Point Loma Nazarene University
EGR 3093 Digital Electronics (3 units)
EGR 3093L Digital Electronics Lab
Spring 2020

CREDIT AND CONTACT HOURS:

Lecture Tue/Thurs 1:30-2:25 pm	RS 365
Lab Tues. 10:30am-11:45 am	RS 265

INSTRUCTOR: Dr. Tom Carter

OFFICE HOURS:

Tue: by appointment, between lab and lecture
Thurs: 10:00 -12:00pm; RS 276

TEXTBOOK: *digital electronics, a practical approach with VHDL, 9th edition*, W Kleitz

REFERENCES/SUPPLEMENTS: *Calculator, LogiSim, Quartus Lite, MultiSim*

CATALOG:

EGR3093 Digital Electronics (2)

Boolean algebra, logic gates, combinational logic circuits, state minimization, flip/flops, sequential circuits, asynchronous and synchronous counters. Course emphasizes design aspects using electronic design software.

EGR3093L Digital Electronics Lab (1)

A lab course designed for a hands-on exploration of Digital Electronics.

COURSE LEARNING OUTCOMES/EXPECTED PERFORMANCE CRITERIA:

PROGRAM OUTCOMES: The objectives of the course are to:

1. Understand the concepts of basic digital electronics and design, the theory of Boolean algebra, logic devices and switching theory.
2. Understand digital logic elements, combinational & sequential circuits, & gate reduction.
3. Learn to design, debug and integrate digital logic circuits
4. Learn to design, debug and integrate digital logic for FPGA implementation using both schematic capture and VHDL programming.
5. Understand and analyze multiplexers, demultiplexers, flip/flop devices, finite state machines, asynchronous and synchronous counters, shift registers and correlators.
6. Study the use of encoders and converters, clocks, timers and practical implementations.
7. Study interfacing with non-digital devices such as Analog to Digital converters, LED displays, LCD crystal displays.
8. Study and analyze memory devices, memory size, organization and allocation, ROM, RAM, and programmable ROM.
9. Become competent in designing and building digital systems with FPGA's and standard interfaces

GRADING

Homework	20%	(lowest score for the semester will be dropped)
Lab	25%	(lowest score for the semester will be dropped)
Midterm #1	15%	
Midterm #2	15%	
Final	25%	

Final grades will be determined as follows:

100-93%	A
90-92.9%	A-
87-89.9%	B+
83-86.9%	B
80-82.9%	B-
77-79.9%	C+
73-76.9%	C
70-72.9%	C-
67-69.9%	D+
63-66.9%	D
60-62.9%	D-
0-59.9%	F

COURSE ORGANIZATION

Lectures: PowerPoint and interactive discussion will cover the topics below. Lectures will be posted on Canvas after the class.

Homework: will be assigned weekly at the end of the lecture period (Tuesdays) and due before the end of the day on the following Monday (since some of homework may be germane to the lab on Tuesday morning). Homework should be submitted on Canvas as either text or attached file (which can include pictures of handwritten work, if clearly legible). If delivered late, but by the end of the next day (Tuesday), the grade will be reduced to a max of 80% of original possible points. No late homework will be accepted after that. The lowest grade of homework assignments for the semester will be dropped.

Lab: will be conducted on Tuesday mornings and will provide hands-on experience with discrete component circuits as well as FPGA programming based on designs related to the material being covered at that time. Some of the lab time may also be used for interactive problem sessions or simulation, as needed. Lab results will be documented in a lab notebook and turned in at the end of the lab session unless otherwise stated. Much of the lab work will be done with a lab partner(s) and lab submittal will be joint, so communication and teamwork will factor into the grade. However, many labs will require prior preparation and you may be individually quizzed on your understanding of that material before proceeding with the lab. Quiz results will be part of that lab grade. The lowest lab grade for the semester will be dropped. A final lab project, which will include some design creativity, is planned for the end of the semester and may be spread over multiple lab sessions with each graded on the current expected step in the process.

Midterms: Two midterms will be given, based on the material covered during that period of the class. Your own personal handwritten notes may be used on these exams, along with a dedicated calculator. Phones and computers will not be allowed. Some programming may comprise a portion of the exam.

Final: The Final will be comprehensive, covering the material of the entire semester. Your own personal handwritten notes and a calculator may be used on the Final.

If you will miss a class or exam for a school function, you must arrange to make it up **ahead of time**. It is your responsibility to let the professor know of such an absence enough ahead of time to accommodate. Absences due to unexpected emergencies will require documentation from a reliable and verifiable source of the time and reason for such absence.

UNIVERSITY MISSION:
Point Loma Nazarene University exists to provide higher education in a vital Christian community where minds are engaged and challenged, character is modeled and formed, and service becomes an expression of faith. Being of Wesleyan heritage, we strive to be a learning community where grace is foundational, truth is pursued, and holiness is a way of life.

DEPARTMENT MISSION:
The Physics and Engineering Department at PLNU provides strong programs of study in the fields of Physics and Engineering. Our students are well prepared for graduate studies and careers in scientific and engineering fields. We emphasize a collaborative learning environment which allows students to thrive academically, build personal confidence, and develop interpersonal skills. We provide a Christian environment for students to learn values and judgment, and pursue integration of modern scientific knowledge and Christian faith.

ATTENDANCE:
Attendance is expected at each class session. In the event of an absence you are responsible for the material covered in class and the assignments given that day.

Regular and punctual attendance at all classes is considered essential to optimum academic achievement. If the student is absent from more than 10 percent of class meetings, the faculty member can file a written report which may result in de-enrollment. If the absences exceed 20 percent, the student may be de-enrolled without notice until the university drop date or, after that date, receive the appropriate grade for their work and participation. See Attendance Policy in the in the Undergraduate Academic Catalog.

CLASS ENROLLMENT:
It is the student's responsibility to maintain his/her class schedule. Should the need arise to drop this course (personal emergencies, poor performance, etc.), the student, not the instructor, has the responsibility to follow through (provided the drop date meets the stated calendar deadline established by the university). Simply ceasing to attend this course or failing to follow through to arrange for a change of registration (drop/add) may easily result in a grade of F on the official transcript.

ACADEMIC ACCOMMODATIONS:
While all students are expected to meet the minimum standards for completion of this course as established by the instructor, students with disabilities may require academic adjustments, modifications or auxiliary aids/services. At Point Loma Nazarene University (PLNU), these students are requested to register with the Disability Resource Center (DRC), located in the Bond Academic Center. (DRC@pointloma.edu or 619-849-2486). The DRC's policies and procedures for assisting such students in the development of an appropriate academic adjustment plan (AP) allows PLNU to comply with Section 504 of the Rehabilitation Act and the Americans with Disabilities Act. Section 504 (a) prohibits discrimination against students with special needs and guarantees all qualified students equal access to and benefits of PLNU programs and activities. After the student files the required documentation, the DRC, in conjunction with the student, will develop an AP to meet that student's specific learning needs. The DRC will thereafter email the student's AP to all faculty who teach courses in which the student is enrolled each semester. The AP must be implemented in all such courses.

If students do not wish to avail themselves of some or all of the elements of their AP in a particular course, it is the responsibility of those students to notify their professor in that course. PLNU highly recommends that DRC students speak with their professors during the first two weeks of each semester about the applicability of their AP in that particular course and/or if they do not desire to take advantage of some or all of the elements of their AP in that course.

ACADEMIC HONESTY
Students should demonstrate academic honesty by doing original work and by giving appropriate credit to the ideas of others. Academic dishonesty is the act of presenting information, ideas, and/or concepts as one's own when in reality they are the results of another person's creativity and effort. A faculty member who believes a situation involving academic dishonesty has been detected may assign a failing grade for that assignment or examination, or, depending on the seriousness of the offense, for the course. Faculty should follow and students may appeal using the procedure in the university Catalog. See the catalog for definitions of kinds of academic dishonesty and for further policy information.

FINAL EXAM:
The final exam will be comprehensive over all the material covered in the class. The Final Exam date and time is set by the university at the beginning of the semester and may not be changed by the instructor. This schedule can be found on the university website and in the course calendar. No requests for early examinations will be approved. Only in the case that a student is required to take three exams during the same day of finals week, is an instructor authorized to consider changing the exam date and time for that particular student.

COPYRIGHT PROTECTED MATERIALS:
Point Loma Nazarene University, as a non-profit educational institution, is entitled by law to use materials protected by the US Copyright Act for classroom education. Any use of those materials outside the class may violate the law.

CREDIT HOURS:
In the interest of providing sufficient time to accomplish the stated course learning outcomes, this class meets the PLNU credit hour policy for a 2 unit class and 1 unit lab delivered over 15 weeks. Details about how the class meets the credit hour requirements can be provided upon request.

EXPECTED COURSE SCHEDULE BY Date:

LECTURE	TENTATIVE SCOPE (* not covered entirely in text)	TEXT SECTIONS	LAB	Probable Date
1	Digital vs Analog, Number Systems & Apps	Chapter 1		1/16
2	Digital Electronic Signals & Switches*	Chapter 2	Logic Simulator	1/21
3	Logic Gates (AND, OR, N-, XOR, XNOR)	Ch 3, 6.1-6.2		1/23
4	Programmable Logic Devices & Simulation*	4.1-4.5	Logic Gate Tests	1/28
5	Intro to HDL*	5.1-5.4		1/30
6	Boolean Algebra *	5.5-5.8	VHDL Intro	2/4
7	VHDL & MultiSim *			2/6
8	Boolean Reduction Techniques *	5.9-5.10	VHDL Boolean Circuits	2/11
9	Parity Comparators & VHDL Implementations*	6.3-6.5		2/13
	1st MIDTERM EXAM (lab period review)			2/18
10	MidTerm1 Recap & Arithmetic Circuits*	7.9-7.11		2/20
11	More Arithmetic Operations & Circuits *	7.1-7.8	VHDL Arithmetic Circuits	2/25
12	Mux/Demux & Decoders*	Chapter 8		2/27
13	Flip-Flops & Registers*	Chapter 10	Sequential VHDL Circuits	3/3
14	Synchronous Design & Debug*	11, 12.1-2		3/5
	SPRING BREAK	no class		3/10
		no class		3/12
15	Synchronous Design & Finite State Machines *	12.10-11	VHDL	3/17
16	Counters & more FSM *	12.2-12.9		3/19
17	Shift Registers & Correlators *	Chapter 13	VHDL FSM Circuits	3/24
18	Catch up & MidTerm Review			3/26
	2nd MIDTERM EXAM (including lab test)			3/31
19	Final Project Plan – Class Presentation/Critique			4/2
20	MidTerm2 recap – possible industry speaker		VHDL Correlator & Counter Circuits	4/7
	EASTER RECESS	no class		4/9
21	Clocks & Timers	Chapter 14	Final Project	4/14
22	Memory Concepts & Interfacing *	15, 16.1-16.5		4/16
23	Other Real World FPGA considerations *		Final Project	4/21

24	Catch Up/Projects			4/23
25	Final Project Presentations & Demos		Final Project	4/28
26	Review for Final			4/30
	Final			5/5