problems in the field and work on hands-on assignments in multicore and GPU architecture systems. Students have options in exploring their own interests in custom assignments. These topics should prove useful to those who are new to advanced computer design, and those with some experience.

COURSE TOPICS: This course covers in depth the following key focus areas:

1 - Principles and Precedent designs
2 - Computer Architecture Fundamentals
3 - Performance Analysis and Pipelining
4 - Cache Design, Coherence and Optimization
5 - Prefetching and Virtual Memory
6 - Advanced Computing Technologies and their impact on design
7 - GPU Programming
8 - Interconnection Networks
9 - Multicore Cache Management
10 - Multiprocessors, Coherence and Consistency
11 - Acceleration, Customization and Heterogeneity

COURSE PRE-REQUISITES: (1) Students must have successfully completed an undergraduate-level computer architecture or microprocessors course or (2) Topic-wise should understand how a basic computer works, assembly language programming, computer organization.

GENERAL INFORMATION
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Office Hours: Tu Th 1-3 pm

CREDIT ALLOCATION: 3

TEXTBOOKS AND REFERENCES:
Computer Architecture: A Quantitative Approach
by John Hennessy and David Patterson (6th Edition)

Programming Massively Parallel Processors: A Hands-on Approach
by David B. Kirk and Wen-mei W. Hwu (3rd Edition)

It is not mandatory to buy the course textbooks, lecture materials provided in the class cover the course content.

COURSE OBJECTIVES:
A student who has successfully completed this course should be able to:

- Discuss the organization of computer-based systems and how a range of design choices are influenced by applications
- Analyze various performance characteristics of a computer system.
- Apply digital design techniques to the microarchitecture construction of a processor.
- Understand the organization and operation of current generation parallel computer systems, including multiprocessor and multicore systems.
- Analyze hardware & software trade-offs to design the instruction set architecture (ISA) interface.
- Understand advanced issues in design of computer processors, caches, and memory.
- Analyze performance trade-offs in computer design.
- Apply knowledge of processor design to improve performance in algorithms and software systems.
- Gain the ability to develop parallel GPGPU solutions.

GRADING POLICY AND STRUCTURE

Time Stamps LMS

- Attendance, participation, and all LMS (Blackboard LMS) postings are counted in Mountain Time (MST). The time stamps in the computer represent MST, regardless of your actual time zone.

Discussion Boards

- Discussion Boards will be available if there is any common question for most of the students in the class.

Assignments

- Assignments are due by **11:59pm (MST)** on the **due date calendar/course schedule**. Assignments **will not be accepted after the due date**. This is done in fairness to those

students who turn in their assignments on time. The only exception is with extenuating circumstances or events that have been discussed with the instructor PRIOR to the deadline.

Quizzes

- Quizzes will be available for a specific timeframe (as indicated on the class calendar). There will be **1 attempt** for each quiz for the quizzes posted in blackboard. The highest grade will be documented in the grade book. Late quizzes will not be accepted. If you would like specific feedback based on your quiz responses, please contact the instructor for an appointment to review your quiz.

In the case of emergencies when you are prevented from logging on, please contact the Course Faculty as soon as possible by phone and/or email. If you know you will be out of town or otherwise prevented from submitting assignments on the due date, make every effort to turn them in early. Anytime you feel that you are falling behind in the course, it is best to contact the Course Faculty immediately to discuss your situation. In regards to dropping the course with a "W", it is the **student's responsibility** to make arrangements with the UTEP Registrar and drop by the "withdrawal date" located on UTEP Registrar website.

GRADING SCALE:

Weightage:

10%	Attendance (Quizzes)
25%	Assignments
30%	Mid-term Exam
35%	Final Exam

Grading scale:

90 - 100	= A
80 – 89	= B
75 – 79	= C
60 – 74	= D
< 60	= F

Assignments *total 100 points*

Expectations of the Class
What should you expect from me as the Lead Faculty?

- I will provide you clear instructions on class expectations
- I will check my **Blackboard course email** at least once a day and will get back to you within 24 hours.

- I will provide graded feedback on your performance within 7 days of the due date.
- I will keep you informed about your graded progress in the class at all times and will make time to discuss your needs.
- I will leave myself open to suggestions about improvement of the class and class related activities.
- I will do all I can to ensure your learning and success in this class.
- The course calendar is a living document and may be adjusted due to events occurring during the class timeframe. If any changes in the course are to be implemented, I will ensure that the class is notified via announcements in a timely manner.

What Faculty expect of their Students:

- At the beginning of each course, students should review the syllabus, and other introductory items located in the "Getting Started" folder.
- Students will be expected to complete a mock assignment on blackboard shell.
- All students are to review the rules of netiquette and follow in their interaction with fellow students and faculty for any discussion boards on course topics.

COURSE POLICIES:

Academic Regulations:
Review in UT El Paso Student Handbook the following policies: *Religious Observance, Ethical and Responsible Use of Social Media, Policy on Academic Integrity, Progression Policy, and Statement on Disability.*

Attendance: Attendance is **mandatory** to follow the classes. Students are expected to attend the class, log-in and check the course shell on blackboard (at minimum) **every week** to keep up. Email messages are sent to your **UTEP email address,** so you will want to check your UTEP email everyday as well.

Blackboard:
- Students are required to subscribe to and access the course Blackboard site. Blackboard is the main source of communication between faculty and students. Students are encouraged to access this site daily. Course syllabus, calendar, topical outline of scheduled lectures, and assigned readings are posted on this site. Grades of assignments will be made available ONLY through this site. **Email messages will be sent through the Blackboard course site—link labeled "Course Messages". Please check this email (at minimum) every other day for any communication.**

Communication:
- Communication is the responsibility of both students and faculty. The faculty will keep students informed of progress in theory. Students with questions or concerns should first contact faculty member.

Policy on Scholastic Dishonesty:

- Students are expected to be above reproach in all scholastic activities. Students who engage in scholastic dishonesty are subject to disciplinary penalties, including the possibility of failure in the course and dismissal from the College of Engineering and/or university. Scholastic dishonesty includes but is not limited to reproducing test or quiz materials from memory, copy/paste or Xerox, cheating, plagiarism, collusion, the submission for credit or any work or materials that are attributable in whole or in part to another person, taking an examination for another person, and any act designed to give unfair advantage to a student or the attempt to commit such acts. Regents' Rules and Regulations, Part One, Chapter VI, Section 3, Subsection 3.2, Subdivision 3.22.
- Since scholastic dishonesty harms the individual, all students, and the integrity of the College of Engineering and the university, policies on scholastic dishonesty will be strictly enforced. See detailed procedure in the Handbook of Operating Procedures (HOP) available in the Office of the Dean of Students.

Policy relating to Disability / Pregnancy/ CASS:

- **Disability**: In Section 504 of the Vocational Rehabilitation Act of 1973 and the Americans with Disabilities Act (ADA) of 1990, if a student needs an accommodation then the Office of Disabled Student Services located at UTEP need to be contacted. If you have a condition, which may affect your ability to perform successfully in this course, you are encouraged to discuss this in confidence with the instructor and/or the director of the Disabled Student Services. Written guidelines r/t accommodations from CASS must be submitted to the course manager PRIOR to the start of the course. If you have a disability and need classroom accommodations, please contact CASS at 747-5148, or by email to cass@utep.edu, or visit their office located in UTEP Union East, Room 106. For additional information, please visit the CASS website at www.sa.utep.edu/cass. *CASS' Staff are the only individuals who can validate and if need be, authorize accommodations for students with disabilities.*
- **Pregnancy**: It is the responsibility of the student to inform the instructor of pregnancy limitations. Written guidelines r/t accommodations from The Center for Accommodations and Support Services (CASS) must be submitted to the course manager PRIOR to the start of the course.

Professional Behavior:

- Students are expected to behave professionally *at all times* with faculty, peers, preceptors, and clients **and** in any setting in which the student is a representative of UTEP. Bullying, verbal abuse, insubordination, or personal attacks will not be tolerated in any form. Any behavior deemed inappropriate by faculty and/or preceptors will result in faculty conference(s), and completion of a Student Opting for Success (SOS) plan that addresses the student's areas of needed improvement. Possible activities available to assist the student in attaining the SOS objectives include stress and/or anger management counseling sessions. Inappropriate behaviors may result in an administrative withdrawal from the course and/or dismissal from the program.

Retention: Students Opting for Success (SOS):

- When a student is not progressing in the course as expected, or is not successful on an examination, they will be required to meet with the instructor to discuss strategies for success as outline on the SOS form. The SOS plan will identify recommendations for improving the student's success potential and will specify time lines for completion of these recommendations. The SOS form (with all recommendations completed and all signatures in place) must be submitted to the course manager by due date. *Students who are not successful in the course should be aware that non-compliance with SOS recommendations jeopardizes eligibility for the opportunity to repeat the course in the subsequent semester.* See respective Blackboard home page for SOS form.

Netiquette

"Netiquette" stands for "Internet Etiquette", and refers to the set of practices developed over the years to make the Internet experience pleasant for everyone. Please review some of the **Netiquette** rules.

- At this point in the course, it is also important to share a word of caution, so we can become wiser about interpersonal distance learning communications. As you may know, when communicating electronically, many of the feelings or impressions that are transmitted via body language in face-to- face communications are lost. Consequently, interpreting emotions and innuendoes is far more difficult. Only what is written, or drawn, carries the message. Often excitement can easily be misinterpreted as anger or an insult. It is important that everyone keep this in mind when communicating electronically. Words in print may appear harmless; however, they can emotionally injure the person reading them. More information can be found at http://www.albion.com/netiquette.

Other BB Learn Student Resources

Technical Assistance

This online class is hosted by UT El Paso. If you have computer, Blackboard problems, or any other kind of technical questions, please contact the UTEP Help Desk via email at **helpdesk@utep.edu** or by phone at (915) 747-5257. The HELP desk hours are: Mon-Fri 7:00am - 8:00pm (Mountain Time), Sat 9:00am - 1:00pm (Mountain Time), Sun CLOSED.

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