S Y L L A B U S

General information	**Title and code of subject, number of credits**	ETR 605, Simulation of electronic devices and circuits, 8 ECTS	
	Department	Physics and Electronics	
	Program	Graduate	
	Academic semester	Fall 2025	
	Lecturer	PhD, dosent, Elchin Gasanov	
	E-mail:	elgafgas@yahoo.com	
	Phone number:		
	Lecture room/Schedule	11 Mehseti Street, AZ1096 Baku, Azerbaijan (Neftchilar campus), room	
	Consultations	II, 15:00 – 16:00	
	Office hours	Sunday 09:00	
Prerequisites	EENG 245		
Course language	English		
Type of the subject	Major		
Textbooks and additional materials	1. G. Streetman, and S. K. Banerjee, “Solid State Electronic Devices,” 7th edition, Pearson,2014. 2. S. M. Sze and K. N. Kwok, “Physics of Semiconductor Devices,” 3rd edition, John Wiley&Sons, 2006. 3. D Vasileska, SM. Goodnick, G Klimeck, "Computational Electronics: Semiclassical and Quantum Device Modeling and Simulation," CRC Press 2010. 4. Selberherr Siegfried, “Analysis and Simulation of Semiconductor Devices”, 1984		
Teaching methods	**Lecture**		+
	Group discussions at seminars		+
Assessment	**Components**	**Date/ Deadline**	**Percent (%)**
	Tests (oral questioning)	During the semester	5
	Activity	At each lesson	10
	Quizzes	3 time during the semester	15
	Attendance	During the semester	5
	Midterm exam		30
	Final exam		35
	Final		**100**
Course description	This syllabus also covers empirical modeling approaches to predict device operation by implementing mathematically fitted equations. In addition, it includes numerical device modeling approaches, which involve numerical device simulation using different types of commercial computer-based tools. Numerical models are used as virtual environment for device optimization under different conditions and the results can be used to validate the simulation models for other operating conditions.		
Course objectives	- to develop the ability to reasonably select and implement in practice an effective methodology for experimental research of the parameters and characteristics of devices, circuits, devices and installations of electronics for various functional purposes; - to develop the ability to conduct computational experiments using standard software tools in order to obtain mathematical models that adequately reflect real processes in an electric drive and other automatic control systems.		
Learning outcomes	• study of methods for analyzing and calculating electronic circuits; • study of methods for solving optimization problems; • mastering the skills of analyzing, calculating and optimizing electronic circuits; • study of basic electric drive models and modeling methods; • mastering the principles of constructing models of real devices in the field of electric drives and control systems; • acquisition of skills in implementing models using computer technology and tools.		

Policy	▪ **Preparation for class** The structure of this course makes your individual study and preparation outside the class extremely important. The lecture material will focus on the major pointsintroduced in the text. Reading the assigned chapters and having some familiaritywith them before class will greatly assist your understanding of the lecture. Afterthe lecture, you should study your notes and work relevant problems and cases from the end of the chapter and sample exam questions. ▪ **Withdrawal (pass/fail)** This course strictly follows grading policy of the School of Science and Engineering. Thus, a student is normally expected to achieve a mark of at least60% to pass. In case of failure, he/she will be required to repeat the course thefollowing term or year. ▪ **Cheating/plagiarism** Cheating or other plagiarism during the Quizzes, Mid-term and Final Examinations will lead to paper cancellation. In this case, the student will automatically get zero (0), without any considerations. ▪ **Professional behavior guidelines** The students shall behave in the way to create favorable academic and professionalenvironment during the class hours. Unauthorized discussions and unethical behavior are strictly prohibited. **Attendance** Students who attend the whole classes will get 5 marks. for three absence student loses 1 mark. ▪ **Activity** Students who will be active during discussion of past lessons and who will be solve homework problems in a seminar will be awarded with one activity mark. ▪ **Quizzes** There will be 3 quizzes examination during the semester. The quizzes will be announced in the classroom two weeks before. Quiz is based on homework problems. The homework problems will be selected from questions and problems in the end of each chapter. The number of homework problems will be announced after finishing each chapter.

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	*20/09/25*	Physics-based and empirical compact modeling for circuit simulation.	[1] p.709-741
		Problem solving.	
2	*27/09/25*	Types of physics-based models Problem solving	[1] p.750-773 [1] p-780-795
		Problem solving..	
3	*04/10/25*	Types of empirical models	[1] p.800-815
		Problem solving.	
4	*11/10/25*	CAD model for SPICE Criteria for a good SPICE model	[1] p.815-838
		Problem solving.	
5	*18/10/25*	Modeling and Simulation	

		Problem solving.	
6	***25.10/25***	Electrical Analysis Current State of the Art and Requirements/Challenges	[1] p.846-872
		Problem solving.	
7	***01/11./25***	Modeling of novel transistors and emerging devices	[1]p.881-900,
		Problem solving	
8	***08/11/25***	Device simulation using semiclassical approach	[1] p.957-984
		Problem solving.	
9		***Mid term exam***	
10	***15/11/26***	Device simulation using quantum mechanical approach	[1] p.916-947
		Problem solving	
11	***22/11/25***	TCAD device simulation (technology computer-aided design)	[4]p. 73-96
		Problem solving	
12	***29/11/25***	Thermal and Thermomechanical Modeling	[1] p.1061-1085
		Problem solving	
13	***06/12/25***	Semiclassical Transport Theory Mechanical and Multi-Physics	[3]p.555-611
		Problem solving.	
14	***13/12/25***	Drift-Diffusion (DD)	[1] page 9-6
		Problem solving	[1] page 10-6
15	***20. 12/25***	Nanoscale phenomena at the device level.	[1] page 11-6