Identification	**Subject (code, title, credits)**	ETR 385 - Designing Radio Electronic Devices – 6 ECTS credits
	Department	Department of Physics and Electronics
	Program	Undergraduate
	Term	Spring, 2021
	Instructors	Assoc.Prof. in Physics and Mathematics, Həsənov Elçin
	E-mail:	elgafgas@yahoo.com
	Phone:	0505287740
	Classroom/hours	Friday 17:10-20:10
	Office hours	9:00 – 10:00
Prerequisites	EENG 245 Basic Electronics	
Language	English	
Compulsory/Elective	Compulsory	
Required textbooks and course materials	**Core Textbook**: 1. Dogadin N.B. Fundamentals of Radioengineering, Moscow 2007 **Supplementary Textbooks:** 2.R.Z.Kazimzade and J.S.Asgerov Fundamentals of electro- and radioengineering Baku-2013 3.Davudov B., Dashdemirov K. Radiophysics Baku-2008 4.Gershunsky B.S. Fundamentals of electronics Moscow-1977 5.Khromoy B.P.,Moiseev U.G. Electro- and Radio measurements.	
Course outline	Introduction. Elements of signal theory. Basic radio-engineering signals their parameters. Classifying signals. Harmonic signal. Pulsed signal. Analytic, temporary and spectral description of signals. Periodic and nonperiodic signals. Modulation. Spectral analysis of periodic and nonperiodic signals. Signal energetic spectrum. Signals with discrete spectrum Calculating circuit at stationary regime. Analysis the transition processes in radio-engineering devices.	
Course objectives	Study of the methodology for the development of designs of electronic equipment using a computer and computer-aided design tools. The course synthesizes and deepens the knowledge gained and, based on its further development, allows solving the problems of designing radio-electronic means of the required reliability based on the wide use of unification, normalization and standardization of elements and units. The core of the course consists of the tasks of designing electronic equipment and methods for ensuring their reliability. To successfully study the course, the student needs to know modern layout methods, circuitry, the basics of probability theory and mathematical statistics, issues of heat and mass transfer, electromagnetic compatibility, the theory of mechanical vibrations. The course consolidates such general subject skills as the classification of problems in the theory of reliability of designing RES, modeling the processes of functioning of systems.	
Learning outcomes	Students will know: classification of radio-electronic devices; contradictions between the expansion of functionality and a restriction on dimensions, weight, ease of use; ensuring electromagnetic compatibility, thermal conditions; design stages and design requirements; design quality indicators; economic requirements; layout of RES; PCB design basic supporting structures; protection of radio-electronic devices from mechanical influences; dynamic models of radio-electronic devices structures; shock absorption and types of vibration isolators; the concept of reliability and failure, properties of reliability, the classification of failures and systems, the probabilistic and statistical forms of reliability indicators; reliability methods; procedure for calculating the reliability of elements and systems; optimal selection of the number of backup elements; reliability prediction. The student will be able to solve the design issues of radio-electronic devices; perform calculations to ensure thermal conditions, electromagnetic compatibility, mechanical effects on the radio-electronic devices; use the basics of a systematic approach, probability theory and mathematical statistics for the formulation and solution of problems of the theory of reliability of radio-electronic devices.	
Teaching methods	**Lecture**	X
	Group discussion	
	Experiential exercise	X
	Case analysis	

	Problem Solving		X
	Course paper		
	Others		
Evaluation	**Methods**	**Date/deadlines**	**Percentage (%)**
	Midterm Exam		30
	Participation	At each lesson	5
	Activity	During the semester	5
	Presentation	At the end of the semester	15
	Quizzes		5
	Final Exam		40
	Total		100

Policy

Methods of Assessment and Evaluation

Quizzes: During the semester in Problems Solving sessions there will be 20-minute written quizzes (5 in total) to evaluate whether assigned readings are completed. No make-up quizzes will be given. Quizzes missed due to a serious illness or a family emergency will be dealt with on a case-by-case basis.

Exams: There will be an in-class mid-term exam and a final exam. The midterm exam will be worth 30% of the total grade. The final exam will be worth 40% of the total grade as well. The mid-term and approximately one-half to two-thirds of the final are not cumulative other than the fact that some of the material will be dependent on previous material. The last portion (one-third to one-half) of the final exam will be cumulative. No make-up exams will be given. If you have a serious conflict with an exam time, you must discuss it with the instructor and take the exam early. Exams missed due to a serious illness or a family emergency (these must be documented) will be dealt with on a case-by-case basis.

For exams students will be allowed to bring an electronic calculator. No other materials or devices (including mobile phones) may be used during the exams.

Pass/Fail: Khazar University uses 100 points grading system with 60 point passing grade for bachelor students. In case of failure, student will be required to repeat the course the following term or year.

Attendance /Activity

Generally, **30%** unauthorized absence marks will lead to the student's expulsion from the Course.

Professional Behavior Guidelines: The student shall behave in the way to create favorable academic and professional environment during the class hours. Unauthorized discussions and unethical behavior are strictly prohibited.

Honesty Issues: All Khazar University students are bound by honor to maintain the highest level of academic integrity. By virtue of membership in the Khazar University community, every student accepts the responsibility to know the rules of academic honesty, to abide by them at all times, and to encourage all others to do the same. Cheating or other plagiarism during the mid-term and final examinations will lead to paper cancellation. In this case, the student will automatically get zero (0), without any considerations.

Students are supposed to read about the topics before they are discussed in lectures. It is not necessary that students study them carefully, but at least they should get the "smell of it". This should make it much easier for students to follow the lectures and find them more interesting.

Tentative Schedule

Week	**Date/Day (tentative)**	**Topics**	**Textbook/Assignments**
1	12.02.21	Introduction. Basic radio-engineering signals. Classifying signals. Harmonic signal. Pulsed signal. Spectral description of a signal. Discretization the signals. Examination knowledges of students individually on the material of respective lecture. Analysis the lecture material in details.	[1], Chapter 1 [2], Chapters 2

		Solving problems.	
2	19.02.21	Modulation. Spectral analysis of periodic and nonperiodic signals. Signal energetic spectrum. Signals with discrete spectrum Calculating circuit at stationary regime. Analysis the transition processes in radio-engineering devices. Seminar 2 Examination knowledges of students individually on the material of respective lecture. Analysis the lecture material in details. Solving problems.	[1], Chapter 2 [3], Chapters 2
3	26.02.21	Searching methods the radio-engineering corcuits. Linear circuits. Computation the circuits in a steady regime. Analyzing transition processes. Examination knowledges of students individually on the material of respective lecture. Analysis the lecture material in details. Solving problems.	[1], Chapter 3. [4], Chapter 4,
4	05.03.21	Electronic devices, their components. Operational principles of lamps. Diode, Triode, Tetrode, Pentode. Cathode ray tube with electrostatic and magnetic fields controlling. Electronic-vacuum devices used in TV receivers. Examination knowledges of students individually on the material of respective lecture. Analysis the lecture material in details. Solving problems.	[1], Chapter 4 [2], Chapter 5
5	12.03.21	P-n junction in semiconductors (s/c).Properties of p-n junction under external electric field. S/c resistors- Thermoresistors. Photoresistors. Varistors. S/c diodes- Rectifying diode. Pulse diode. Tunnel diode. Photodiode. Light diode. Seminar 5 Examination knowledges of students individually on the material of respective lecture. Analysis the lecture material in details. Solving problems.	[1], Chapter 5 [3], Chapters 6
6	19.03.21	S/c triode (bipolar transistor). Circuits with common emitter and base. Static and dynamic characteristics of transistors.Amplifying parameters of bipolar transistors. Temperature and frequency response of bipolar transistor. Transistor as a switch Seminar 6 Examination knowledges of students individually on the material of respective lecture. Analysis the lecture material in details. Solving problems.	[1], Chapter 6 [3], Chapters 7
7	26.03.21	Field effect transistor. Transistor with a single junction. Four layer s/c devices. Thyristor. Examination knowledges of students individually on the material of respective lecture. Analysis the lecture material in details. Solving problems.	[1], Chapter 7 [2], Chapter 8
8	02.04.21	Amplifiers of electrical oscillations. Basic characteristics of amplifiers. Amplifying cascades with bipolar transistor. Amplifying cascades with	[1], Chapter 8 [2], Chapter 9

		field transistor. Double cascade wider band amplifier with RC-connection. Negative Feedback in amplifiers. Voltage amplifier of narrower band. Examination knowledges of students individually on the material of respective lecture. Analysis the lecture material in details. Solving problems.	
9	09.04.21	**Midterm exam**	
10	16.04.21	Amplifiers of direct current. Differential amplifiers. Operational amplifiers. Power amplifiers. Oscillatory circuits and selective amplifiers. Induced oscillations in series(voltage resonance) and parallel (current resonance) oscillatory circuits. Bound oscillatory circuits . Selective amplifiers. Examination knowledges of students individually on the material of respective lecture. Analysis the lecture material in details. Solving problems.	[1], Chapter 9 [2], Chapter 10
11	23.04.21	Generators of harmonic oscillations. Excitation of harmonic electrical signals. LC-autogenerators. RC-autogenerators. Frequency stabilizing for the oscillations generated in autogenerators. Examination knowledges of students individually on the material of respective lecture. Analysis the lecture material in details. Solving problems.	[1], Chapter 10 [2], Chapter 12
12	30.04.21	Communication channel. Characteristics of communication channel. Structural network of radio link. Conversion of signal spectrum . Amplitude modulated signal. Frequency modulated signal. Other types of modulation. Conversion of electrical oscillations Detecting of the amplitude modulated oscillations. Schemes of detectors. Conversion of frequency. Examination knowledges of students individually on the material of respective lecture. Analysis the lecture material in details. Solving problems.	[1], Chapter 11 [2], Chapter 11
13	07.05.21	Radio-receiving equipment. Technical characteristics and classification of radio-receiving equipment. Detecting of amplitude modulated signal. Detecting of frequency modulated signal. Basic elements of pulse and digital technique. Characteristics and parameters. Electronic switch. Simple formatters of pulsed signals. Differentiating and integrating circuits. Elements of logic. Triggers. Registers. Multivibrators. Blocking generator. Generators of linearly varying voltage. Examination knowledges of students individually on the material of respective lecture. Analysis the lecture material in details. Solving problems.	[1], Chapter 12 [2], Chapter 13
14	14.05.21	Rectifying circuits. Half -wave rectification of one phase alternating current. Full-wave rectification of one phase alternating current. Rectification of triple phase alternating current. Smoothing filters. Examination knowledges of students individually on the material of respective lecture. Analysis the lecture material in details. Solving problems.	[1], Chapter13 [2], Chapter 14
15	21.05.21	Antennas and propagation of waves. Classification and basic factors of aerials. Mirror-parabolic antennas. Propagating properties of longer, average , short and ultra short waves. Examination knowledges of students individually on the material of respective lecture. Analysis the lecture material in details. Solving problems.	[1], Chapter 14 [2], Chapter 15
		Final Exam