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	Master	
	Academic semester	2024 Fall	
	Lecturer	PhD, dosent, Hasanov Elchin	
	E-mail:	elgafgas@yahoo.com	
	Phone number:	+994 50 5287740	
	Lecture room/Schedule	11 Mehseti Street, AZ1096 Baku, Azerbaijan (Neftchilar campus), room	
	Consultations	II, 15:00 – 16:00	
	Office hours		
Prerequisites			
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	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.		
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		

	before midterm and final exams. Submission of the individual works by the end of course is obligatory. • Effectiveness (pass/fail) This course strictly follows the assessment policy conducted by the subject teaching faculty. Hencew a student must score at least 60% to pass the course normally. In case of failure he will be forced to repeate the course in the next term or year. • Plagiarism Cheating or other forms of plagiarism during review surveys, midterms and final exams will result in disqualification. In this case a student will automatically receive zero "0" without furher discusstion. • Professional conduct directives Students will behave professionally during class hours to create a conductive academic environment. Off course discussions and unethical behavior are strictly prohibited. • 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. • Quizzes. Quizzes will be four times during semester. The time of quizzes will be announced in the classrom three weeks before.The quizzes will be related to the homework material. • Activity Students who will be active during discussion of past lessons will be awarded with one activity mark.

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	***21/09/24***	Physics-based and empirical compact modeling for circuit simulation.	[1] p.709-741
		Problem solving.	
2	***28/09/24***	Types of physics-based models	[1] p.750-773 [1] p-780-795
		Problem solving.	
3	***05/10/24***	Types of empirical models	[1] p.800-815
		Problem solving.	
4	***12/10/24***	CAD model for SPICE Criteria for a good SPICE model	[1] p.815-838
		Problem solving.	
5	***19/10/24***	Modeling and Simulation	
		Problem solving.	
6	***26.10/24***	Electrical Analysis Current State of the Art and Requirements/Challenges	[1] p.846-872
		Problem solving.	
7	***02/11./24***	Modeling of novel transistors and emerging devices	[1]p.881-900,
		Problem solving	
8	***09/11/24***	Device simulation using semiclassical approach	[1] p.957-984
		Problem solving.	

9		***Mid term exam***	
10	***16/11/24***	Device simulation using quantum mechanical approach	[1] p.916-947
		Problem solving	
11	***23/11/24***	TCAD device simulation (technology computer-aided design)	[4]p. 73-96
		Problem solving	
12	***30/11/24***	Thermal and Thermomechanical Modeling	[1] p.1061-1085
		Problem solving	
13	***07/12/24***	Semiclassical Transport Theory Mechanical and multi-physics	[3]p.555-611
		Problem solving.	
14	***14/12/24***	Drift-Diffusion (DD)	[1] page 9-6
		Problem solving	[1] page 10-6
15	***21. 12/24***	Nanoscale phenomena at the device level.	[1] page 11-6