

General information	Title and code of subject, number of credits	ETR 520 Microcontroller Electronic Devices and Systems 8 ECTS	
	Department	Physics and electronics	
	Program	Master	
	Academic semester	2023 fall	
	Lecturer	Doctor of philosophy (PhD) in Physics & Mathematics Shahmerdan Sh. Amirov	
	E-mail:	<a href="mailto:phys_med@mail.ru">phys_med@mail.ru</a>	
	Phone number:		
	Lecture room/Schedule	11 Mehseti Street, AZ1096 Baku, Azerbaijan (Neftchilar campus), room Lectures: Seminars:	
	Consultations		
Course language	English		
Type of the subject	Major		
Textbooks and additional materials	Textbooks: 1. S. Vijayarghavan Microprocessors and microcontrollers 2. D.A.Patterson and J.H.Hennessy ‘ Computer organization and design. Hardware and software interface. ‘Morgan Kaufmann Publishers 2011. 2. M.A.Mazidi, J.G.Mazidi, Rolin Mckinaly “ The 8051 Microcontroller and Embedded Systems: Using Assebly and C “ Pearson Education 2011/ 3. Sh.Sh. Amirov Lecure materials 4. R.M. Hajiyev Theoretical bases of electrical circuits 2011		
Teaching methods	Lecture		15
	Group discussions at seminars		15
Assessment	Components	Date/ Deadline	Percent (%)
	Quizzes	During the semester	10
	Active participation	At each lesson	5
	Presentations	At the end of the semester	10
	Attendance	During the semester	5
	Midterm exam		30
	Final exam		40
	Final		100
Course description	<p>The course of “Microcontrollers and microcontroller systems” taught by the masters of electronic engineering discipline provides following knowledge’s: To study how to calculate elements of microprocessors. This course introduces binary system. Rules of binary addition and Subtraction. Binary multiplication and division. Introduction. Definition.</p> <p>Students also study the classification of microcontroller functions and parts. They should be familiar with the programs for management of microcontrollers and their system Types of microcontrollers (bit-size based categorization, memory –based categorization, external memory microcontroller instruction-set based categorization, PIC, AVR and AMR microcontrollers.</p> <p>During the semester students are to be familiar with the different peripheral parts of modern electronic computers and their own microcontrollers.</p> <p>Microcontroller architecture (CPU-Controller’s processor unit, I/O-input-output unit, memory, timer counter ADC-analog to digital converter, DAC-digital to analog converter )</p>		
Course objectives	The main objective of this course is to enable students to develop a basic familiarity with all the major electronic techniques in particular microcontrollers and microprocessors, a study decimal ,binary,octal etc number systems and arithmetic operations (addition,subtraction,multiplication and division) with them.		
Learning outcomes	<p>What students should know by the end of the course:</p> <ul style="list-style-type: none"> <li>*Explain briefly the microcontroller based system using block-diagram.</li> <li>* list the types of microcontroller and examples of embedded microcontroller /embedded system.</li> <li>*describe feature and internal structure of a microcontroller PIC 16 F 877A</li> <li>* describe how an instruction is executed. .</li> </ul>		
Rules (Educational	<ul style="list-style-type: none"> <li>• <b>Lesson organization</b></li> </ul> <p>General information on the subject will be provided for the students during lectures.</p>		

policy and behavior)	<p>Student's knowledge on the previous topics will be evaluated and new topic will be explained by means of visual aids during seminars. Student's knowledge level will be tested orally and in written forms before midterm and final exams. Submission of the individual works by the end of course is obligatory.</p> <ul style="list-style-type: none"> <li>• <b>Effectiveness (pass/fail)</b> This course strictly follows the assessment policy conducted by the subject teaching faculty. Hence a student must score at least 60% to pass the course normally. In case of failure he will be forced to repeat the course in the next term or year.</li> <li>• <b>Plagiarism</b> Cheating or other forms of plagiarism during review surveys, midterms and final exams will result in disqualification. In this case a student will automatically receive zero "0" without further discussion.</li> <li>• <b>Professional conduct directives</b> Students will behave professionally during class hours to create a conducive academic environment. Off course discussions and unethical behavior are strictly prohibited.</li> <li>• <b>Attendance</b> Participation of students at all classes is important. Students should inform dean's office about missing lessons for particular reasons (illness, family issues and etc.). Students, missing more than 25% of lessons, are not allowed to take the exam.</li> <li>• <b>Quizzes.</b> Quizzes will be four times during semester. The time of quizzes will be announced in the classroom three weeks before. The quizzes will be related to the homework material.</li> <li>• <b>Presentations</b> Students will submit their presentations at the end of the semester and will be graded out of 10. Topics will be given by the teacher, the main requirement for the presentation should be research oriented.</li> <li>• <b>Activity</b> Students who are active in all seminar classes will be evaluated with 5 points, those who are active in 60% of seminars will be evaluated with 3 points.</li> </ul>
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This program reflects the comprehensive information about the subject and information about any changes will be provided in advance.

Week	Dates (planned)	Subject topics	Textbook/ Assignments
1	12.09.23	Lecture №1 Binary system. Rules of binary addition and Subtraction. Binary multiplication and division. (Khazar-Digital Electronics p.47)	[1] p. 4-28 [3]
		Seminar №1 Practices and problem solving on the topic.	[1] p.2-2
2	19.09.23	Lecture №2. Binary- to decimal conversion. Decimal to binary conversion.	[1] p.30-80 [3]
		Seminar №2: Practices and problem solving on the topic	[1] p.
3	26.09.23	Lecture №3. Introduction. Definition. Types of microcontrollers (bit-size based categorization, memory –based categorization, external memory microcontroller instruction-set based categorization, PIC, AVR and AMR microcontrollers. Khazar-MCU-3	[1] p.82-127 [3]
		<b>Seminar №3:</b> Practices and problem solving on the topic	[1] p.
4	03.10.23	Lecture №4 Microcontroller architecture (CPU-Controller's processor unit, I/O-input-output unit, memory, timer counter ADC-analog to digital converter, DAC-digital to analog converter ) (Khazar-MCU-3)	[1] p. 128-174 [3]
		<b>Seminar №4:</b> Practices and problem solving on the topic	[3] p.
5	10.10.23	Lecture №5. Diagrammatic representation for the microcontroller. Advantages and disadvantages of microcontrollers. (Khazar-MCU-3	[1] p.175-215 [3]
		<b>Seminar №5:</b> Practices and problem solving on the topic	[1] p.

6	17.10.23	Lecture №6. Introduction to Microprocessor and Microcomputer Architecture	[1] p.216-252 [3]
		Seminar №6: . Practices and problem solving on the topic	[1] p.
7	24.10.23	<b>Lecture №7.</b> 8051 Microcontroller Applications; Block Diagram, features Embedded Systems Interfacing with 8051(Relay, PWM Generator, DC Motor and Stepper Motor) (Khazar –MCU-2)	[1] p.370-411 [3]
		<b>Seminar №7:</b> Practices and problem solving on the topic	[1] p.
8	31.10.23	Lecture №8. Embedded system. Examples to embedded system (Consumer electronic DVD player, hi-fi, TV, air-conditioner, washing machine , medical monitoring devices EKG, blood pump, blood pressure meter, security system alarm, remote surveillance, smart card reader, personal computing keyboard, printer, USB hub, automotive ignition control, ABS(anti-lock brake system, automatic transmission, communications handphone, modem, radio, radar, satellite etc.	[1] p.613-647 [3]
		<b>Seminar №8:</b> Practices and problem solving on the topic	[1] p.
9	07.11.23	Mid term exam	
10	14.11.23	Lecture №9. Microcontroller vs. Microprocessor. Input and output devices (sensors). Provision interface hardware from software. Memory mapped I/O.	[1] p.2-2 [3]
		<b>Seminar №9</b> Practices and problem solving on the topic	[1] p.
11	21.11.23	Lecture №10. Microcontroller 8051 family (8048, 8049, 8050). Memory mapping of microcontroller 8051. Advantages of microcontroller over microprocessor.	[2] p. [3]
		<b>Seminar №10:</b> . Practices and problem solving on the topic	[2] p.
12	28.11.23	Lecture №11. Integrated Circuit. Central Processing Unit. Graphics processing units.	[2] p.
		<b>Seminar №11:</b> Practices and problem solving on the topic	
13	05.12.23	Lecture №12. Arithmetic-logic unit. Processor registers. Fetching, decoding, execution.	[2] p
		<b>Seminar №12:</b> Practices and problem solving on the topic	[2] p.
14	12.12.23	Lecture №13. Electric circuit. Main and virtual Memory. Flash memory .Multi-level cell. ROM,PROM, EPROM and EEPROM	[2] p.
		<b>Seminar №13:</b> <i>Practices and problem solving on the topic</i>	[2] p.
15	19.12.23	Lecture №14. Power Analysis. Instantaneous and average power. Power in circuits. Power factor. Active reactive power. Maximum power transformation.	[2] p.
		<b>Seminar №14</b> <i>Practices and problem solving on the topic</i>	[2] p.
16		Lecture №15. Input-Output channels. Hardware. Operating System Peripheral equipment.	[2] p.
		<b>Seminar №15:</b> . <i>Practices and problem solving on the topic</i>	[2] p.
		<b>Final Exam</b>	