EET 121 Digital Systems 1

Course Description: A course on analyzing, designing, and troubleshooting digital logic circuits. Topics include: basic gates and PLDs, number systems and codes, Boolean algebra, circuit simplification, functions of logic circuits, latches, flip-flops, counters, timers, and memory.

Prerequisites(s): EET 131, MAT 121 (minimum grade C) or appropriate placement test score

Corequisite(s): No corequisite

Lecture Hours: 2	Lab Hours: 3	Credit Hours: 3
Lab Fee: 105	Supplemental Fee: 0	Purpose:
X Transfer Assurance Guide Course (TAG)	☐ Transfer Module Course (TM)	
Course Format: Lec/Lab	Grading: A/B/C/D/F/I	
Delivery Method: □ Web	□ Hybrid	x Classroom
Semesters Offered: x Fall	x Spring	x Summer

Course Primary Text:

Title: Digital Fundamentals	Edition: 11th
Author(s): Floyd, T. L.	
Publisher: Pearson/Prentice Hall (ISBN-13 978-0-13-273796-8)	

Supplemental Materials:

Digital/Analog Trainer RSR Electronics part no. 32CSTOHK1 or 01PAD234A
Obtain from the bookstore, or www.elexp.com

Course Outcomes:

1	The goal of this course is to introduce students to the field of computer engineering, in particular, the fundamentals of digital logic design.
2	Students will develop knowledge of the fundamentals of Boolean algebra, binary arithmetic, characteristics of logic gates, flip-flops, basic logic circuits, timing circuits, and programmable logic devices.
3	Students will develop an awareness of abstraction, computer organization, and software used for the simple digital circuit simulation. Lab work provides hands-on experience with digital systems.

Specific Student Outcomes

The primary student outcomes desired for this course listed by topic are:
Information and data Representation

- an ability to express numbers in decimal, binary, and hexadecimal formats
- an ability to represent characters with ASCII notation with and without parity
- an understanding of binary numbers

Computer Organization Introduction

- an understanding of hierarchical design principles
- an understanding of a generic microprocessor architecture

Computer Arithmetic

- an ability to perform binary arithmetic

Boolean Algebra

- an understanding of the basic operations and law of Boolean algebra
- an ability to construct a truth table for a Boolean expression
- an understanding of the minterms and maxterms of a Boolean algebraic expression

Combinational Logic

- an ability to implement a Boolean algebraic expression with digital logic gates
- an understanding of digital logic

Sequential Logic

- an ability to construct a timing diagram for a digital system
- an ability to implement basic synchronous sequential circuits with flip-flops
- an ability to derive the state table diagram from a sequential circuits

Digital Devices

- an understanding of the operation of logic gates
- an understanding of the operation of SR, T, JK, and D flip-flops
- an understanding of the operation of counters and registers
- an understanding of the operation of multiplexers, decoders and ROM
- an understanding of the use of programmable logic devices
- an understanding of the operation of timing circuits

Software Introduction

- a knowledge of the basic circuit simulation software

121 Lab

- an ability to experimentally validate a theoretical property
- a knowledge of IC pin numbering
- an ability to coordinate circuit simulation with hardware results

Course Topics:

	Course Material	Text	*Lab*
Week 1	Digital Concepts, Binary numbers, Basic Gates	Chapter 1,3	*Introduction to Digital Trainer and MultiSim*
Week 2	Symbols, Boolean Equations, Truth Tables	Chapter 3	*Basic gates*
Week 3	Eqs to Truth table, SOP to Truth tables	Chapter 3	*Circuit from rough schematic*
Week 4	Boolean simplification, DeMorgan's Theorem	Chapter 4	*Circuit form boolean equation*
Week 5	**Exam 1**		*Circuit from written instruction (panic light)*
Week 6	Karnough Maps I	Chapter 4	*Circuit building lab test*
Week 7	Karnough Maps II	Chapter 4	*PLD circuit operation and programming (Chapter 11)*
Week 8	Binary, Hex, BCD, Adders and Math functions	Chapter 2	*Circuit from written instructions (burgler alarm)*
Week 9	MUX/DMUX, Decodes/Encoders	Chapter 6	*Circuit from written instructions (pH mixing tank)*
Week 10	**Exam 2**		*Circuit from written instructions (Flow meter readout)*
Week 11	SR, D latches Edge triggering SR, D, JK Flip Flops	Chapter 7	*Gated D Latch and D Flip Flop*
Week 12	Counters 1	Chapter 7,8	*Flip Flop frequency divider*
Week 13	Counters 2	Chapter 7,10	*Binary and Pseudo-Random Counters*
Week 14	Shift Registers	Chapter 9	*Shift Registers*
Week 15	Review **Final Exam**		*Lab Final*

Methods of Evaluation/Assessment

Grading

The percentage weight of various evaluation components used in this course is given below:

CLASS WORK (70%)
Homework (15%)
Online Quizzes (15%)
Midterms (20% each)
Final Examination (30%)

LAB WORK (30%)
Attendance/Timeliness/Preparedness (20%)
Lab Performance/Results (40%)
Lab Report (40%)

93-100	A	72-76	C
90-92	A-	69-71	C-
87-89	B+	67-68	D+
82-86	B	62-66	D
80-81	B-	59-61	D-
77-79	C+	0-58	F

The above grade levels are assured, however, the actual grading for this course depends on actual performance of the class. In other words, an A could begin at 85, depending on the average scores of the class on all material.

Assignments

Quizzes and Exams

We will have three exams (two Midterms and one Final) in this course to give you the opportunity to show that you have mastered the knowledge and skills addressed. Two midterm exams have the same weight and cover roughly two halves of the course work, while the final exam is based on all class works including the lab modules. Quizzes for this class will be online and cover both lab and course material. Quizzes will be timed and due before the beginning of the Friday class.

Homework Exercises

Exercises will be assigned weekly throughout the term to assist you in mastering the basic course concepts. Homework will be due each Friday at the end of class. Unless you have a prior agreement with the professor, any homework turned in after the due date will be downgraded by 25% for the first 3 days (the following Wednesday usually). After that, it will not be accepted. It is strongly encouraged that any student having difficulty with homework assignments come to office hours or email the instructor with questions.

Labs and Lab Reports

Students are required to attain a digital/analog trainer by the 2nd lab of the course (2nd week of classes). All students will be working independently during the lab session. Prior to each session (except for the 1st meeting), lab materials will be posted on Blackboard. It is the responsibility of the student to print the lab handout and review the material prior to coming to lab. Most of the labs for this course also require exercises and/or calculations to be done prior to the lab meeting and all students must come to the lab prepared, which is graded. Students are also strongly encouraged to set up circuits on their digital trainers prior to the lab session as well as perform necessary circuit simulations. Students are required to submit a lab report for every lab performed which is due by the beginning of the next lab session. The format of these reports will be discussed at the first lab session.

Attendance

Due to the participatory nature of this course, attendance in class activities will be required. Exceptions to this will be noted; however attendance for class will not be taken. If you will need to miss class for some reason, you should contact Prof. Whaley in advance to determine the consequences of missing class. If you need to miss a lab session for any reason, you must contact Prof. Whaley in advance and make arrangements to make up the lab before the next lab session; otherwise, you will receive no credit for the lab.

Academic Honesty

Instances of academic dishonesty could result in an "F" for the course and a referral to the Cincinnati State judiciaries that may impose additional sanctions if warranted. Academic dishonesty includes, but is not limited to, the following examples: permitting another student to plagiarize or cheat from your work (Cheating implies dishonesty or deception in fulfilling academic requirements. Plagiarism involves the presentation of some other person's work as if it were the work of the presenter.), submitting an academic exercise (written work, printing, sculpture, computer program) that has been prepared totally or in part by another, acquiring improper knowledge of the contents of an exam, using unauthorized material during an exam, submitting the same paper in two different courses without knowledge and consent of professors, or submitting any forged documentation.

Collaboration

Students are encouraged to work together on homework assignments; however, submitting work that is not one's own is considered academic dishonesty and also teaches you nothing. If you are having any problems with any material in the class, please see Professor Whaley or contact him by phone or email.

Classroom Privacy

While it is sometimes desirable for classroom practices to be observed for the purpose of improvement of pedagogy, and such observation is sometimes required for annual faculty evaluation and for tenure and/or promotion evaluation, faculty are entitled to classroom privacy, academic freedom, and professional courtesy. Consequently, observation and evaluation of any classroom by any observer or evaluator requires the prior notification and mutual agreement of the class instructor and the observer or evaluator. Furthermore, recording of classroom activities by any electronic means, by students, other faculty, university administrators, or others, requires permission of the instructor. All students in a class must be informed if permission has been given for a class to be recorded. Under no circumstances may verbatim recording of copyrighted classroom lectures and materials by electronic or any other means (including note taking) be conducted for 1) sale, whether or not it is for educational benefit, or 2) for the educational benefit of those not enrolled in the class. This does not apply to non-verbatim notes taken by students.

Disabilities Policy

Any student with a disability necessitating accommodations prescribed by the Americans with Disabilities Act must meet with a Special Needs Counselor (Room Main 129) prior to participating in classroom or laboratory activities. The Special Needs Counselor must determine your accommodation requirements. They may be contacted at 569-1775.

Course Keeper: Ralph Whaley

Date Completed: April 19, 2019