ENS 315 - Energy Fall 2022 (Tentative) Syllabus

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Course Schedule	Tuesday : 11:40 - 12:30 @ Room: FENS-L029 Wednesday : 14:40 - 16:30 @ Room : FENS-L055		
Purpose of the course	This course aims to provide basic concepts towards understanding the world energy problems, renewable and non-renewable energy sources, their advantages, shortcomings and impacts to the environment.		
Objectives	After the course, the students should be able toIdentify different types of energy in energy sources, systems or processes.		
	• Be able brake down the energy conversion mechanisms in systems such as power plants, air conditioners, solar collectors etc.		
	• Identify renewable and nonrenewable energy resources.		
	• Calculate thermodynamic efficiency limits of heat engines and heat pumps.		
	• Be able explain the working principle of the various energy conversion systems including heat engines and heat pumps, photovoltaic cells, fission reactors.		
	• Calculate the power and energy capacity of windmills, hydropower plants, geothermal plants etc.		
	• Approximately estimate the energy content of fossil fuels and nuclear fuels.		
Tentative Outline	Below is the topics we intend to cover. We might need to update the coverage slightly throughout the semester depending on how we proceed.		
	• Weeks 1&2: Energy Fundamentals, Sustainability Basic definitions, energy and power, forms of energy conversions, efficiency, energy units, critical resources, historical development, climate change, future scenarios		
	• Week 3: Fossil Fuels Fossil fuel formation theories, types, reserves and resources, energy content, exploration and production technologies, impact of fossil fuels on the environment		
	• Weeks 4&5: Thermal Energy Heat transfer, laws of thermodynamics, heat engines and heat pumps Midterm 1 (tentative, exact day and time will be announced).		
	• Weeks 6&7: Solar Energy Solar incidence power and spectrum, Principles of photovoltaics, PV technologies, PV cost vs efficiency, trends, solar thermal systems.		
	• Week 8: Electricity Introduction to electricity, batteries, fuel cells, motors, generators. Transmission and distribution of electricity, energy storage systems.		
	• Weeks 9&10: Wind Energy and Hydropower Wind Energy: Wind power capacity, wind turbines and systems Hydropower : Capacity, systems Midterm 2 (tentative, exact day and time will be announced).		
	• Weeks 11&12: Other Renewables and Energy Sources Geothermal and Biomass: capacity analysis, hydrothermal systems, renewability analysis,		

biomass conversion technologies

Hydrogen: hydrogen as an energy source, hydrogen production, potential uses, hydrogen storage and distribution.

• Week 13: Nuclear Energy

Fission and fusion, radioactivity, fission reactors, fuel production, nuclear waste management, safety and risk assessment, future of nuclear energy, new reactor designs, fusion power project.

• Week 14: Transportation

Alternative vehicle technologies, current trends, issues, relation to energy systems.

- REFERENCES There is no specific textbook for the material presented in this course. Students will be recommended to follow the references listed below occasionally. Additional reading materials will be shared at SUCourse when necessary.
 - David JC MacKay, Sustainable Energy-without the hot air, 2009. (Free e-book available on the web)
 - Ernie L. McFarland, James L. Hunt, John L. Campbel, *Energy, Physics and the environment*, 3rd Edition, Cangage Learning, 2007.
 - Christian Ngo, Joseph Natowitz, Our Energy Future: Resources, Alternatives and the Environment, 2nd Edition, Wiley, 2016. (Online access available at IC)
 - Ziyad Salameh, *Renewable Energy System Design* , Academic Press, 2014. (Online access available at IC)
 - Robert A. Ristinen, Jack J. Kraushaar, Jeffrey Brack *Energy and the environment*, 3rd *Edition*, Wiley, 2016.

LECTURES

- Lectures will be held physically in class. There will be no recordings.
- Powerpoint slides will be used in lectures. Board will also be used occasionally. Students are encouraged to take their own notes during classes.
- Slides will be shared on SUCourse before the class. There will be missing content on the shared slides. Students are responsible to fill out the missing parts during the class.

GRADING Homework (15%), 2 Midterms (25% each), Final (25%), Quizzes (10%). POLICY

- Midterms will be held during class hours. Tentative weeks are given on the outline above. Exact dates and contents will be announced at SUCourse. Final exam will be scheduled by Student Resources.
- Pop-quizzes with short answer questions (10 minutes max) will be given randomly during classes. The quizzes will be unannounced and there might be more than one quiz per class. You must be present in the lecture for at least 40 minutes otherwise your quiz will be void. Best 80% of the quizzes will be counted towards your final grade.
- All examinations will be closed book and notes.
- One make-up examination, covering the whole course material, will be given after the final exam date. You can take a make-up only if you have a valid health report approved by the University Health Services. (It is your responsibility to get approval from University Health Services. Please make sure you learn the details about the procedures.)
- Homework will be written assignments consisting of numerical problems and/or open ended questions that require you to provide commentary and discussion in your own sentences. Zero credit for late homework unless arrangements are made in advance (only with valid excuses). You can discuss the problems/questions with your

classmates but copying work is against University regulations and might result in a grade zero (0).

- No make-up will be given for quizzes.
- Attendance will be taken. Attendance and active participation/interest in lectures may affect the final grade for borderline cases.
- No extra homework/exam/project/etc. will be given to increase your grade at the end of the semester.
- All announcements will be made through SUCourse, students are responsible from following the announcements.
- Students who are registered to the course with time-conflict override accept the responsibility of any inconvenience that might occur due to missed content and/or quiz/attendance. No make-up will be provided for quizzes/content missed due to time conflict.
- ACADEMIC
 Students are expected to be familiar with and comply with Sabanci University Academic INTEGRITY
 Students are expected to be familiar with and comply with Sabanci University Academic Integrity Statement. Any form of academic dishonesty (plagiarism, copying/using other people's work, attending classes/exams on behalf of other people, etc) will be penalized with a failing grade (i.e., zero points) for the related assignment, quiz, or exam and disciplinary actions will be taken.