S Y L L A B U S

General information	**Title and code of subject, number of credits**	EENG 211 Circuit Theory 6 ECTS	
	Department	Physics and Electronics	
	Program	Bachelor	
	Academic semester	2023 spring	
	Lecturer	Doctor of philosophy (PhD) in Physics & Mathematics Shahmerdan Sh. Amirov	
	E-mail:	phys_med@mail.ru	
	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. Charles K. Alexander, Mattew N.O.Sadiku Fundamentals of circuit theory** **2. R Akhmedov Circuits Theory** **3. Sh.Sh. Amirov Lecure materials** **4. R.M. Hajiyev Theoretical bases of electrical circuits 2011** **Auxiliary Web sources:** https://www.youtube.com/watch?v=BgvRi0Jl43g https://www.youtube.com/watch?v=VJfIbBDR3e8&list=PL5351D9CFF725FA6A https://www.youtube.com/watch?v=dEdR4iOdLh0&list=PL5DUVGfj6BJa4THJwSN8wJljvkHvInrMq https://www.youtube.com/watch?v=4ZoKGFLg0HQ https://www.youtube.com/watch?v=Gv0VMx25_Dk https://www.youtube.com/watch?v=9SUHgtREWQc https://www.youtube.com/watch ?v=Ok9ILIYzmaY https://www.youtube.com/watch?v=v38-I58H2Uc&list=PLc1hOdhp9OEF-PbWusarZmubWggC_zp3K		
Teaching methods	**Lecture**		15
	Group discussions at seminars		15
Assessment	**Components**	**Date/ Deadline**	**Percent (%)**
	Tests	During the semester	10
	Active participation	At each lesson	5
	Individual research papers and presentations	At the end of the semester	10
	Attendance	During the semester	5
	Midterm exam		30
	Final exam		40
	Final		**100**
Course description	The course of "Circuit Theory" taught by the students of electronic engineerin discipline provides following knowledge's: Introduction. Electric Charge and Electric Current. Voltage. Electric Power and Energy Inductance. Voltage and Current Sources. Basic laws. Ohm's Law. Short and open circuits. Resistance and conductance. Nodes, Branches and Loops. Fundamental theorem of network topology. KCL and KVL. Series resistors and voltage division. Parallel resistors and current division. Wye-Delta transformations. Capacitors. Series and parallel capacitors. Inductors. Series and parallel inductors. Integrator. Differentiator. First order circuits. The source-free RC circuit. The source-free RL circuit. Step response of an RC circuit AC Circuit Concepts. Sinusoidal voltage and Current in Passive elements. Inductive and Capacitive Reactances and Susceptances, Impedance and Admittance. Impedance combinations. Ohm`s and Kirchoff`s Laws for AC Circuits. Phasor relationships for Circuit Elements		
Course objectives	**Course objectives for the Students:** • Develop a high level of understanding of the fundamental principles of DC and AC current Systems. Develop basic laboratory skills demonstrating the application of physical principles.		

	• Work cooperatively to facilitate a collegial atmosphere conducive to learning for all students in the class. • Prepare for and attend each class by reading the assigned sections before class, completing homework, and participating in class discussions and team activities. **Course objectives for the Instructor:** • To provide all students the tools necessary to succeed in their pursuit of a high level of understanding of the principles of Operational Amplifiers. Ideal Op. Amplifier. Inverting Amplifier. Non-inverting amplifier. Summing Amplifier. Difference Amplifier. Cascaded Operational Amplifiers Circuits. • To provide all students with an atmosphere conducive to learning the principles of physics. • To provide sufficient feedback to students, enabling them to gauge their progress towards achieving their goal in learning the principles of physics. • To facilitate student learning using appropriate activities, appropriate technology, and the illustration of physics applications in the real world.
Learning outcomes	• Students will know and will be able to explain the concepts. Circuit Theory elements. Technical characteristics and classification of radio-receiving equipment. Detecting of amplitude modulated signal. Detecting of frequency modulated signal. Students will be able to collect, analyze, and explain data from physics experiments in Capacitors. Series and parallel capacitors. Inductors. Series and parallel inductors. Integrator. Differentiator. First order circuits. The source-free RC circuit. The source-free RL circuit. Step response of an RC circuit. Delay circuits to communicate physics concepts effectively both orally and in writing. Students will demonstrate a comprehension of physical and environmental reality by understanding how fundamental physical principles of AC Circuit Concepts. Sinusoidal voltage and Current in Passive elements. Inductive and Capacitive Reactances and Susceptances, Impedance and Admittance. Impedance combinations. Ohm`s and Kirchoff`s Laws for AC Circuits. Phasor relationships for Circuit Elements underlie the huge variety of natural phenomena and their interconnectedness. Students will demonstrate a comprehension of technology by understanding how things work on a fundamental level.
Rules (Educational policy and behavior)	• **Lesson organization** General information on the subject will be provided for the students during lectures. Student's knowledge on the previous topics will be evaluated and new topic will be explained by mins of visual aids during seminars. Student's knowledge level will be tested oraly and in written forms before midterm and final exams. Submission of the individual works by the end of course is obligatory. • **Effectiveness (pass/fail)** This course strictly follows the assessment policy conducted by the subject teaching faculty. Hencew a student must score at least 60% to pass the course normally. In case of failure he will be forced to repeate the course in the next term or year. • **Plagiarism** 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 furher discusstion. • **Professional conduct directives** Students will behave professionally during class hours to create a conductive academic environment. Off course discussions and unethical behavior are strictly prohibited. • **Attendance** Participation of students at all classis 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. • **Quizzes.** Quizzes will be four times during semester. The time of quizzes will be announced in the classrom three weeks before.The quizzes will be related to the homework material. • **Activity** 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.

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	*17.02.23*	***Lecture №1.*** **Introduction. Basic concepts.** Systems of units. Charge and current. Voltage. Power and Energy. Passive sign convention. Circuit elements. Ohm's law. Open and Short circuits. Conductance and Power.	[1] p. 4-28 [3]
		Seminar №1: *Solving problems* Systems of units. Charge and current. Voltage. Power and Energy. Passive sign convention. Circuit elements. Ohm's law. Open and Short circuits. Conductance and Power.	[1] p.2-2
2	*24.02.23*	***Lecture №2.*** **Basic laws in circuit theory.** Nodes , branches and loops. Network topology theorem. Kirchhoff's current law (KCL). Kirchhoff's voltage law (KVL). Series resistors and voltage division. Parallel resistors and current division. Delta to wye conversion. Wye to delta conversion.	[1] p.30-80 [3]
		Seminar №2: *Solving problems.* Nodes , branches and loops. Network topology theorem. Kirchhoff's current law (KCL). Kirchhoff's voltage law (KVL). Series resistors and voltage division. Parallel resistors and current division. Delta to wye conversion. Wye to delta conversion	[1] p.
3	*03.03.23*	***Lecture №3***. **Methods of analysis.** Nodal analysis without voltage source. Nodal analysis with voltage source. Supernode. Mesh analysis without current source. Mesh analysis with current source. Supermesh.	[1] p.82-127 [3]
		Seminar №3: *Solving problems.* Nodal analysis without voltage source. Nodal analysis with voltage source. Supernode. Mesh analysis without current source. Mesh analysis with current source. Supermesh.	[1] p.
4	*10.03.23*	***Lecture №4.***. **Circuit theorems.** Linearity. Superposition principle. Source transformation. Thevenin's theorem. Norton's theorem. Maximum power transfer.	[1] p. 128-174 [3]
		Seminar №4: *Solving problems* . Linearity. Superposition principle. Source transformation. Thevenin's theorem. Norton's theorem. Maximum power transfer.	[3] p.
5	*17.03.23*	***Lecture №5***. **Operational amplifiers.** A structure of Op Amp. Ideal Op Amp. Inverting Op Amp. Noninverting Op Amp. Summing Op.Amp. Digital to analog converter (DAC). Difference Op Amp. Instrumentation Op.Amp. Cascaded Op.Amp.	[1] p.175-215 [3]
		Seminar №5: *Solving Problems* A structure of Op Amp. Ideal Op Amp. Inverting Op Amp. Noninverting Op Amp. Summing Op.Amp. Digital to analog converter (DAC). Difference Op Amp. Instrumentation Op.Amp. Cascaded Op.Amp.	[1] p.
6	*24.03.23*	***Lecture №6.*** **Capacitors and Inductors.** Series combination of capacitors. Parallel combination of capacitors. Inductors. Series combination of inductors. Parallel combination of inductors. Integrator. Differentiator.	[1] p.216-252 [3]
		Seminar №6: : *Solving Problems* Series combination of capacitors. Parallel combination of capacitors. Inductors. Series combination of inductors. Parallel combination of inductors. Integrator. Differentiator.	[1] p.

7	***01.04.23***	***Lecture №7.*** **Ac Circuits. Sinusoids and Phasors.** Introduction. Sinusoids. Phasors. Phasor relationship for Circuit Elements. Impedance and admittance. Kirchhoff's laws in the frequency domain.	[1] p.370-411 [3]
		Seminar №7: : *Solving Problems* . Sinusoids. Phasors. Phasor relationship for Circuit Elements. Impedance and admittance. Kirchhoff's laws in the frequency domain.	[1] p.
8	***08.04.23***	***Lecture №8.*** **Frequency Response .** Passive Filters. Lowpass Filter. Bandpass Filter. Bandstop Filter.	[1] p.613-647 [3]
		Seminar №8: *Solving Problems* Passive Filters. Lowpass Filter. Bandpass Filter. Bandstop Filter.	[1] p.
9	***15.04.23***	***Mid term exam***	
10	***22.04.23***	***Lecture №9.*** **Frequency Response** Active Filters: First-order Lowpass Filter. First-order Highpass Filter. BandPass Filter. Bandreject (or Notch) Filter	[1] p.2-2 [3]
		Seminar №9: *Solving Problems* Active Filters: First-order Lowpass Filter. First-order Highpass Filter. BandPass Filter. Bandreject (or Notch) Filter	[1] p.
11	***29.04.23***	***Lecture №10.*** **Sinusoidal alternating current circuit**. Basic definitions. Period, frequency, angular frequency, peak value, epoch angle. **AC** Average value, root-mean square value. Peak factor. Form factor.	[2] p. [3]
		Seminar №10: *Solving Problems* Basic definitions. Period, frequency, angular frequency, peak value, epoch angle. **AC** Average value, root-mean square value. Peak factor. Form factor.	[2] p.
12	***06.04.23***	***Lecture №11.*** **Representation of sinusoidal quantities by vectors and complex numbers**. Addition of sinusoidal time functions. Series connection of resistance, inductance and capacitor. Parallel connection of resistance, inductance and capacitor.	[2] p.
		Seminar №11: *Solving Problems* Addition of sinusoidal time functions. Series connection of resistance, inductance and capacitor. Parallel connection of resistance, inductance and capacitor.	
13	***13.04.23***	***Lecture №12.*** **Resonance circuits**. Series (voltage) resonance. Parallel (current) resonance.	[2] p
		Seminar №12: *Solving Problems* Series (voltage) resonance. Parallel (current) resonance.	[2] p.
14	***20.04.23***	***Lecture №13.*** **Magnetically Coupled circuits**. Transformer. Impedance transformations.	[2] p.
		Seminar №13: *Solving Problems* Transformer. Impedance transformations.	[2] p.
15	***27.04.23***	***Lecture №14.*** **Power Analysis.** Instantaneous and average power**.**Power in circuits. Power factor. Active reactive power. Maximum power transformation.	[2] p.
		Seminar №14: *Solving Problems* Instantaneous and average power**..**Power in circuits. Power factor. Active reactive power. Maximum power transformation.	[2] p.
16		Lecture ***№15.*** **Complex transfer function**. Analyzing RC Circuits. Analyzing RLC circuit	[2] p.
		Seminar №15: *Solving Problems* RC and RLC circuits.	[2] p.
		Final Exam