

Identification	Subject	ETR320 – Digital Electronics - 6 ECTS credits
	Department	Physics and Electronics
	Program (Undergraduate, Graduate)	Undergraduate
	Term	Fall 2026
	Instructor	Nijat Hajiyev
	Email:	hajiyevnijat@gmail.com
	Classroom/hours	11 Mehseti str. (Neftchilar campus), Monday and Friday, 08:30-18:40
Prerequisites	ETR 231- Analog Electronics	
Language	English	
Compulsory/Elective	Compulsory	
Textbooks and course materials	Textbooks: 1. Digital Fundamentals - Thomas L. Floyd, Eleventh Edition, 2015 2. Shustov, M. A., & Shustov, A. M. (2026). Digital Electronics: The Basics, New Ideas & Applications. Elektor. 3. Harris, S. L., & Harris, D. (2021). Digital Design and Computer Architecture: ARM Edition. Morgan Kaufmann. 4. Kleitz, W. (2022). Digital Electronics: A Practical Approach with VHDL (9th ed.). Pearson.	
Course description	This course provides a comprehensive introduction to the fundamental concepts, principles, and techniques of digital electronics, based on Thomas L. Floyd's widely recognized textbook. Students will explore the transition from analog to digital systems, starting with number systems, operations, and binary codes. The curriculum covers core topics including basic logic gates, Boolean algebra, logic simplification using Karnaugh maps, and the design and analysis of combinational and sequential logic circuits. Special emphasis is placed on practical components such as adders, multiplexers, flip-flops, counters, shift registers, and an introduction to memory systems and programmable logic devices (PLDs). The course bridges theoretical foundations with hardware applications, preparing students for advanced studies in embedded systems, computer engineering, and electronics design.	
Course objectives	1. Understand the fundamental differences between analog and digital systems, along with standard number systems, conversions, and binary codes. 2. Master Boolean algebra laws, theorems, and Karnaugh map simplification techniques to optimize logic expressions. 3. Comprise the operational principles and electrical characteristics of basic and universal logic gates. 4. Analyze and design combinational logic functions such as adders, comparators, decoders, encoders, and multiplexers. 5. Explore sequential logic circuits, including various flip-flop types, counters, shift registers, and basic timing/clock circuits.	
Learning Outcomes	1. Employ simple logic gates and integrated circuits to build functional digital blocks in hardware or simulation environments.. 2. Analyze combinational logic circuits to determine their truth tables, Boolean expressions, and logical behavior.	

	3. Design optimized combinatorial networks and state machines for specific arithmetic and control tasks.. 4. Implement sequential elements (latches, flip-flops, counters, and registers) for data storage, synchronization, and frequency division. 5. Troubleshoot common hardware faults and logic errors in basic digital circuits using systematic diagnostic techniques.		
Teaching methods	Lecture		☒
	Classroom exercises		☒
	Laboratory projects		☒
	Quiz		☒
	Taking notes on a copybook		☒
	Homework exercises		☒
Evaluation Criteria	Methods	Date/deadlines	Percentage (%)
	Midterm Exam	TBA	30
	Quiz	After the midterm	5
	Homework	At each lesson	5
	Final Project	After the midterm	15
	Activity	At each lesson	5
	Final Exam	TBA	40
	Total		100
Class Policy	▪ Preparation for class The structure of this course makes your individual study and preparation outside the class extremely important. The lecture material will focus on the major points introduced in the text. You must have a copybook and take notes at each lesson. Reading the assigned chapters and having some familiarity with them before class will greatly assist your understanding of the lecture. After the lecture, you should study your notes and work relevant problems and cases from the end of the chapter and sample exam questions. Also, you must explore additionally and try to make circuits on your own after the lessons. Before using the laboratory at additional times, please inform faculty or department staff. • Withdrawal (pass/fail) This course strictly follows grading policy of the School of Science and Engineering. Thus, a student is normally expected to achieve a mark of at least 60% to pass. In case of failure, he/she will be required to repeat the course the following term or year. • Cheating/plagiarism Cheating or other plagiarism during the Quiz, Mid-term and Final Examinations will lead to paper cancellation. In this case, the student will automatically get zero (0), without any considerations. • Professional behavior guidelines The students shall behave in the way to create favorable academic and professional environment during the class hours. Unauthorized discussions and unethical behavior are strictly prohibited. • Quiz There will be a quiz after the midterm. The quiz will be announced in the classroom two weeks before and will relate to homeworks. Students will get maximum 5 marks in a quiz. • Activity		

	Students who will be active during classroom exercises, laboratory tasks and answering questions in the classroom will get 5 marks at each lesson. All students marks will be recorded in teacher's personal copybook and average mark will be calculated according to all marks at the end of semester. Final project Students should make a circuit on the breadboard, calculate and measure all parameters. When they get proper results they should note all measured parameters and the circuit on their copybook. Final project should be prepared during out of lessons. But students can ask any questions to the teacher with email or whatsapp. Final project can be made by a student or a group. Maximum 3 students can be grouped. The final project topic will be chosen by students or teacher during the semester. Homework Homework will be issued in lectures and collected a week later in recitation. You are welcome and encouraged to discuss the homework among your colleagues. However, the final formulation and write up of your homework answers must be your own. More importantly, although homework counts for only 5 percent of the grade, they are critical to learning the material and to doing well on the quizzes and final exam. Rulings on using Generative AI Within this course, artificial intelligence tools can be used to support the learning process, brainstorm ideas, structure data, and assist with language editing. However, the core content, scientific analysis, and results of assignments must be independently prepared by the student. The use of AI tools is strictly prohibited during quiz, midterm and final exams. Students who use AI must appropriately cite its usage. Students must design, draw, and perform the calculations for circuits entirely by themselves. However, they are permitted to use AI for assistance with tasks such as calculating resistor color codes or looking up IC pinouts. The main rule is to use AI strictly as an auxiliary helper.
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Tentative Schedule

Week	Date/Day (tentative)	Topics	Textbook/Assignments
1		Introduction to Digital Logic and Electronics.	[1] p15
2		Number Systems, Operations, and Codes	[1] p65
3		Logic Gates	[1] p125
4		Boolean Algebra and Logic Simplification	[1] p191
5		Combinational Logic Analysis, Karnaugh map method	[1] p219-261
6		Functions of Combinational Logic	[1] p313
7		Calculating and making lab. projects on comb. Logic Gates	
		Midterm exam	
8		Latches, Flip-Flops, and Timers	[1] p387
9		Shift Registers	[1] p449
10		Counters	[1] p497
11		Quiz	
12		Data Storage methods, RAM, ROM	[1] p627

13		Revising past lessons for the final projects	
14		Building experimental circuits for the final projects	
15		Final Project	
		Final exam	

