

# Course Syllabus

Welcome to Computer Organization. This course is an *intensive* introduction to the fundamentals of computer architecture. Relying heavily on the elementary principals taught in ECE 331 and ECE 332, we will discuss the basic design, or architecture, of computing hardware. Taking a largely bottom-up approach, we will focus on the microarchitecture level (the computing hardware itself) and the instruction set architecture level (the interface between software and the computing hardware). This course has a demanding design component; you will implement the concepts presented in lecture using real hardware design tools.

**Topics:** include instruction set architecture, addressing modes, RISC and CISC, computer arithmetic, evaluating performance, datapath and control, single cycle and multi cycle datapaths, exceptions and hazards, pipelining, cache and memory hierarchy, assembly language, processor simulation.

<b>Faculty:</b>	Jens-Peter Kaps	ENGR 3222	jkaps@gmu.edu
<b>Teaching Assistant:</b>	Sahil Bhat		sbhat6@gmu.edu
<b>Grader:</b>	Haotian Zhai		hzhai@gmu.edu
<b>Lectures:</b>	1:30 – 2:45 pm, Monday and Wednesday		Exploratory Hall L003
<b>Labs:</b>	7:20 – 9:10 pm, Wednesday		ENGR 1505
	4:30 – 6:20 pm, Thursday		ENGR 1505
<b>Textbook:</b>	Computer Organization and Design, The Hardware / Software Interface by David A. Patterson and John L. Hennessy, Morgan Kaufmann; 5 <sup>th</sup> edition, 2014, ISBN: 978-0-12-407726-3 (or earlier editions till 3 <sup>rd</sup> revised).		

## Office Hours:

Please check the class web page for the current office hour schedule. You should feel free to approach Dr. Kaps and the TA at any time if you need help in addition to the scheduled sessions. The best way to contact us is via e-mail. Please make sure to put “ECE445” into the subject line.

## Required Background:

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|---|------------|--|
| <ul style="list-style-type: none"> <li>• <a href="#">ECE 331</a> Digital System Design (grade C or better)</li> <li>• <a href="#">ECE 332</a> Digital Electronics and Logic Design Lab</li> </ul> | and either | <ul style="list-style-type: none"> <li>• <a href="#">CS 262</a> Introduction to Low-Level Programming</li> </ul> |
|   | or         | <ul style="list-style-type: none"> <li>• <a href="#">CS 222</a> Computer Programming for Engineers</li> </ul>    |

## Homework:

Homework will be assigned on a weekly basis (up to 12 assignments total). Homework is due on **Monday** and is to be submitted in PDF only on myMason before the **beginning** of class. Homework is very helpful in preparation for exams and is required to achieve an ‘A’ in this class. **Late submission will result in 20% deduction per day. Homework cannot be submitted later than Wednesday at the end of class** because then the solutions will be posted. Only if you can't make it to class, please e-mail the homework solution before the due date and time to the grader. All homework questions will be graded on an: Not attempted (0 points), attempted (0.5 x points), solved (1 x points) scale.

## Exams:

There will be two exams during the course. Exams will be **closed book**. A single (two-sided) blank note card (3” x 5”) will be provided by the instructor on which you can write down **your own notes**. You are not allowed to use more than one card or to attach anything to this card. Your notes have to be hand written. Additionally, the unmodified green MIPS Reference Data card from the textbook and a calculator will be allowed. There will be NO make-up exams. (See Dr. Kaps for an exception.)

Students who are more than 15 minutes late for an exam may not be admitted and will be assigned a grade of zero for the exam.

- **Midterm Exam:** Wednesday March 6<sup>th</sup>.
- **Final Exam:** Monday May 8<sup>th</sup>, 1:30 am – 4:45 pm.

### Projects:

This course features six projects which are based upon each other. Projects will be performed in groups of 2. All projects must be tested using Xilinx Vivado. Students are encouraged to discuss with TA options for working remotely. **Late submissions** will be subjected to a **10% grade reduction for the 1<sup>st</sup> week and 25% for the 2<sup>nd</sup> week**. **No credit will be given to any submissions that are more than 2 weeks past the due date**. The projects are as follows (percentage of final grade):

Project 1: MIPS Arithmetic and Logic Unit (4%)

Project 2: MIPS Datapath and Control Unit to implement R-type instructions (10%)

Project 3: Running MIPS on BASYS3 (3%)

Project 4: MIPS Datapath and Control Unit to implement I-type instructions (6%)

Project 5: Datapath and Control Unit to implement jump instructions (6%)

Project 6: Attach simple Input/Output devices to MIPS (6%)

### Grading:

The final grade is based on a weighted sum of your performance in exams, homeworks, recitations and class participation:

	Total
Projects	35%
Midterm Exam	25%
Final Exam	30%
Homeworks	10%
	100%

### Honor Code:

All rules of the GMU Honor Code system will be in effect. You must review the rules and be familiar with them.

You are encouraged to discuss homework problems and projects with other students and/or obtain the assistance of the TA. Nevertheless, **you must write down your own homework solutions** which represent your understanding of the material. Projects must be completed in groups of 2 or individually. No part of a project submission can be copied from another group or any other source.

Duplicating someone else's work such as but not limited to homework solutions, hard-ware/software designs, diagrams, source code, project reports, and exam notes, is considered cheating. If you use material from other sources such as but not limited to the web, books, journals, data sheets, etc. you must reference the source. Honor code violations will be followed up with full force.

### Classroom Etiquette:

Cellphones, pagers have to be put into silent mode. If you have an emergency need to answer a call please quietly leave the room BEFORE answering the call. Lectures may not be recorded without express written permission from the instructor.

### E-Mail:

When e-mailing the instructor or the TA you must use your Mason e-mail account and start the subject line with **ECE445**. Otherwise we might not be able to find your e-mail in our inbox.

### Students with Disabilities

If you need special assistance, please inform the instructor and the Office of Disability Services (ODS, <http://ods.gmu.edu>) as soon as possible. All special accommodations must be arranged through ODS.