ME420/520 Renewable & Sustainable Energy Systems
Spring 2023

In addition to providing technical competence in analysis of energy systems, this advanced undergraduate/introductory-graduate course intends to review technical aspects of renewable & sustainable energy systems, such as thermal, solar, wind and nuclear plants. Thermodynamic analysis of various power cycles such as Rankine, Brayton, Otto, Diesel and refrigeration will be reviewed at the beginning of the course. Then, technical analysis of wind and power systems, and lastly, the nuclear energy is reviewed. Throughout the course impacts of these technologies are summarized. Subject to in-class progress, energy storage and distribution technologies will be analyzed as well. Students must be familiar with thermodynamics (ENS202 or ENS207) and thermal-fluid sciences (ME307 and ME309) at undergraduate level; some basics will be reviewed but will not be extensive.

TEXTBOOKS:

Fundamentals of Renewable Energy Processes, 3e, Aldo Vieira da Rosa, Academic Press, 2013 (should be available in Homer, and on reserve in the library).

Sustainable Energy — without the Hot Air, David JC MacKay, 2010 (available via free download from http://www.withouthotair.com/).

REFERENCES:

Renewable and Efficient Electric Power Systems, Gilbert M. Masters, Wiley, 2003.

Principles of Sustainable Energy Systems, 2e, Frank Kreith, CRC Press, 2014.

Fundamentals of Engineering Thermodynamics, 8e, Moran, Shapiro, Boetner & Bailey, Wiley.

Fundamentals of Heat & Mass Transfer, 7e, Frank P. Incropera and David P. Dewitt, Wiley, 2011.

GRADING:

IMPORTANT NOTE: ***Grading methods and weights are subject to change according to the progress in regulations about online vs hybrid lectures.***

Midterm: 20%

Final: 60%

SUCourse quizzes (about one in every lecture, it also counts as attendance): 5%

Take-home assignments: 15%

Note: take-home assignments are subject to the same conditions as the exams, plagiarism will be subject to disciplinary action and NA grade conditions. If a take-home assignment is considered as plagiarism, it will be treated as not turned in. You may discuss the solution strategy with your friends and use online resources available for similar problems. In order to avoid plagiarism: **you must ensure to answer the problems with your own explanations and in your own words.**

Attendance is compulsory. NA (not-attended) grade will be given in case of one of the following conditions:

- Less than 50% attendance in quizzes
- .OR. 3 or less take-home assignments turned-in with reasonable effort.
- .OR. you miss one exam without an excuse.

You must attend the synchronous Zoom lectures, recitations, online exams with your SU email account.

During online exams (if any), your webcam and microphone should be on during the exams (midterm & final). In the case of non-compliance with this and other declared exam procedures, your exam will be void. Make sure to check that your webcam and microphone function properly before the exam. In

case of non-compliance with any of exam instructions a follow-up oral exam will be held. If the student refuses to take the oral exam, their exam will count as not-attended.

ZOOM LINK for ONLINE PARTICIPANTS

https://sabanciuniv.zoom.us/j/94628273115?pwd=bUpKZUZKUUVUNWtvWDkyNmRaSkk1QT09

Meeting ID: 946 2827 3115

Passcode: 735356

TENTATIVE SCHEDULE

Week 1-2: Introduction, utilization of energy, energy resources, environmental impact, global energy flow, renewable and nuclear capacity.

Week 2-6: Thermodynamic fundamentals, first and second laws, ideal Carnot cycle, gas power systems (Otto, Diesel, Brayton and Stirling cycles), steam power systems (Rankine cycle) refrigeration and heat pump cycles.

Week 7-9: Solar energy utilization, solar collectors, photovoltaics (1^{st} Midterm)

Week 10-11: Wind energy fundamentals

Week 12-13: Nuclear fission, radiation & fusion (2^{nd} Midterm)

Week 14: Fuel cells & batteries