

Identification	Subject	Fundamentals of electrical engineering 6 ECTS credits
	Department	Physics and Electronics
	Program (Undergraduate, Graduate)	Undergraduate
	Term	Fall 2026
	Instructor	Asim Mammadov
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	Classroom/hours	11 Mehseti Street, AZ1096 Baku, Azerbaijan (Neftchilar campus), Tuesday, 18:40-20:00,20:10-21:40
Prerequisites	None	
Language	English	
Compulsory/Elective	Compulsory	
Textbooks and course 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	
Course description	The course introduces DC and AC electrical systems, Ohm's Law, Kirchhoff's Laws, series and parallel circuits, nodal and mesh analysis, electrical power and energy calculations, capacitance, inductance, magnetic fields, electromagnetic induction, transformers, and basic electrical machines. Students also learn the principles of electrical measurements and the operation of common electrical components and devices. The course further introduces semiconductor devices and basic electronic circuits, including diodes, rectifiers, transistors, operational amplifiers, filters, and digital logic circuits. Practical circuit examples and engineering applications are used throughout the course to strengthen students' understanding of electrical systems and develop their analytical and problem-solving skills. By the end of the course, students will have a strong foundation in electrical engineering and will be able to analyze basic electrical circuits, understand the operation of electrical and electronic devices, perform fundamental electrical calculations, and apply electrical engineering principles to automation, instrumentation, control systems, and other engineering applications.	
Course objectives	The purpose of the "Fundamentals of Electrical Engineering" subject is to provide students studying at the bachelor's level in "Electrical and Electronics 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.		
Learning Outcomes	By the end of the course, students will be able to: • Describe and mathematically represent different types of motion, including one-dimensional, projectile, and uniform circular motion. • Apply Newton's Laws of Motion to identify and analyze contact and non-contact forces in mechanical systems. • Explain the fundamental principles of simple harmonic motion and analyze common oscillatory systems, including pendulums. • Determine and interpret basic thermodynamic state variables, particularly temperature and pressure. • Explain the principles of fluid statics and apply Archimedes' Principle to problems involving buoyancy. • Apply the concepts of work, energy, and conservation of energy to analyze mechanical systems and selected fluid-related processes. • Use appropriate mathematical and physical methods to analyze and solve theoretical and practical problems of varying complexity. Demonstrate an integrated understanding of the fundamental concepts covered in mechanics, molecular physics, and thermodynamics through quizzes, midterm assessment, and final examination.		
Teaching methods	Case analysis		☒
	Group discussion		x
	Lecture		☒
	Simulation		x
Evaluation Criteria	Methods	Date/deadlines	Percentage (%)
	Midterm Exam	TBA	30
	Quizzes	4 times during the semester	20
	Practical Assignments	-	0
	Lab work	During the semester	5
	Attendance	At each lesson	5
	Final Exam	TBA	40
	Total		100
Class Policy	General information on the subject will be provided for the students during lectures. Students' knowledge on the previous topics will be evaluated, and new topics 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 work 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 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 exams 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

Generative AI Policy

The use of Generative Artificial Intelligence (GAI) tools is partially permitted in this course. Students may use GAI tools for learning purposes, such as obtaining explanations of course concepts, organizing information, generating practice questions, and supporting their understanding of the course material.

GAI tools may not be used to complete or generate answers for quizzes, midterm examinations, final examinations, or other assessed work unless explicitly authorized by the instructor. Students are responsible for the accuracy of any information obtained through GAI tools and must ensure that their submitted work reflects their own understanding, analysis, and intellectual contribution.

Any use of GAI in accordance with the permitted purposes should be appropriately acknowledged by the student.

Professional behavior guidelines

Students are expected to conduct themselves in a manner that fosters a constructive academic and professional environment during instructional hours. Unauthorized discourse and unethical behavior are strictly prohibited.

Attendance

Students who maintain full attendance for the duration of the course will be awarded 5 marks. Conversely, for every three absences recorded, the student will incur a deduction of 1 mark.

Quizzes

Four quizzes will be administered throughout the semester, with formal announcements made in class two weeks prior to the assessment date. The

		content of each quiz is based on assigned homework problems, which are curated from the questions and problems at the end of each chapter. Activity Students who demonstrate active engagement during the review of previous lessons and proficiently solve problems during seminar sessions will be awarded one activity mark. Assessment will be based on students’ participation and performance in laboratory work and practical activities.	
Tentative Schedule			
Week	Date/Day (tentative)	Topics	Textbook/Assignments
1	15-09-2026	<i>Basic Concepts:</i> Systems of units. Charge and current, Voltage, Power and energy, Circuit elements, Applications, Electrical safety. <i>Questions and Exercises</i>	[1] – p. 1-11, 15-32
2	22-09-2026	<i>Basic Laws:</i> Ohm’s law. Nodes, branches, and loops. Kirchhoff’s laws. Series resistors and voltage division. Parallel resistors and current division. Nodal and Mesh Analysis. <i>Questions and Exercises</i>	[1] – p. 44-58 [2] – p. 68-90
3	29-09-2026	<i>Electric Field and Capacitance:</i> Electric field, Capacitors and dielectrics, Capacitor circuits, Energy stored in electric fields. <i>Questions and Exercises, Quiz 1</i>	[1] – p. 92-110 [4] – p.116-125 Ch.5
4	06-09-2026	<i>Magnetic Field and Electromagnetic devices:</i> Magnetic field, Electromagnetism, Electromagnetic Devices, Electromagnetic Induction, DC Generators, DC Motors. <i>Questions and Exercises</i>	[1] – p. 125-136
5	13-10-2026	<i>Inductor and transformers:</i> Inductors and inductance, Inductor circuits, Mutual inductance, Energy stored in magnetic fields, Transformers. <i>Questions and Exercises</i>	[1] – p. 136-142
6	20-10-2026	<i>Alternating Current and Voltage:</i> 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. <i>Questions and Exercises</i>	[1] – p. 142-146
7	27-10-2026	<i>Filters:</i> First-Order Filters, Transfer Functions, Low-Pass Filters, High-Pass Filters, Second-Order Filters, Band-Pass Filters, Band-Stop Filters. <i>Questions and Exercises, Quiz 2</i>	[1] – p. 168-192 [3] – p. 192-200 Ch.8
	TBC	Midterm exam	
8	03-11-2026	<i>Semiconductor Devices and Circuits:</i> Diodes and applications. Half-wave rectifiers. Full-wave rectifiers. <i>Questions and Exercises</i>	[1] – p. 205-215 [2] – p. 222-226
9	10-11-2026	<i>Semiconductor Devices and Circuits:</i> The Zener Diode. Zener diode applications. The varactor diode. Optical diodes. <i>Questions and Exercises</i>	[1] – p. 229-238

0	17-11-2026	<i>Semiconductor Devices and Circuits: Bipolar junction transistors, BJT amplifiers. Operational amplifiers. Emphasis on basic interfacing and measurement circuits for engineering applications</i> <i>Questions and Exercises.</i>	[1] – p. 238-245
11	24-11-2026	<i>Semiconductor Devices and Circuits: Bipolar junction transistors. BJT amplifiers. Emphasis on basic interfacing and measurement circuits for engineering applications</i> <i>Questions and Exercises. Quiz 3</i>	[1] – p. 238-245
12	01-12-2026	<i>Semiconductor Devices and Circuits: Operational amplifier. Operational amplifier circuits.</i> <i>Questions and Exercises.</i>	[1] – p. 266-285
13	08-12-2026	<i>Semiconductor Devices and Circuits: Operational amplifier. Operational amplifier circuits.</i> <i>Questions and Exercises.</i>	[1] – p. 266-285
14	15-12-2026	<i>Logic Circuits: Number systems. Boolean algebra. Boolean logic gates.</i> <i>Questions and Exercises,</i>	[1] – p. 290-300
15	22-12-2026	<i>Electrical Troubleshooting and Fault Diagnosis</i> <i>Questions and Exercises Quiz 4</i>	[1]
		Final exam	

