Identification	**Subject (Code, title, credits)**	ETR320 – Digital Electronics - 6 ECTS credits
	Department	Physics and Electronics
	Program	Undergraduate
	Term	Fall 2024
	Instructor	MSc, MIET, Alim Huseynov
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	Phone:	+99455 425 3599
	Classroom/hours	11 Mehseti str. (Neftchilar campus)
	Office hours	Monday-Friday, from 9:00 to 18:00
Prerequisites	-	
Language	English	
Compulsory/Elective	Elective	
Required textbooks andcourse materials	Textbooks: 1. Digital Fundamentals - Thomas L. Floyd, Eleventh Edition, 2015 2. Digital Electronics, Principles, Devices and Applications - Anil K.Maini, 2007 3. Modern Digital Electronics - R.P.Jain, 2010	
Course outline	The Digital Electronics course begins with an introduction to the basic concepts of digital logic and electronics, distinguishing between analog and digital systems and highlighting the significance and applications of digital circuits in modern technology. Next, students will explore number systems, operations, and codes, including binary, octal, and hexadecimal systems, learning to convert between them and perform arithmetic operations. The course will cover essential binary codes such as BCD, Gray code, and ASCII. Following this, the course dives into logic gates, introducing students to fundamental gates like AND, OR, NOT, NAND, NOR, XOR, and XNOR, as well as their truth tables and Boolean expressions. Boolean algebra and logic simplification techniques, including De Morgan's laws, Karnaugh Maps, and the Quine-McCluskey method, will be discussed to teach circuit simplification methods. In the section on combinational logic, students will analyze and design circuits such as multiplexers, demultiplexers, encoders, decoders, and arithmetic circuits like half adders and full adders. The course then progresses to combinational logic applications, addressing arithmetic and data processing functions, comparators, and parity generators. Sequential logic is introduced through a study of latches, flip-flops (SR, JK, D, T), and timers, including their timing diagrams and real-world applications. Students will learn about shift registers, focusing on various types (SIPO, PISO, PIPO, SISO) and their applications, followed by an exploration of counters (asynchronous, synchronous, up/down, and modulus) and their role in timing and control systems. The course also includes an in-depth study of programmable logic devices, such as PLDs, FPGAs, CPLDs, and programmable logic arrays (PLA), with an emphasis on designing and implementing programmable circuits. Data storage will cover different memory types like RAM, ROM, and EEPROM, along with memory addressing techniques. Signal conversion and processing topics will introduce students to analog-to-digital (ADC) and digital-to-analog converters (DAC), the Nyquist theorem, and key concepts in digital signal processing. The course will also cover data transmission methods, examining serial and parallel transmission, communication protocols, and error detection/correction methods. Lastly, the course will focus on data processing and control systems using microprocessors and microcontrollers, preparing students for applications in automation and communication. The course concludes with an overview of integrated circuit technologies, examining the evolution of ICs from SSI to VLSI and exploring future trends in digital electronics.	
Course objectives	• Provide a solid foundation in the fundamental principles of digital logic and electronics. • Enable students to understand and analyze digital systems using Boolean algebra, logic gates, and combinational logic circuits. • Equip students with the skills to design, implement, and troubleshoot sequential logic circuits such as flip-flops, counters, and shift registers. • Introduce students to programmable logic devices and integrated circuits technologies, preparing them for real-world applications. • Familiarize students with digital data processing, transmission, and storage concepts. • Develop practical skills in the application of digital systems for signal conversion, control, and automation.	
Learning outcomes	• Demonstrate a deep understanding of the difference between analog and digital systems and apply this knowledge in real-world applications. • Perform binary arithmetic, conversions, and operations using various number	

	systems and codes. • Analyze and simplify digital circuits using Boolean algebra and logic minimization techniques like Karnaugh Maps. • Design and implement combinational logic circuits such as adders, multiplexers, and encoders. • Construct and troubleshoot sequential circuits using flip-flops, latches, shift registers, and counters. • Explain the operation and applications of programmable logic devices and integrated circuits. • Describe the principles of data transmission, storage, and digital signal conversion. • Apply knowledge of digital electronics in the design of microcontroller-based systems for data processing and control.		
Teaching methods	**Lecture**		☑
	Group discussion		☑
	Experiential exercise		☑
	Case analysis		☐
	Quiz, Classroom Exams		☑
	Course paper		☐
	Others		☑
Evaluation	**Methods**	**Date/deadlines**	**Percentage (%)**
	Midterm Exam		30
	Attendance	At each lesson	5
	Quiz	During the semester	15
	Activity	During the semester	10
	Final Exam		40
	Total		100

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 pointsintroduced in the text. Reading the assigned chapters and having some familiaritywith them before class will greatly assist your understanding of the lecture. Afterthe lecture, you should study your notes and work relevant problems and cases from the end of the chapter and sample exam questions. • **Withdrawal (pass/fail)** This course strictly follows grading policy of the School of Humanities, Education and Social sciences. 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 thefollowing term or year. ▪ **Cheating/plagiarism** Cheating or other plagiarism during the Quizzes, 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. **Attendance** Students who attend the whole classes will get 5 marks. for three absence student loses 1 mark. • **Quizzes** There will be a quizzes per two weeks. The quizzes will be announced in the classroom two weeks before and will relate to homework. • **Activity** Students who will be active during discussion of past lessons will be awarded with one activity mark.

Tentative Schedule			
Weeks	Date/Day	Topics	Reference to textbooks
1.	18-09-24	Introduction to Digital Logic and Electronics. Conduction of oral and written survey. Problem solving	[1] p15 [3] p1
2.	25-09-24	Number Systems, Operations, and Codes Conduction of oral and written survey. Problem solving	[1] p65 [2] p23 and p41 [3] p28
3.	02-10-24	Logic Gates Conduction of oral and written survey. Problem solving	[1] p125 [2] p90
4.	09-10-24	Boolean Algebra and Logic Simplification Quiz 1 - Lecture 1 – Lecture 3	[1] p191 [2] p209
5.	16-10-24	Combinational Logic Analysis Conduction of oral and written survey. Problem solving	[1] p261 [2] p252 [3] p165
6.	23-10-24	Functions of Combinational Logic Conduction of oral and written survey. Problem solving	[1] p313 [2] p288 [3] p231
7.	30-10-24	Latches, Flip-Flops, and Timers Quiz 2 - Lecture 4 – Lecture 6	[1] p387 [2] p375 [3] p279
8.	06-11-24	Mid term exam.	
9.	13-11-24	Shift Registers Conduction of oral and written survey. Problem solving	[1] p449 [2] p429 [3] p312
10.	20-11-24	Counters Conduction of oral and written survey. Problem solving	[1] p497 [2] p429 [3] p312
11.	27-11-24	Programmable Logic Quiz 3 - Lecture 7 – Lecture 10	[1] p561 [3] p522
12.	04-12-24	Data Storage Conduction of oral and written survey. Problem solving	[1] p627 [3] p463
13.	11-12-24	Signal Conversion and Processing Conduction of oral and written survey. Problem solving	[1] p697 [2] p491 [3] p429
14.	18-12-24	Data Transmission Conduction of oral and written survey. Problem solving	[1] p739
15.	25-12-24	Data Processing and Control, Integrated Circuit Technologies Quiz 4 - Lecture 11 – Lecture 14	[1] p801 [3] p577
	TBC	Final exam	

This syllabus is a guide for the course and any modifications to it will be announced in advance.