CPEN 230: Introduction to Digital Logic – Syllabus – Spring 2020

Lectures:
T, R 12:25 PM – 1:40 PM, PAC 005

Office Hours:
T, R 3:15 PM - 5:15 PM, HRK 215
Feel free to walk-in anytime or to make an appointment

Instructor:
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Course Description
Number systems and codes, Boolean algebra, Logic gates and flip-flops, Verilog HDL, Combinational and sequential logic design using Programmable Logic Devices.

Required Textbook
W. J. Dally and R.C. Harting, *Digital Design: A Systems Approach,* Cambridge University Press.
You are welcome to use any version/format of the textbook.

Supplementary References
S.L. Harris and D.M. Harris, *Digital Design and Computer Architecture ARM Edition*, Elsevier
J. F. Wakerly, *Digital Design: Principles and Practices with Verilog*, Pearson 5/e
S. Brown and Z. Vranesic, *Fundamentals of Digital Logic with Verilog Design*, McGraw-Hill 3/e

Grading Policy

Letter	Percentage
A	100-94
A–	93-90
B+	89-86
B	85-82
B–	81-78
C+	77-74
C	73-70
C–	69-66
D+	65-62
D	61-58
F	57-0

Course Grading:

Homework:	20% (lowest score will be dropped)
Midterms:	40%
Final:	40%

No Late work will be accepted.
No make-up exams.

Classroom Etiquette:

- Arrive in class on time
- Turn off cell phones
- No distracting conversations -- relevant questions are strongly encouraged

CPEN 230 Main Learning Outcomes

- Explain the basics of Boolean algebra, logic functions and circuits.
- Analyze logic networks, synthesize simple circuits and derive minimum-cost implementation of logic functions.
- Design simple combinational circuits.
- Design simple sequential circuits.
- Utilize Verilog HDL to design, simulate and synthesize logic circuits.

Detailed Class Schedule (Tentative)

Date	Topic	HW Due
Jan. 14	Introduction. Digital Systems. Variables and Functions. Inversion.	
16	Truth Tables. Logic Gates. Analysis of Logic Network. Boolean Algebra.	
21	Boolean Algebra (cont.). Venn Diagrams. Synthesis using Logic Gates. Sum of Products. Products of Sums. Min-terms & Max-terms.	
23	Min-terms & Max-terms (cont.). NAND & NOR Networks. Minimum SOP & POS. Multiplexers.	HW 1
28	Karnaugh Maps	
30	Minimization Procedure for SOP and POS. Positional Number Representation	HW 2
Feb. 04	Logic Implementation of Adders. Addition and Subtraction of Signed Numbers.	
06	Arithmetic Overflow. Introduction to Verilog.	HW 3
11	Design of Arithmetic Circuits using Verilog.	
13	Design of Arithmetic Circuits using Verilog.	HW 4
18	*Review for Exam 1*	
20	*Exam 1*	HW 5
25	BCD and ASCII Codes. Multiplexers.	
27	Shannon's Expansion Theorem. Decoders. Demultiplexers. Code Converters. Arithmetic Comparison Circuits.	HW 6
Mar. 03	More Verilog: Conditional Operator; If-else statement; Case statement; For-loop statement.	
05	Storage elements (SR Latch, D Latch)	HW 7
10	More storage elements (D-Flip Flop, JK-Flip Flop, T flip Flop). Using Verilog for storage elements	
12	*Spring Holiday – No Class*	
17	*Spring Holiday – No Class*	
19	Binary Counter.	HW 8
24	Counters with Parallel Load and Reset. Modulo Counters. Using Verilog for Counters.	
26	Registers and their Verilog Realization.	HW 9
31	Review for Exam 2	
Apr. 02	*Exam 2*	HW 10
07	Verilog Testbenches	
09	Multilevel Synthesis. Factoring. Functional Decomposition.	HW 11
14	Finite State Machines (Mealy and Moore)	
16	State Diagram Charts	HW 12
21	Examples of State Machine Design using SM diagrams	
23	ASM Charts	HW 13
28	Examples of State Machine Design using ASM diagrams	
30	Designing State Machines using Verilog	HW 14
May 05	Final (3:30 pm – 5:30 pm PAC 005)	

Important Dates:

- Tuesday, Jan. 14 – Instruction Begins
- Monday, Jan. 20 – Martin Luther King, Jr. Holiday
- Monday, Feb. 17 – President's Day Holiday
- Monday, Mar. 9 – Friday, Mar. 13 – Spring Vacation
- Friday, Apr. 10 – Good Friday Holiday
- Monday, Apr. 13 – Easter Holiday
- Tuesday, May. 5 – Final Exam (3:30pm – 5:30 pm; PAC 005)

ADDENDA TO THE SYLLABUS

A NOTE ON HARASSMENT, NON - DISCRIMINATION AND SEXUAL MISCONDUCT:

Consistent with its mission, Gonzaga seeks to assure that all community members learn and work in a welcoming and inclusive environment. Title VII, Title IX and Gonzaga's policy prohibit gender-based harassment, discrimination and sexual misconduct. Gonzaga encourages anyone experiencing gender-based harassment, discrimination or sexual misconduct to talk to someone from the Campus and Local Resources list found in the Gonzaga's Harassment and Non-Discrimination Policy.

It may be helpful to talk about what happened in order to get the support needed and for Gonzaga to respond appropriately. There are options for support and resolution, namely confidential support resources, and campus reporting and support options are available. Gonzaga will respond to all reports of sexual misconduct in order to stop the harassment, discrimination, or misconduct; prevent its reoccurrence; and address its effects. Responses may vary from support service referrals to formal investigations.

As a faculty member, I want to get you connected to the resources here on campus specially trained in and experienced in assisting in such complaints, and therefore I will report all incidents of gender-based harassment, discrimination and sexual misconduct to Title IX. A representative from that office will reach out to you via phone and/or email to explore options for support, safety measures and reporting. I will provide our Title IX Director with all relevant details, including names and identifying information, of the information reported. For more information about policies and resources or reporting options, please visit the following websites: Equity and Inclusion and Title IX. If you would like to make a report of harassment, discrimination or sexual misconduct directly, you may:

- Contact the Title IX Director by phone, email, or in person

Stephanie N. Thomas, Title IX Director 509-313-6910
whaleys@gonzaga.edu
Business Services Building, 018

- Or complete an online form: Sexual Misconduct Report Form

NOTICE TO STUDENTS WITH DISABILITIES/MEDICAL CONDITIONS:

The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability/medical condition requiring an accommodation, please call or visit the Disability Access Office (second floor of Foley Center Library, Room 208.)

CLASS ATTENDANCE:

I follow Gonzaga's standard policy on absences: the maximum allowable absence is two class hours (100 minutes) for each class credit. For three-credit classes, the maximum absence is, therefore, six class hours (300 minutes). The grade for excessive absences is "V," which has the same effect as "F" **(Fail) and is counted in the GPA.**

ACADEMIC INTEGRITY

All members of the Gonzaga community are expected to adhere to principles of honesty and integrity in their academic endeavors. You are expected to be familiar with the University's Academic Integrity Policy and the potential sanctions for violating it. I will abide strictly by this policy's procedures and guidelines. Ignorance of the policy will not serve as a defense against any violations.

RELIGIOUS ACCOMMODATIONS FOR STUDENTS

In compliance with Washington State law (RCW 28.10.039), it is the policy of Gonzaga University to reasonably accommodate students who, due to the observance of religious holidays, expect to be absent or endure a significant hardship during certain days of their academic course or program. The Policy on Religious Accommodations for Students describes procedures for students requesting a Religious Accommodation and for faculty responding to such a request.

COURSE EVALUATION:

At Gonzaga, we take teaching seriously, and we ask our students to evaluate their courses and instructors so that we can provide the best possible learning experience. In that spirit, we ask students to give us feedback on their classroom experience near the end of the semester. I will ask you to take a few minutes then to carry out course/instructor evaluation on-line. Please know that I appreciate your participation in this process. This is a vital part of our efforts at Gonzaga to improve continually our teaching, our academic programs, and our entire educational effort.