CST 250: **Microcomputer Architecture and Programming Syllabus**

ADMINISTRATIVE DETAILS

Instructor: Sohum Sohoni
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Office hours: Tuesday, Thursday 1:30 P.M to 2:30 P.M and by appointment

Lecture: Tuesday, Thursday 12 P.M to 1:15 P.M

Location: POLY AGBC 145

Schedule No: 12240

Description: Microcomputer architecture, instruction set, assembly language programming and debugging, I/O considerations, memory interface, peripherals and busses, exception/interrupt handling.

Prerequisites: Enroll requirements: Pre-requisites: CST 100 and CST 150;

Required Text: There is no required textbook for this course. You could refer to *Computer Organization and Design* By D. Patterson, J Hennessy, Morgan Kaufmann Publisher

WHAT IS THIS COURSE ABOUT?

Welcome to CST 250! Think about all the things in the world that have a microprocessor in them. Your laptop, your refrigerator, car, TV, phone, pacemaker... This class is the study of these systems and the microprocessors that are the brains of these systems. That includes topics such as number systems, assembly language programming, organization and design of a microcomputer, and interfacing with sensors, A/D converters, etc.

This course introduces you to core, low-level, computing systems concepts including assembly programming and the organization of computing systems. We'll look at tradeoffs in various contemporary architectures (ARM, Intel), practical limitations of computing systems, and some of the rationales behind their designs. Additionally, we'll be interfacing a lot with other systems through sensors and controls, which is what real engineers do. Throughout the course we will work on multiple labs and micro projects some of which will come together as a final class project.

It has been my personal experience as a student and as a teacher for many years that we often think we have understood a concept when someone explains it to us but when we try to apply it to solve a problem or build a project, we realize that we really didn't get it. This course is based on the pedagogy of active learning, where you apply your knowledge to solve problems and reflect on your learning. In that process you gain procedural knowledge and also gain and strengthen conceptual knowledge that is required in the context of your projects and activities. Be prepared to work hard. What you gain from this course will be proportional to how hard you are willing to work. Remember, a 3 credit-hour course entails 9 hours of work/study per week.

COURSE OBJECTIVES

By the end of this course, you should be able to:

- Draw a block diagram of the main parts of a CPU and describe each part
- Define basic terminology related to computing (e.g. Program Counter, Stack, Algorithm)
- Show (through drawings and short descriptions) how numbers and program statements are stored and operated on by the CPU
- Generate original assembly code using the software development cycle (analyze problem, create algorithm, draw flowchart, write program, and debug program).
- Utilize the advanced features of the CPU (stacks, interrupts, advanced instructions) to accomplish complex tasks.
- Identify problems in familiar and unfamiliar programs, and correct and improve the code.
- Interface with different types of I/O devices with a range of interface protocols (serial, parallel, digital, analog)
- Compare different approaches/solutions to a specific assembly programming situation/problem and evaluate which one is better
- Work with other students to develop teamwork skills and an appreciation for alternate approaches to a problem

GRADING

COURSE GRADING	
Based on Points (**absolute, fixed, no curve**)	
>= 95.0 <= 100.0	**A+**
>= 87.5 < 95.0	**A**
>=85.0 < 87.5	**A-**
>= 82.5 < 85.0	**B+**
>= 75.0 < 82.5	**B**
>=72.5 < 75.0	**B-**
>= 65.0 < 72.5	**C**
>= 57.5 < 65.0	**D**
< 57.5	**F**

POINTS DISTRIBUTION	
Quizzes:	10 (2 * 5)
Projects and/or Labs:	40 (10 * 4)
Final Project:	20
Assignments:	10 (2 * 5)
Midterms:	10
Final Exam:	10
Total Points Available:	100

COURSE TOPICS AND TENTATIVE CALENDAR

Week	Topic	Project/Lab
1	PLP tool: Overview and Familiarity	Lab 1: Hello PLP!
2	PLP Architecture, Registers	
3	What is Assembly Language? Review of Binary and Hexadecimal Number Systems and Arithmetic	Lab 2: Number Representations
4	MIPS/PLP ISA: Relationship Between ISA and Hardware: An Overview; Data transfer, Arithmetic	
5	Addressing, Jumps and Loops	Lab 3: RPN Calculator
6	Interrupts and Timers	
7	**Team Presentations for RPN Calculator**	Lab 4: Timers and Interrupts
8	**Review for Midterm; Midterm Exam**	
9	Spring Break	
10	Interfacing	Final Project
11	Case study : ARM architecture	
12	High Level Languages to Assembly	
13	Case Study: x86 and Modern Intel Processors	
14	Focus on Final Project	
15	Full Course Review and Project Updates	
16	**Final Team Presentations**	

PEER EVALUATION

Throughout the semester a number of peer evaluations will be administered through CATME. These peer evaluations give each student a chance to rate team member performance and provide comments to the instructor and the student. Peer evaluations may be used to weight **team-based** course grades (the projects). Weighting is at the discretion of the instructor, and is to encourage you to improve your contribution to the team if your teammates deem that you are not contributing enough. Weighting will not fall outside the range of 50% to 150% of your raw **team-based** score. If you have major issues with your team, do not wait, see the instructor sooner rather than later.

CLASS PARTICIPATION AND ATTENDANCE

There is no attendance policy. If you need to skip (or want to skip), feel free. We sometimes have in-class quizzes and assignments that can't be made up however, and you'll miss out on whatever is discussed in class.

You are expected to participate in class such as taking part in group based problem solving, preparing your solution to the homework that is to be discussed in class, taking quizzes, and contributing to in-class discussions in a constructive manner.

DATES OF NOTE

Classes Begin:	January 13th
Last day to add/drop:	January 19th
Martin Luther King, Jr. Holiday Observed:	January 20th
Midterm:	**March 6th**
Spring Break:	March 9th – 16th
Course withdrawal deadline:	April 6th
Classes end:	May 2nd
Final exam :	TBD

Wish you the best in this class and in all your endeavors!