EML 6451: Energy Conversion, Spring, 2020
EML 4450: Energy Conversion, Spring, 2020
9th Period (4:05 pm – 4:55 pm) MWF
Sections : 2318, 2F49

1. Catalog Description: Credits: 3; Introduction to principles, theories and processes of devices and systems that convert thermal, chemical, nuclear, and electromagnetic energy to electrical, mechanical and alternative chemical form. Energy conversion performance characteristics and sources of inefficiencies are explored for a variety of applications that include conventional fossil energy combustion based systems, nuclear, solar, wind, and biomass systems.

2. Pre-requisites and Co-requisites: *Engineering Thermodynamics (EML3100), Fluid Dynamics (EGN3353C) and Heat Transfer (EML4140).*

3. Course Description: This course provides fundamentals of thermodynamics, chemistry, and transport physics applied to energy conversion systems. Analysis of energy conversion and storage in thermal, mechanical, nuclear, chemical, and electrochemical processes in power systems, with emphasis on efficiency, performance and environmental impact. Topics include fossil and nuclear power systems, solar energy, wind energy, biomass energy, and fuel cell systems, CO_2 separation and capture.

4. Course Objectives: The purpose of this course is to critically examine the technology of energy systems that will be acceptable in a world faced with global warming, local pollution, and declining supplies of oil. The focus is on renewable energy sources (wind, solar, biomass), but other non-carbon emitting sources (nuclear) and reduced carbon sources (co-generative gas turbine plants, fuel cells) are also studied. Both the devices and the overall systems are analyzed.

5. Course Outcomes:

1. The student will become proficient in engineering calculations of the performance and preliminary design of various energy conversion systems.
2. The student will become familiar with the physics of the environmental issues, including the greenhouse effect and global climate change.
3. The student will become adept in the comparative analysis of various energy conversion systems. The comparisons will include cost, social acceptability as well as environmental consequences.
4. The student will be able to apply engineering analysis techniques to the emerging energy technologies of the 21st century (e.g. wind turbines, combined cycle power plants), and to understand the context in which the design of energy systems takes place.

6. Instructor: Dr. J. N. Chung, Professor
Department of Mechanical and Aerospace Engineering
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Gainesville, FL 32611-6300
Tel (352) 392-9607/Fax (352) 392-1071, e-mail : jnchung@ufl.edu
Office Hours: Wednesday and Friday 7th period.

7. Teaching Assistants: Hao Wang, MAE-B 331, 352-392-4617
e-mail : fzarcher@ufl.edu
Office Hours : Tuesday and Thursday, 7th period.

8. Meeting Times: MWF 4:05 pm – 4:55 pm (9th Period)

9. Meeting Location: NEB 201

10. Class Homepage: On Canvas

11. Material and Supply Fees: None

12. Textbooks and Software Required: Energy Systems Engineering, F.M. Vanek, L.D Albright, and Largus Angenent, Second Edition, McGraw-Hill, Inc., 2012, ISBN: 9780071787789

13. Recommended Reading: 1. Energy Conversion, Edited by D.Y. Goswami and F. Kreith, CRC Press, 2008.

14. Course Outline:

Unit	Topics
#1	Outline of the course. Introduction and scope of energy conversion. World Energy Production and Balance. Motivations for studying future energy systems (e.g. pollution, climate change, energy security).
#2	Fossil Energy : Overview of fossil fuel resources and energy contents. Cycle analysis (Rankine, Brayton, combined cycles, cogeneration).
#3	Nuclear Energy : nuclear reaction and energy conversion physics (fission and fusion), nuclear power systems.
#4	Solar-thermal energy: solar thermal radiation physics, Active and passive solar-thermal energy collection and conversion systems.
#5	Photoelectric energy : Photoelectric physics. Solar photovoltaic cell materials and technology.
#6	Wind Energy: Wind interaction with objects fluid dynamics. Wind harvesting devices and systems.
#7	Biomass and Waste to Energy : Potential and resources of biomass and waste energy. Thermal-chemical and bio-chemical conversion methods.
#8	Overview of Climate Control, CO_2 Sequestration and Energy Sustainability.

15. Exam Schedule
Mid-Term Exam : February 26, Wednesday, 4-6 pm.
Final Exam : April 27, Monday, 10:00 am – 12:00 pm.

Exam window for Edge students : One day ahead and one day after the on-campus exam. Or by special arrangement.

16. Attendance and Expectations:
Attendance is mandatory, it is extremely important that students attend the class regularly. Irregular attendance always results in poor or mediocre performance. Excused absences will be given for documented medical reasons, UF related travel or job interview travel. Documentation must be in the form of a doctor's note, or a letter from the sponsor of the travel. **Re-grading Policy:** Any re-grade requests must be submitted in writing within two weeks after return of the graded paper. The written request must explain in detail what you want the grader to do and where you believe a mistake in grading was made. These requests will be accepted by Dr. Chung only. The request must have a date on the top of the page, your name, your telephone number(s), and e-mail address. **Policy on Homework Assignments:** Homework problem sets will be assigned during the semester with due dates indicated and **for on-campus students you need to turn hard copies in class**. Edge students turn in scanned copies. You may not turn homework assignments in early. Late homework is not accepted without a legitimate reason. Homework handed in after solutions are posted will not be accepted. **Miscellaneous Policies:** Students will be held responsible for knowledge of all scheduling and policy announcements made in class. You may contact Dr. Chung or send him an e-mail 24 hours a day, 7 days a week. Please make sure you leave a phone number if you call and can't find him. If you send an e-mail please also list a phone number where you could be reached. Sending an e-mail along with the voice message can also help alert him to your request.

17. Make-up Exam Policy: There will be no make-up exams. Unless there is a **documentable extreme medical or family emergency**, you must contact the instructor prior to the exam or no credit will be given for a missed exam. It is the student's responsibility to make sure he/she is available to take the exam.

18. Grading:

Homework	30%
Mid-Term Exam	35%
Final Exam	35%

19. Grading Scale (department standard, used as a reference):

93 – 100: A, 90 – 92.9: A- , 87– 89.9: B+, 83 – 86.9: B, 80 – 82.9: B-
77 – 79.9: C+, 73 – 76.9: C, 70 – 73.9: C-, 67 – 69.9: D+, 63 – 66.9: D
60 – 63.9: D-, 0 – 59.9: E

20. Honesty Policy – All students admitted to the University of Florida have signed a statement of academic honesty committing themselves to be honest in all academic work and understanding that failure to comply with this commitment will result in disciplinary action. This statement is a reminder to uphold your obligation as a UF student and to be honest in all work submitted and exams taken in this course and all others.

21. <u>Accommodation for Students with Disabilities</u> – Students Requesting classroom accommodation must first register with the Dean of Students Office. That office will provide the student with documentation that he/she must provide to the course instructor when requesting accommodation.

22. <u>UF Counseling Services</u> – Resources are available on-campus for students having personal problems or lacking clear career and academic goals. The resources include:

- University Counseling Center, 301 Peabody Hall, 392-1575, Personal and Career Counseling
- SHCC mental Health, Student Health Care Center, 392-1171, Personal and Counseling.
- Center for Sexual Assault/Abuse Recovery and Education (CARE), Student Health Care Center, 392-1161, sexual assault counseling
- Career Resource Center, Reitz Union, 392-1601, career development assistance and counseling

23. <u>Software Use</u> – All faculty, staff and student of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.