General information	**Title and code of subject, number of credits**	ETR 466 Power Electronics Devices 8 ECTS credits	
	Department	Physics and Electronics	
	Program	Master	
	Academic semester	2023 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	***Textbooks*:** 1. Keith Billings, Taylor Morey. Switchmode power supply, London 2011. 2. V.Ramanarayanan. Course on material on Switched mode power conversion. Indian Institute of science.2008. E-book pdf ***Web pages:*** https://www.electrical4u.com/electrical-engineering-articles/power-electronics/# https://www.bharathuniv.ac.in/page_images/pdf/courseware_eee/Notes/sem5/SEM%20V%20BEE%20502POWER%20ELECTRONICS.pdf		
Teaching methods	**Lecture**		+
	Group discussions at seminars		+
Assessment	**Components**	**Date/ Deadline**	**Percent (%)**
	Tests		
	Active participation, oral questions and discussion	At each lesson 5 point for participation 5 point for activity	10
	Assignment and quizzes	2 quizzes during the semester Each 5 point	10
	Presentation work	Prepare presentation work on the topics given by the teacher during the semester	10
	Midterm exam		30
	Final exam		40
	Final		**100**
Course description	The course of Power Electronics Devices is an introduction to power converters. It provides a basic knowledge for the control and conversion of electrical power with high efficiency. Overall field of electrical engineering divide into three electronics, power, and control areas of specialization. The goals of all parts of Power Electronics are the control and conversion of large amounts of energy. The process of control and conversion of energy is carried out with the help of converters, diodes, transistors, MOSFET, SCR and thyristors, IGBT, DC to DC chopper, cycloconverter and other electronic devices. This course studies the operation, characteristic, structure and application of semiconductor devices and control systems. All begins from the devices were utilized for the rectification of AC to DC or the inversion of DC to AC. However, rapidly growing usage of power electronics has resulted from the development of solid-state power devices, where the power flows through and is controlled by one or more solid-state power devices. The design of power electronics devices involves interactions with the source and the load, and utilizes small-signal electronic control circuits as well as power devices. Therefore, power electronics is related to and dependent on other areas of electrical power engineering.		
Course	Power electronics is defined as the application of electronic devices and associated components to the		

objectives	efficient conversion, control and conditioning of electric power. The key aspect of power electronics is the efficiency of power processing. The subject of power electronics is introduced in an curriculam more as thyristor and its applications. In this course, students will study the working principle, characteristics and application of basic power semiconductor devices and control systems, in particular its power diode, thyristors, SCR, controller, DC chopper and other converters. Students will be able to understand how power electronics is developed with the solid state power switching devices, will examine the conversion and control processes of electrical energy, how the device supplies electric energy to the load with high efficiency. The students will be able to analyze the basic power electronic circuit, their switching characteristics and block diagram.
Learning outcomes	What students should know by the end of the course: - how power energy convert, transfer and control at high efficiency; - how work converters, SCR or thyristors, MOSFET, IGBT, dual converter, phase converter, flyback converter, controllers. - functions of converters and their applications as power supply, cycloconverter, chopper and DC-DC converter, buck and boost converter. - be able to analyze power electronics circuit.
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 (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 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. 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 are rewarded with 10 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	19.09	*Power semiconductor devices: construction, principle of operation power diodes ,*	[2] chapter 1, p.1-

	21.09	*ideal switches, real swiches, practical power switching devices, power supply and power supply circuit.* ***Oral questions and discussing***	10 https://www.bharathuniv.ac.in/page_images/pdf/courseware_eee/Notes/sem5/SEM%20V%20BEE%20502POWER%20ELECTRONICS.pdf https://www.electrical4u.com/electrical-engineering-articles/power-electronics/#
2	26.09 28.09	*Silicon controlled rectifier (SCR): construction, modes of operation, characteristics of SCR, application* ***Discussing and testing***	[2] chapter 1 p.9-11 https://www.electrical4u.com/thyristor-silicon-controlled-rectifier-scr/
3	03. 10 05.10	*Direct –off-line switchmode power supplies. Triac:construction and operation.* ***Oral qustions and discussing***	[1] chapter 1 p.1.3
4	10.10 12.10	*DC Power Supply, AC to DC Power supply, Protection devices, varistors.* ***Testing and discussing***	[1] chapter 2 p.1.17
5	17.10 19.10	*MOSFET , Gate turn-off thyristor.* ***Testing***	http://www.electrical4u.com/ https://www.bharathuniv.ac.in/page_images/pdf/courseware_eee/Notes/sem5/SEM%20V%20BEE%20502POWER%20ELECTRONICS.pdf
6	24.10 26.10	*IGBT - insulated gate bipolar transistor* ***Testing and discussing***	[2] chapter 1, p. 26-30 https://www.electrical4u.com/insulated-gate-bipolar-transistor-igbt/
7	31.10 02.11	***Converters:*** *converters, primitive converter, DC converter, isolated and non-isolated converter.* ***Quizze 1***	[2] chapter 4, p. 95-99 https://www.bharathuniv.ac.in/page_images/pdf/courseware_eee/Notes/sem5/SEM%20V%20BEE%20502POWER%20ELECTRONICS.pdf
8	07.11	*Line rectification and capacitor input filters for direct –off-line switchmode power*	[1] chapter 6

		supplies.	p.1.55
	14.11	***Midterm exam***	
9	16.11 21.11	*Inrush control. Inrush current in power supply.* ***Activity testing***	[1] chapter 7 p.1.73 https://www.electronicproducts.com/Electromechanical_Components/Understanding_power_supplies_and_inrush_current.aspx
10	23.11 28.11	***Phase controlled converters****- Single phase and three phase controlled rectifiers.* ***Presentation work***	http://www.electrical4u.com/
11	30.11 05.12	***Control , drive and protection of power switching devices:*** *base drive circuits, requirements of base drive, drive circuits. Copper or DC to DC.* ***Presentation work***	[2] chapter 3 p.69-80 https://www.electrical4u.com/chopper-dc-to-dc-converter/
12	07.12 12.12	***Controller basics:*** *DC to DC controller, buck and boost converter, DC –to –DC converter dynamics, idealized DC-DC converter* ***Quizze 2***	[2] chapter 5 p.135, 159-160 p.208-212
13	14.12 19.12	*Overvoltage and overload protection. Types of over protection. Dual converter* ***Testing for activity point***	[1] chapter 11, 13 p.1.107 https://www.sunpower-uk.com/glossary/what-is-over-voltage-protection/
14	21.12 23.12	*Flyback transformer design, flyback converter.* ***Presentation work***	[1] part 2, chapter 2 , p.2.53 https://www.sunpower-uk.com/glossary/what-is-a-flyback-converter/
15	26.12 28.12	*AC chopper,cycloconverter and voltage controller.* ***Testing for activity point and prepare to final exam***	https://www.electrical4u.com/cycloconverter/
		Final Exam	

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