EE 3921
Digital System Design
Fall 2021

Syllabus

JUST THE FACTS

Class Format:
This class will be taught in a flipped format. This format requires students to critically read/view the lecture material before class. Class time will be spent highlighting key points, answering student questions and working through examples.

Class website:
https://faculty-web.msoe.edu/johnsontimoj/EE3921/index-ee3921.html
or search "Johnson MSOE", it will be the first result in Google
Notes, Handouts, readings, and assignments will be available on the website

Grading:	**Final Taken**
• Homework (lowest dropped)	20%
• Labs (including practical)	35%
• Tests (weighted to highest score)	30%
• Final Project	15%

Lab attendance is mandatory

No late assignments will be accepted.

Grade scale: 60 – 70 – 80 – 90 – 100
F | D | C | B | A
Final scores in the lower 15% of each range and the upper 15% of the subsequent range will receive a mixed grade of AB, BC, or CD.

The web page will be used for distributing all material in this class. Canvas will be used for announcements and grades. All assignments will be due as indicated.

Help:
MSOE is a student-centered educational institution. If you need help – ASK!

Don't Cheat!

COVID STATEMENT

MSOE is committed to the health, safety, and well-being of all members of our community. In an effort to maintain such an environment, as well as to prevent further spread of COVID-19, students, faculty, staff and guests of the university must wear a facial covering in indoor, public spaces.

- Failure to wear a facial covering in class or laboratory will result in your faculty member requiring you to leave class and not return until you have secured a facial covering for yourself.
- Failure to comply with your faculty member's instructions will result in immediate action from the Office of the Dean of Students.
- Failure to comply with this policy will be handled according to the Student Code of Conduct and may result in sanctions, up to and including expulsion.
- The university strongly encourages all students to keep an extra and clean facial covering on their person at all times and strongly discourages students from borrowing and lending others their facial coverings.

If you receive a positive COVID-19 test result; or are symptomatic of COVID-19; or are an unvaccinated student who has been a close contact of an individual who is symptomatic or positive, please login to my.msoe.edu and click on the COVID-19 Report form located on the home page. Please do not physically come to campus if you are ill or suspect you may be ill. MSOE is committed to your education and your faculty will work to support your learning should you need to isolate or quarantine.

STUDENT ACCESSIBILITY SERVICES (SAS)

Student Accessibility Services (SAS): For students with documented disabilities, chronic medical conditions or mental health concerns; MSOE provides services to make reasonable accommodations available. If you are a student who requires or anticipates the need for accommodations, please contact Student Accessibility Services Office at 414-277-7281, by email at moureau@msoe.edu, or in person at K250 to discuss appropriate accommodations and eligibility requirements.

Your success as a student is of utmost importance to me. If you have a disability or any other special circumstance that may have some impact on your work in this class, and for which you may require special accommodations, please contact me early in the semester so that accommodations can be made in a timely manner.

COURSE DESCRIPTION, GOALS, and OUTCOMES

Course Description
The objective of this course is to give students a solid foundation in 21st century digital systems design practices. The primary emphasis of the course is on designing a SOPC (System-On-A Programmable- Chip). Thus, the course incorporates the use of soft processors, such as the NIOS II from Altera. Designs are specified using VHDL and simulated on a personal computer. The design is then realized on an FPGA. Real-time verification of the design using an in-system logic analyzer such as SignalTap is emphasized. The course also involves advanced projects based on a soft processor interface. Due to the project-oriented nature of the course, the syllabus is organized as a set of case studies.

Prerequisites & Notes
CE1911 or EE 2902, EE2050

Course Outline:
The course will consist of four major sections:

- Review and extension – 2 weeks
- FPGA Basics – 2 weeks
- Embedded Processor Development – 3 weeks
- Mixed Systems – 3 weeks

Learning Outcomes and Objectives:
A student who successfully fulfills the course requirements will have demonstrated:

- An understanding of the internal components and operation of a FPGA device
    - Structure
    - Cell operation
    - Memories
    - PLLs
    - Multipliers
- VHDL coding techniques for moderate complexity blocks/modules
- Compilation and debug tools and techniques
- The ability to interface an FPGA to an external component/system
- An understanding of processor/peripheral interconnect and communication
- Processor system development/integration
- Coding for custom developed processor systems
- The ability to integrate/interface/use an integrated FPGA system (Processor + logic) with an external component/system

COURSE MECHANICS

Class Details: All Sections

Room - Sec 011 – S359
Sec 021 – DH129
Days - Monday, Wednesday, Friday
Time - Sec 011 – 11:00
Sec 021 – 3:00

Lab Details: All Sections

Room - S-343
Days - Thursday
Time - Sec 011 – 11:00 – 12:50
Sec 021 – 3:00 – 4:50

Instructor:

Dr. Johnson
Office: S-336
Email: johnsontimoj@msoe.edu
preferred method of contact
(prepend all email subjects with EE3921 - subject**…)**
Website – ***https://faculty-web.msoe.edu/johnsontimoj***
Office phone - (414) 277-2682
Office hours: Monday/Tuesday 9-10, Wednesday 10-11, Thursday/Friday 2-3

Text Book – optional – not very good

Embedded SOPC Design with NIOS II Processor and VHDL Examples,
Chu, Wiley 2011 - ISBN: 978-1-118-00888-1

Free Range VHDL
http://freerangefactory.org/

Class website:
https://faculty-web.msoe.edu/johnsontimoj/EE3921/index-ee3921.html

Support Outside of Class:
If you are struggling it is ALWAYS better to ask for help early since concepts build upon each other. In addition, office hours will be more crowded prior to the test and you may not get the kind of time needed to clarify your understanding.

COURSE POLICIES

Lab Attendance:
Lab attendance is REQUIRED, any unexcused lab absences will result in a 0 for the lab.

Class Attendance:
This is a junior level course and will move pretty quickly. While you may be able to learn the material on your own, if you fail to attend class you will not:

be exposed to the subtlety of the concepts
learn the details "between the lines"
know what points I consider important
learn from the questions of other students
get the benefit of the doubt on any borderline decisions

In Class Behavior:
You are young professionals and I expect you to act accordingly. Disruptive behavior of any kind will be referred to the appropriate administrative office.

I expect your focus in class to be on the course material. Cell phones, MP3 players, laptops, tablets, … are not allowed in my class. If you must use one of these devices you are welcome to leave the room. Research shows that taking notes on a laptop or tablet is less effective than taking them long-hand, so please do not ask for an exception.

No video or audio recording is allowed in class. Failure to follow this rule will be treated as academic dishonesty and dealt with accordingly.

Professionalism and Academic Honesty:

A professional does not take credit for the work of someone else.

A major component of your education is learning how to learn and perform. Now is the time you must develop the discipline, mindset, and ethics to contribute in the technical society. I can assure you; those who claim the work of others in the workplace are dealt with rather harshly.

Any documented case of "cheating" will result in a **FAILING GRADE** as well as possible disciplinary action. All cases of academic dishonesty will be reported to the EECS Chair as well as to the Dean of Students.

Examples of Cheating include **(but are not limited to)** the following:
Testing

- copying the work of another student (past or present) during a test
- providing test information to students who have not yet taken it
- obtaining information about a test prior to taking it
- having someone else take a test for you
- bringing "cheat sheets" in any form with you to a test

- using a cell phone or other electronic device during a test

Homework

- modifying a graded lab or homework paper and submitting it for reevaluation
- turning in work that was done by someone else
- using another student's (past or present) homework files
- posting solutions to homework problems or lab experiments

Working collaboratively on homework assignments is allowed and encouraged. The work you turn in however must be your own. If you short circuit this process and let someone else do the work for you, you will be cheating yourself.

EFFECTIVE LEARNING CONCEPTS

As an engineer you most likely consider yourself a scientist also. A critical piece of being a scientist is believing in the scientific method and not ignoring the results. Here are some key learning and learning behavior results.

- Multi-tasking reduces competency in each task undertaken
- <5% of the population can multi-task and the odds are high that you are not one of them
- Repetition is a key factor in long term retention
- Your brain tosses out anything it thinks is irrelevant each night – review material the same day to help make it relevant to your brain
- Sleep is not an option – it is critical to learning (7 hours min – no exceptions)
- Connect new concepts to concepts you already know
- Taking notes by hand increases understanding – not true for typing
- Study as you go and review in the days before the test – then sleep the night before
- Hear – Do – Teach Teaching others solidifies learning
- Cramming has no long term learning value
- Cramming works for a few hours – if you do it – do it the morning of the test

Seven Things you can do to be a better learner:

1. Make connections. Use analogies or mnemonic devices to build upon your existing knowledge. Not only do these help you remember – but the act of creating these helps you learn.
2. Never read anything without a purpose and stop once you have accomplished it.
3. When you read – stop after every major section or chapter and write down a few key notes. Review the summary within 24hrs to help transition it from short term to long term memory.
4. 20-30 min maximum at any task – then take a short stretch break (30-60sec) and get the blood flowing – review what you have been doing in your mind.
5. 2 hours total without a long break (10 - 15 minutes). Do something that stimulates other parts of your brain – music, exercise, food – when you return – review your short notes from earlier.
6. Plan your time – keep a record – modify your schedule accordingly – Stress reduces learning and being overloaded with no time left is very stressful.
7. Ask – when you don't get it, and have tried a few times - ASK

Always remember – your goal is not to accomplish a task – it is to learn something in the process.

COURSE SCHEDULE

SUBJECT TO CHANGE – depending on overall class progress and any unforeseen natural phenomena.

Please check the website for the current schedule