Course Syllabus

ECE452: Computer Organization and Architecture

Instructor: **Dr. Sudeep Pasricha**, Engr B119**,** 970-491-0254

Course Description: The objective of the course is to provide students with a solid foundation in computer system design, spanning the spectrum of smart mobile devices and high performance supercomputing. Modern computer technology requires professionals to understand both hardware and software concepts. Accordingly, this course focuses on the interaction between hardware and software at a variety of levels to promote a deep understanding of the fundamentals of computing. Topics that will be covered include instruction set architectures, computer arithmetic, RISC CPU and pipelining, memory hierarchy, networks on chip, parallel programming models, multicores and multiprocessors, graphics and computing GPUs, and game console architectures (such as Xbox One, PS4, Wii Switch).

Prerequisites: ECE251 or equivalent with a C+ or better (or written consent); C programming

Grading: Grading is based on the following components:

- Homework Assignments (6): 20%
- Reading Assignments: 0% (you will get questions on reading assignments in your exams)
- Class participation: 10%
- Examinations (closed book): 70%
  - Midterm: 20%
  - Quizzes (1): 10%
  - Comprehensive Final: 40%

Textbook: Computer Organization and Design: The Hardware/Software Interface. David A. Patterson and John L. Hennessy, Morgan Kaufmann Ed., Fourth Revised Edition (Fifth Edition preferred but not essential).

Topics:

Week	Topic
1	Introduction: Computer Abstractions, Performance, Power, and Technology
2-3	MIPS Instruction Set Architecture (ISA)
4	Computer Arithmetic
5-6	Processor Internals: Introduction to Pipelining
7-8	Memory Hierarchy: Caches, Buffers, and Main Memory
9	Spring Break
10	Midterm Week
11	Mobile Computing
12-13	Multicores, Multiprocessors, and Clusters
13-14	Interconnection Networks
15	Storage and Other I/O Topics
16	Advanced Topics (e.g., Machine Learning, Warehouse Scale Computing)
17	Finals

Grading Methodology and Scale

A+ ≥ 95%; 90 ≤ A < 95%; 85 ≤ A- < 90%; 80 ≤ B+ < 85%; 75 ≤ B < 80%; 70 ≤ B- < 75%; 65 ≤ C+ < 70%; 55 ≤ C < 65%; 40 ≤ D < 55%; F < 40%;

Course Objectives

At the end of the course, all students will be able to:

- Model and evaluate hardware components (processors, memories, accelerators, peripherals, sensors/actuators) and their numerous configurations as used in contemporary computing platforms at various scales (e.g., IoT devices, smartphones, servers, and supercomputers)
- Understand the detailed interactions between software applications, operating systems, and hardware in computing systems

- Write assembly code in MIPS, optimize assembly code, and optimize high-level (e.g., C) programs for various hardware platforms
- Understand the importance of memory and network architectures in computing platforms; and be able to optimize these components for improved performance and energy efficiency
- Learn the skills required to succeed in doing research in computer architecture