General information	Title and code of subject, number of credits	EENG250, Fundamentals of electrical engineering (Mechanical Eng), 6 ECTS
	Department	Physics and Electronics
	Program	Bachelor
	Academic semester	Spring 2026
	Lecturer	Asim Mammadov
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	Lecture room/Schedule	11 Mehseti Street, AZ1096 Baku, Azerbaijan (Neftchilar campus), room
	Consultations	
Prerequisites		
Course language	English	
Type of the subject	Major	
Textbooks and additional materials	*Textbooks*: 1. Electrical Engineering: Principles and Applications, Allan R. Hambley, Pearson, 7th Edition 2021 2. Electronics Fundamentals Circuits, Devices and Applications, Thomas L. Floyd, David L. Buchla 8th Edition, Pearson, 2014 Optional Reference Texts: 3. Fundamentals of Electrical Engineering, Giorgio Rizzoni, 2nd Edition, McGraw-Hill, 2022. 4. Principles and Applications of Electrical Engineering, Giorgio Rizzoni and James Kearns, 7th Edition, McGraw-Hill, 2022. 5. Electrical Engineering: Principles and Applications by William Hayt Jr., Jack Kemmerly, and Steven Durbin, McGraw-Hill, 2021	

Teaching methods	Case analysis	x
	Group discussion	x
	Lecture	x
	Simulation	x

Evaluation Criteria	Components	Date/ Deadline	Percent (%)
	Activity	During the semester	5
	Quizzes	4 times during the semester	20
	Attendance	At each lesson	5
	Midterm exam		30
	Final exam		40
	Final		100

Course description	This course is designed to provide students with a solid foundation in the principles and concepts of electrical engineering. It covers the fundamental topics related to electric circuits, electromagnetic fields, semiconductor devices and logic circuits. Moreover, along this course students will be introduced. Multisim schematic capture and simulation software that make easier to design and analyses electrical circuits. The course emphasizes practical applications and problem-solving techniques.

Course objectives	The purpose of the "Fundamentals of Electrical Engineering" subject is to provide students studying at the bachelor's level in "Mechanical Engineering" with the analysis and calculation of stable and variable electric circuits, the analysis and calculation of electric and magnetic fields, the application of the electromagnetic field in electrical and electronic engineering. This course mainly covers topics related to direct current circuits. In general, the course consists of the following sections. The first section covers the basic concepts and basic laws of electrical circuits. The second section analyzes the working principles of filters. The third part studies electronic components such as diodes, capacitors, inductors, transistors and operational amplifiers and their applications. The final section discusses magnetically coupled circuits, electrical machines, and logic circuits. In addition, throughout this course, students will be introduced to Multiuse, a schematic capture and simulation program that facilitates the design and analysis of electrical circuits.
Learning outcomes	Upon completing this course on Electrical Engineering Fundamentals, students should be able to achieve the following learning outcomes: • Understand the fundamental concepts of electrical engineering, including units, charge, current, voltage, power, and energy. • Apply circuit analysis techniques using Ohm's law, Kirchhoff's laws, and nodal/mesh analysis for solving electrical circuits. • Analyze electric fields, capacitance, and the behavior of capacitors in circuits. • Evaluate magnetic fields, electromagnetism, and the operation of electromagnetic devices. • Study inductors, mutual inductance, and transformers. • Analyze alternating current and voltage, including AC generators and motors. • Design and analyze filters, including low-pass, high-pass, and band-pass filters. • Understand the behavior and applications of diodes, BJTs, and operational amplifiers. • Apply knowledge of logic circuits and Boolean algebra in digital circuit analysis. • Develop problem-solving and critical thinking skills relevant to electrical engineering. • Apply learned principles to real-world engineering challenges and ensure electrical safety considerations. • Use basic semiconductor and operational amplifier circuits for sensor signal conditioning and simple measurement applications

Class Policy	**Lesson organization**
	General information on the subject will be provided for the students during lessons. Students' knowledge on the previous topics will be evaluated, and new topic will be explained by mines of visual aids. 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.
	Attendance
	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. Students are required to attend at least 75% of the total classes (lectures and seminars). Students who miss more than 25% of the classes are not allowed to take the final exam. Attendance contributes 5% to the final grade.
	For every two absences, 1 point is deducted from the attendance mark.
	Quizzes
	Those students who have informed the teacher and the dean's office about missing the quiz in advance for particular reasons, are allowed to take the quiz next week.
	Exams
	All the issues related to the participation and admission to the exam are regulated by the faculty dean. Topics of midterm and final exams are provided for the students before the exams. The questions of midterm exam are not repeated in the final exam.
	Violation of the rules of the exams
	Disrupting the quiz and taking copy during midterm and final exams is forbidden. Quiz papers of the students who do not follow these rules are canceled and the students are expelled from the quiz by getting 0 (zero).
	The rule for completing the course
	In accordance with the University rules the overall success rate to complete the course should be 60% or above. The students who failed the exam would be to take this subject next semester or next year
	Rules of conduct for Students
	Disruption of the lesson and not following ethical norms during the lesson, as well as conduction of the discussions by the students without permission and using mobile phones is forbidden
	Quizzes
	Quizzes will be held 4 times during the semester The quizzes will be announced in the classroom two weeks before. Quiz is from homework problems. The homework problems will be selected from questions and problems in the end of each chapter. The No. of homework problems will be announced after finishing each chapter
	Activity
	Students who will be active during discussion of past lessons will be awarded one activity mark.

Tentative Schedule

Week	Dates (planned)	Subject topics	Textbook/ Assignments
1.		*Basic Concepts:* Systems of units. Charge and current, Voltage, Power and energy, Circuit elements, Applications, Electrical safety. *Questions and Exercises*	[1]- Ch. 1, pp. 1–30 [2]- Ch. 1, pp. 1–28

2.		*Basic Laws:* Ohm's law. Nodes, branches, and loops. Kirchhoff's laws. Series resistors and voltage division. Parallel resistors and current division. Nodal and Mesh Analysis. *Questions and Exercises*	[1]- Ch. 2, pp. 31–60 [2]- Ch. 2, pp. 29–60
3.		*Electric Field and Capacitance:* Electric field, Capacitors and dielectrics, Capacitor circuits, Energy stored in electric fields. *Questions and Exercises, Quiz 1*	[1]- Ch. 3, pp. 61–90 [2]- Ch. 3, pp. 61–88
4.		*Magnetic Field and Electromagnetic devices:* Magnetic field, Electromagnetism, Electromagnetic Devices, Electromagnetic Induction, DC Generators, DC Motors. *Questions and Exercises*	[1]- Ch. 4, pp. 91–120 [2]- Ch. 4, pp. 89–118
5.		*Inductor and transformers:* Inductors and inductance, Inductor circuits, Mutual inductance, Energy stored in magnetic fields, Transformers. *Questions and Exercises*	[1]- Ch. 5, pp. 121–150 [2]- Ch. 5, pp. 119–148
6.		*Alternating Current and Voltage:* The Sinusoidal Waveform, Voltage and Current Values of Sine Waves, Angular Measurement of a Sine Wave, The Sine Wave Formula, Analysis of AC Circuits, Alternators (AC Generators), AC Motors. *Questions and Exercises*	[1]- Ch. 6, pp. 151–180 [2]- Ch. 6, pp. 149–180
7.		*Filters:* First-Order Filters, Transfer Functions, Low-Pass Filters, High-Pass Filters, Second-Order Filters, Band-Pass Filters, Band-Stop Filters. *Questions and Exercises, Quiz 2*	[1]- Ch. 7, pp. 181–210 [2]- Ch. 7, pp. 181–210
8.		*Semiconductor Devices and Circuits*: Diodes and applications. Half-wave rectifiers. Full-wave rectifiers. *Questions and Exercises*	[1]- Ch. 8, pp. 211–240 [2]- Ch. 8, pp. 211–240
9.		*Semiconductor Devices and Circuits*: The Zener Diode. Zener diode applications. The varactor diode. Optical diodes. *Questions and Exercises*	[1]- Ch. 9, pp. 241–270 [2]- Ch. 9, pp. 241–270
10.		**Mid-term exam**	
11.		*Semiconductor Devices and Circuits*: Bipolar junction transistors, BJT amplifiers. Operational amplifiers. Emphasis on basic interfacing and measurement circuits for engineering applications *Questions and Exercises.*	[1]- Ch. 10, pp. 271–300
12.		*Semiconductor Devices and Circuits*: Bipolar junction transistors. BJT amplifiers. Emphasis on basic interfacing and measurement circuits for engineering applications *Questions and Exercises. Quiz 3*	[1]- Ch. 11, pp. 301–330

13.		*Semiconductor Devices and Circuits*: Operational amplifier. Operational amplifier circuits. *Questions and Exercises.*	[1]- Ch. 12, pp. 331–360
14.		*Semiconductor Devices and Circuits*: Operational amplifier. Operational amplifier circuits. *Questions and Exercises.*	[1]- Ch. 13, pp. 361–390
15.		*Logic Circuits:* Number systems. Boolean algebra. Boolean logic gates. *Questions and Exercises, **Quiz 4***	[2]- Ch. 15, pp. 421–450
		Final Exam	