

Identification	Subject	Renewable Energy Systems 8 ECTS credit
	Department	Physics and Electronics
	Program (Undergraduate, Graduate)	Graduate
	Term	Fall 2026
	Instructor	Nijat Hajiyevev
	Email:	hajiyevnijat@gmail.com
	Classroom/hours	11 Mehseti str. (Neftchilar campus), Monday and Friday, 08:30-18:40
Prerequisites	None	
Language	English	
Compulsory/Elective	Compulsory	
Textbooks and course materials	Textbooks: [1] - Messenger, Roger A. Photovoltaic systems engineering. CRC press, 2018. [2]- Duffie, John A., and William A. Beckman. Solar engineering of thermal processes. John Wiley & Sons, 2013. [3]- El-Sharkawi, Mohamed A. Wind energy: an introduction. CRC Press, 2015.	
Course description	This course provides a comprehensive introduction to renewable energy systems, covering key sources like solar, wind, hydro, and biomass. The curriculum explores the scientific, technical, and economic aspects of these technologies, with a strong emphasis on their role in addressing global energy challenges and mitigating climate change. Students will learn to critically evaluate energy conversion technologies, understand grid integration, and analyze the environmental and societal impacts of these systems, equipping them with the knowledge to contribute to discussions on sustainable energy practices.	
Course objectives	1. Understanding basic characteristics of renewable sources of energy and technologies for their utilization. 2. To give review on utilization trends of renewable sources of energy 3. To give review on legislative and regulatory rules related to utilization of renewable sources of energy.	
Learning Outcomes	1. Define basic properties of different renewable sources of energy and technologies for their utilization, 2. Understand the role of solar energy in the context of regional and global energy systems, its economic, social, and environmental connotations, and the impact of technology on a local and global context. 3. Understand the physical principles of the photovoltaic (PV) solar cell and what are its sources of losses.	

	4. Know the most important characteristics of the elements within a PV system and how they work: battery and charge controller, DC/DC converter, DC/AC converter (inverter) and loads. 5. List the relevant organizations, major projects at the international level, the main sources of information and regulations related to solar photovoltaic technology. 6. Carry out a basic engineering project related to energy supply using solar photovoltaic technology. 7. Know the main lines of research in the field of solar energy. 8. Bring innovative ideas in the field of solar photovoltaic energy.		
Teaching methods	Lecture		☒
	Classroom exercises		☒
	Laboratory projects		☒
	Quiz		☒
	Taking notes on a copybook		☒
	Homework exercises		☒
Evaluation Criteria	Methods	Date/deadlines	Percentage (%)
	Midterm Exam	TBA	30
	Quiz	After the midterm	10
	Homework	At each lesson	10
	Activity	At each lesson	10
	Final Exam	TBA	40
	Total		100
Class 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 points introduced in the text. You must have a copybook and take notes at each lesson. Reading the assigned chapters and having some familiarity with them before class will greatly assist your understanding of the lecture. After the lecture, you should study your notes and work relevant problems and cases from the end of the chapter and sample exam questions. Also, you must explore additionally and try to make circuits on your own after the lessons. Before using the laboratory at additional times, please inform faculty or department staff. • 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 least 60% to pass. In case of failure, he/she will be required to repeat the course the following term or year. • Cheating/plagiarism Cheating or other plagiarism during the Quiz, 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 professional environment during the class hours. Unauthorized discussions and unethical behavior are strictly prohibited. • Quiz		

	There will be a quiz after the midterm. The quiz will be announced in the classroom two weeks before and will relate to homeworks. Students will get maximum 10 marks in a quiz. • Activity Students who will be active during classroom exercises, laboratory tasks and answering questions in the classroom will get 10 marks at each lesson. All students marks will be recorded in teacher's personal copybook and average mark will be calculated according to all marks at the end of semester. • Homework Homework will be issued in lectures and collected a week later in recitation. You are welcome and encouraged to discuss the homework among your colleagues. However, the final formulation and write up of your homework answers must be your own. More importantly, although homework counts for only 10 percent of the grade, they are critical to learning the material and to doing well on the quizzes and final exam. • Rulings on using Generative AI Within this course, artificial intelligence tools can be used to support the learning process, brainstorm ideas, structure data, and assist with language editing. However, the core content, scientific analysis, and results of assignments must be independently prepared by the student. The use of AI tools is strictly prohibited during quiz, midterm and final exams. Students who use AI must appropriately cite its usage. Students must design, draw, and perform the calculations for circuits entirely by themselves. However, they are permitted to use AI for assistance with tasks such as calculating resistor color codes or looking up IC/transistor pinouts. The main rule is to use AI strictly as an auxiliary helper.
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Tentative Schedule

Week	Date/Day (tentative)	Topics	Textbook/Assignments
1		Introduction to renewable energy and historical overview of solar cells, Functioning of the photovoltaic cells and Efficiency of solar cells	[1] Chapter 1
2		Types of solar photovoltaic cells and Energy depreciation of photovoltaic cells, Photovoltaic system types, conversion, and specifications	[1] Chapter 2,3
3		Charge regulators, Power factor Energy, Network-connected photovoltaic systems (on-grid)	[1] Chapter 2-4
4		Standalone systems (off-grid) or isolated systems, Hybrid systems, Independent, systems for economic purposes	[1] Chapter 4,5
5		Introduction of solar thermal energy, residential, commercial, and industrial applications	[2] Chapter 1,2
6		Solar radiation, heat transfer, Solar thermal power	[2] Chapter 3-5
7		Review of past lessons, preparing for the midterm	
		Midterm exam	
8		Plane and concentrated collectors, water heating applications, heating and cooling the buildings,	[2] Chapter 10-12

9		Thermal industrial applications, Water desalination, Solar thermal energy system,	[2] Chapter 13-14
10		History of the Wind Energy Development and Aerodynamics of Wind Turbines	[3] Chapter 1-2
11		Quiz	
12		Generators.	[3] Chapter 6-7
13		Physical principles of Wind Energy Conversion, Wind Turbine system.	[3] Chapter 8-9
14		Estimating Wind Turbine average power and energy production	[2] Chapter 2-4
15		Review of past lessons, preparing for the Final exam	
		Final exam	

