



ELEC 204 Digital Design

Spring 2021

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Week 1



ELEC 204: Digital Design

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elec204-group@ku.edu.tr: For all general questions in ELEC 204 regarding homeworks, PS sessions, exam grades etc.



ELEC 204

Course Objectives:

- ELEC 204 is a course targeting electrical and computer engineering students to **build the fundamental digital design and experimentation concepts.**
- In this course we will study
 - Combinational logic circuit design techniques, sequential logic circuits, registers and counters, memory, and state machines.
- In parallel to lectures we will develop experimental skills studying various digital design techniques during our laboratory hours.
 - Our experimental setup will be based on Field Programmable Gate Array (FPGA) structure, and we'll experience various design tools.

*“Computers are incredibly fast, accurate and stupid.
Human beings are incredibly slow, inaccurate and brilliant.
Together they are powerful beyond imagination.” Albert Einstein*



ELEC 204

Teaching Methods

- Used to be:
 - In-class teaching and laboratory work go in parallel through-out the semester.
- Now:
 - Online teaching and laboratory work go in parallel through-out the semester.
 - Online Lectures: Fundamentals of digital design techniques, combinational and sequential circuits, design of registers, counters, memory, data-path, etc.
 - Online Laboratory: Digital design with VHDL by Cengiz Onbaşı
- Textbook: M.M. Mano and M. D. Ciletti, Digital Design with an Introduction to the Verilog HDL, VHDL, and SystemVerilog, 6th Edition, Pearson.
- Reference Book: Thomas L. Floyd, Digital Fundamentals, 11th Edition, Pearson.



ELEC 204: Assessment

Type	Description	Final Grade %
Lecture Part	Letter graded separately.	3 credits
Homeworks	To test the students' knowledge after each lecture.	10
Midterm Exam	There will be two midterm exams covering relevant topics.	50
Final Exam	Lecture Part: Assessment of students' knowledge and comprehension on the digital design concepts.	40
Lecture Total		100
Lab Part	Letter graded separately.	1 credit
Lab	Bi-weekly lab assignments. Laboratory work delivers hands-on experience and experimentation of the in-class material. Students are expected to construct working embedded systems with the recent in-class material.	50
Project	Lab Project: Students are expected to design and construct a real, working digital system as a term project (demo, instructor interview and project source code/demo video and report submission).	50
Lab Total		100

Final Grading:

- The lecture and lab letter grades will be combined (3 credits for the lecture and 1 credit for the lab) for the final letter grade.
- A passing final letter grade requires passing grades from both the lecture and lab parts.
- A working project is necessary for a passing lab grade.



ELEC 204: Semester Plan

Week	LECTURE Mo 17:30-18:45	LECTURE We 17:30-18:45	LAB Fr 14:00-17:50	PS Mo 19:00-19:50
1	Feb 15	Feb 17	Lab Tutorial	Lab Q&A
2	Feb 22	Feb 24	Lab Tutorial	
3	Mar 1	Mar 3	Lab1	PS - R
4	Mar 8	Mar 10	Lab Tutorial	
5	Mar 15	Mar 17	Lab2	PS - F
6	Mar 22	Mar 24	Lab3	
7	Mar 29	Mar 31	Lab3	PS - Y
8	Apr 12	Apr 14	Lab Tutorial	
9	Apr 19	Apr 21	Lab4	PS - Y
10	Apr 26	Apr 28	Lab4	
11	May 3	May 5	Lab Tutorial	PS - F
12	May 10	May 12	Lab5	
13	May 17	May 19	Lab5	PS- R
14	May 24	May 26	Lab Project Interviews	



Honor Code for the Online Exams

You will be expected to state and sign the following Honor Code for all online exams.

“I hereby certify that I have completed this exam on my own without any help from anyone else.

I understand that the only sources of authorized information in this open-book exam are

- (i) the course textbook, and
- (ii) the lecture notes self-taken or distributed by the instructor at Blackboard for this class.

I have not used, accessed, received or distributed any information from/to any other unauthorized source in taking this exam.

The effort in the exam thus belongs completely to me.”



Course Targets

- What is Digital and Why Digital?
- Number Representations in Binary Forms
- Basic Digital System Components: Gates
- Simple Digital Systems: Combinational Systems (No Memory!)
- Complex Digital Systems: Sequential Systems (With Memory!)



Course Plan

Week	Topics (Tentative)
Week 1	Course Regulations; Introductory Concepts, Digital and Analog Quantities, Binary Digits, Logic Levels, Digital Waveforms, Basic Logic Functions, Introduction to Programmable Logic
Week 2	Binary Numbers, Number-base Conversions, Octal and Hexadecimal Numbers, Complements
Week 3	Signed Binary Numbers, Binary Codes, Binary Storage and Registers, Binary Logic
Week 4	Boolean Algebra and Logic Gates, Basic Theorems and Properties of Boolean Algebra, Boolean Functions
Week 5	Canonical and Standard Forms, Digital Logic Gates, Integrated Circuits
Week 6	The Map Method, Product of Sums Simplifications, Don't-Care Conditions
Week 7	NAND & NOR Implementations, XOR Func. + <u>MIDTERM EXAM I (04 April)</u>
Week 8	Combinational Circuits, Analysis and Design Procedures, Binary Adder-Subtractor
Week 9	Decimal Adder, Binary Multiplier, Decoders, Encoders, Multiplexers
Week 10	Sequential Circuits, Latches, Flip-Flops
Week 11	Analysis of Clocked Sequential Circuits, State Reduction and Assignment, Design Procedures
Week 12	Registers, Shift Registers, Ripple Counters, Synchronous Counters
Week 13	Memory and Programmable Logic, Random-Access Memory, Error Det. & Correction + <u>MIDTERM EXAM II (22 May)</u>
Week 14	Read-Only Memory, Programmable Logic Array, Programmable Array Logic