Walla Walla University ENGR 433 - Digital Design
Fall 2020, 4 credits

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Textbook: RTL Hardware Design Using VHDL by Pong Chu (REQUIRED)

References: Engineering Digital Design, 2cd ed by Richard Tinder
Fundamentals of Digital Logic with VHDL Design, 3rd ed by Brown & Vranes
Digital Design: Principles and Practices, 4th ed by John Wakerly

General Description: The focus of this class is the design of sequential logic circuits typified by the synchronous state machine. A Register Transfer level (RTL) design methodology will be emphasized. Most circuits you design will be constructed and tested using a field programmable gate array (FPGA).

Goal: To efficiently design combinational and sequential digital logic circuits using methodologies that result in sound and reliable systems.

Knowledge domains: The following knowledge domains will be addressed:

- Digital logic concepts & devices
- Combinational logic design
- Sequential logic design
- Programmable logic (FPGAs)
- Electrical and timing details of logic circuits
- Design using a hardware description language

Objectives:

1) Build a solid basis for digital circuit design
2) Thoroughly understand synchronous state machines
3) Design and implement state machines using manual synthesis.
4) Design state machines using a hardware description language (VHDL). Synthesize these designs, implement, and test.
5) Understand programmable logic and the role it plays in digital design
6) Understand how signals propagate through logic circuits
7) Understand RTL abstraction and design methodology
7) Develop the ability to handle large problems systematically and efficiently
8) Design and implement a significant digital circuit or system.

Handouts: Occasionally there will be handouts that extend or clarify material covered in the textbook. Unless stated otherwise, **you are responsible for the content of these handouts.**

Assignments: **Reading assignments** will be given and **you are expected to read** them prior to the class period they are listed for. ***Read!!!*** I expect it. Written assignments are due at the start of class. There may be quizzes.

Late work: Not accepted unless one of the following conditions is met (but do inform me if you are getting behind or have questions) :

a) A valid medical reason exists

b) You confer in advance with the instructor and receive an ok.

Cheating: Will be rewarded. With scores of zero. And a possible F for the quarter. I expect anything you turn in for grading to be your work and represent your understanding of the material, See WWU integrity policy link below.

Grading:

Homework (& quizzes)	25%
Labs	33%
Lab use & cleanup	02%
Exam 1	20%
Exam 2	20%

The instructor reserves the right to shift this distribution to best serve the needs of the class. Scoring generally follows 90,80,70,60% for A,B,C,D but scores may be curved when needed.

Missed exams will receive a score of zero and cannot be made up.

Final Exam: Final exam time is Sunday, November 22, at 10am. We will meet the.

Homework: To promote good problem solving and facilitate grading, I require that the following guidelines be followed:

- Solutions are to be neatly written on engineering paper, sheets folded together lengthwise, and stapled. The following must be on the outside of the folded papers:
  ENGR 433
  your name
  assignment number
  due date
- The problem number must be clearly stated for each problem.
- Each problem solution must begin with a statement of the problem.
- Work must be neat and readable.
- Templates must be used for drawing logic diagrams
- Work you submit must be your own. Consultation with friends regarding concepts is expected when doing homework but solutions to assigned problems are to be your own work. This is also true for lab assignments when individual submissions are specified. There may be team submissions for some labs. Read lab assignment statements carefully.

See the Engineering Department Professionalism handout.

Labwork: Lab is held in CSP-316, the Digital Lab, on Tuesdays 2 to 5pm

Disability: If you have a physical and/or learning disability and require accommodations, please contact the Disabilities Support Services office at 527-2366 and also inform the instructor.

Walla Walla University (WWU) is a Seventh Day Adventist institution of higher education

Bulletin description of this class:

MSI, LSI, and programmable logic circuits and applications; analysis and design of synchronous and asynchronous circuits and systems; VHDL design and synthesis. Laboratory work required. Prerequisite: ENGR 355.

WWU Integrity policy:

www.wallawalla.edu/academics/academic-administration/academic-policies/academic-integrity-policy/

WWU Emergency information

WWU is committed to having a safe campus. Emergency information is at: www.wallawalla.edu/campus-life/student-life/campus-security

WWU Disability accomodations

In addition to the phone number listed above, see: www.wallawalla.edu/?id=4318

WWU Title IX sex discrimination and sexual misconduct policy

WWU prohibits all forms of sex discrimination and sexual misconduct including, but not limited to, sex-based intimidation and harassment, sexual harassment, domestic violence, dating violence, stalking and sexual violence. If you have been subjected to, or are aware of, an instance of sex discrimination or sexual misconduct, you are highly encouraged to report it to the Title IX coordinator, through the Title IX webpage, or by calling (509) 527-2141. The University has resources to help.
Title IX coordinator email address: jennifer.carpenter@wallawalla.edu
Title IX web page: www.wallawalla.edu/resources/human-resources-payroll/titleix/

Relationship of this class to the WWU core themes

Excellence in Thought

This class helps students develop ability to perform design that requires excellence in thought.

Generosity in Service

Course content does not directly address generosity in service although as an engineering professional there are opportunities to contribute professional service to the community.

Beauty in Expression

There is beauty in carefully crafted documentation that is clear, concise, and complete. Such is required in this class.

Faith in God

A life with inner peace comes through faith in God.