

S Y L L A B U S

General information	Title and code of subject, number of credits	ETR466 Power Electronics - 6 ECTS credits	
	Department	Physics and Electronics	
	Program	Bachelor	
	Academic semester	2024 fall	
	Lecturer	Associate Professor, Ph.D Sevda N. Garibova	
	E-mail:	sevdaqaribova@khazar.org	
	Phone number:		
	Lecture room/Schedule	11 Mehseti Street, AZ1096 Baku, Azerbaijan (Neftchilar campus), room Lectures:	
	Consultations	Saturday 12:00 -13:20	
Prerequisites	EENG 245		
Course language	English		
Type of the subject	Major		
Textbooks	<p>Textbooks:</p> <ol style="list-style-type: none"> Muhammad H.Rashid. Power Electronics. Third edition, USA 2016. https://powerunit-ju.com/wp-content/uploads/2016/11/Book-Power_Electronics_Handbook_3rd_Edition_M_Rashid.pdf V.Ramanarayanan. Course on material on Switched mode power conversion. Indian Institute of science.2008. E-book pdf <p>Web pages: https://www.electrical4u.com/electrical-engineering-articles/power-electronics/#</p>		
Teaching methods	Lecture		15
	Group discussions at seminars		15
Assessment	Components	Date/ Deadline	Percent (%)
	Tests		
	Active participation, oral questions and discussion	At each lesson	5 point for participation 5 point for activity
	Assignment and quizzes	2 quizzes during the semester Each 5 point	10
	Presentation work (with practical work results)	Prepare presentation work on the topics given by the teacher during the semester (with laboratory works)	10
	Midterm exam		30
	Final exam		40
	Final		100
Course description	Power electronics is the study of electronic circuits designed to control the flow of electrical energy. Electronic circuits control the flow of power at levels well above the rated characteristics of individual devices. In general, electronic engineering is the circuits that engineers design and use to convert energy. The goal of modern electronics is to solve problems of reliable and efficient energy. To do this, it is necessary to clarify how electronic circuits and systems can be used to solve problems of energy conversion and control. Course of Power Electronics includes the working principles of converters, inverters, and rectifiers, and their critical role in power electronic systems.		
Course objectives	The course of Power Electronics includes the conversion process of electrical energy from a source to the correct voltage to the load with lossless. As is already known, any energy conversion process cannot be done without loss. Therefore, the students as future engineers should be known how clarify the efficiency of the circuit so that the system reduces losses to a minimum. To this end, students will know analyze modern power circuits during their studies, and solve basic problems related to reliable and efficient energy.		
Learning outcomes	What students should know by the end of the course:		

	Fundamentals of Power electronics, working principle inverters and converters, structure of power circuit, master engineering logic, switching characteristics of SCR, about thyristor protection and gate characteristics, about IGBT and other power converters, such as buck and boost converters.
Rules (Educational policy and behavior)	<ul style="list-style-type: none"> • 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 means of visual aids during seminars. Student's knowledge level will be tested orally, with practical works and in written forms (quizzes) before midterm and final exams. Submission of the individual works by the end of course is obligatory. • Exams (pass/fail) 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. 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. Students who got 57% can retake the exam. • Violation of the rules of the exams Disrupting the test and taking copy during midterm and final exams is forbidden. Test papers of the student who do not follow these rules are canceled and the students are expelled from the test by getting 0 (zero). • 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. • 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 who attend the whole classes will get 5 marks. For three absences student loses 1 mark. • Quizzes There will be quizzes per two weeks. The quizzes will be announced in the classroom two weeks before and will relate to homework. Depending on the difficulty of the lesson, quizzes can be two or three times during the semester, each with three or five points. • Activity For activity during lessons in the whole semester, students are rewarded with 5 points. The activity of students is assessed by the preparation of home questions, which is given by the teacher after the lessons; it can also be oral discussions. • Project or presentation work Students individually or in a group must prepare a project or presentation work either on a free topic or and a topic assigned by a teacher. Students have two months to prepare, and at the end of the semester, each group or individual student must present their work. The good work of the students is rewarded with 10 points. Presentation should consist of laboratory work and theoretical explanation. The students also present laboratory part that they have done during the last month. 5 points out of 10 are given to the practical work and the remaining 5 to how the student understands the theme and presents it.

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Week	Dates (planned)	Subject topics	Textbook/ Assignments
1	19.09 19.09	Power electronics, ideal and real switches. Fundamentals of power electronic circuit, power supplies. Power diodes, parallel and series connection. <i>Oral questions and discussing</i>	[1] chapter 1 p.1-10 Chapter 2 p.601 https://www.electrical4u.com/concept-of-power-electronics/
2	26.09 26.09	Characteristics of thyristors, operational modes, thyristor triggering <i>Discussing and testing</i>	[1] chapter 6 p.91-100
3	03.10 03.10	Switching characteristics and structure of SCR. Energy sources, storage and transmission <i>Oral questions and discussing</i>	https://www.electrical4u.com/switching-of-on-off-characteristics-

			of-scr-turn-on-turn-off-time/ [1] chapter 45-46
4	10.10 10.10	Two transistor model of thyristor (SCR). Thyristor protection, varistors. Testing and discussing, practical work in laboratory	https://www.electrical4u.com/two-transistor-model-of-scr/
5	17.10 17.10	Structure of IGBT, switching and transfer characteristics of IGBT, working principle. Testing and discussing	[1] chapter 5, p. 73 https://www.electrical4u.com/in-sulated-gate-bipolar-transistor-igbt/
6	24.10 24.10	Triac: construction and operation. AC-AC converter. Power factor correction circuit Practical work in laboratory	https://www.electrical4u.com/ [1]chapter18-19
7	31.10 31.10	Copper and DC to DC converters. Photovoltaic system conversion Quizze 1	[1] chapter 13 p.249, chapter 27, [2] chapter 3 p.69-80 https://www.electrical4u.com/chopper-dc-to-dc-converter/
8	07.11 07.11	Buck converter, step down chopper, circuit component and PWM Mid term exam	https://www.electrical4u.com/buck-converter-step-down-chopper/
9	14.11 14.11	Boost converter, step up chopper. Motor drives Activity testing and practical work in laboratory	[1]Chapter 34 https://www.electrical4u.com/boost-converter-step-up-chopper/
10	21.11 21.11	Buck-boost converter, circuit diagram, steady state analysis Presentation work	[2] chapter 5 p.135, 159-160 p.208-212 https://www.electrical4u.com/buck-boost-converter/
11	28.11 28.11	Flyback transformer design, flyback converter. EMI effects of power converters Presentation work	[1] chapter 42 https://www.sunpower-uk.com/glossary/what-is-a-flyback-converter/
12	05.12 05.12	Cycloconverter and types, single phase cycloconverter. DSP-based Control of Variable Speed Drives Quizze 2	https://www.electrical4u.com/cycloconverter/ [1] chapter 39
13	12.12 12.12	Dual converter, types and modes of operation. Energy power transmission Testing for activity point with practical work in laboratory	https://www.electrical4u.com/dual-converter/ [1] chapter 47

14	19.12	Three phase full wave diode rectifiers, circuit diagram, diode conduction.	[1] Chapter 11 p.183 https://www.electrical4u.com/three-phase-full-wave-diode-bridge-rectifier/
	19.12	<i>Presentation work</i>	
15	26.12	Inverters. Single –phase voltage source inverters.	[1] chapter 15 p.375
	26.12	<i>Testing for activity point and prepare to final exam</i>	
		<i>Final Exam</i>	

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