Course Number & Title: AME577/EE626: Survey of Energy and Power for a Sustainable Future

Units: 4

Semester: Spring

Schedule: Class: M, W 12:00-1:50 pm

Location: OHE 100C and DEN

Instructor: Wei Wu

Office: PHE 632

Office Hours: T 4-5 pm

Contact Information: wu.w@usc.edu, 213-740-3085

Teaching Assistant: Sushmit Hossain, hossains@usc.edu

Catalog Description:
Power production includes conventional fossil fuels, synthetic fuels, hydroelectric, tidal, solar, wind, geothermal, biomass, and nuclear. The environmental consequences of various energy sources are discussed.

Course Description:
Providing Energy for the world to use in a sustainable fashion is a major challenge for humanity. Energy is also an essential scientific topic studied intensively for over a few thousand years. Therefore, this survey class will start with fundamental sciences relating to energy and power issues and then study the technologies relating to energy/power production, transmission, and storage. Moreover, the externalities of those technologies will be discussed, too.

Learning Objectives:
By the end of the course, the student will be able to:

1) Build the scientific foundations needed to understand energy- and power-related technologies.
2) Know the landscape of state-of-the-art energy/power generation, transmission and storage technologies.

3) Apply the fundamental sciences behind the above technologies to sample problems reflecting real-world implementation.

4) Apply the fundamental sciences behind the above technologies to investigate the impacts of those technologies on the sustainability of humanity.

5) Acquire basic knowledge to start sustainable energy-related research.

**Prerequisite:** Graduate standing in Engineering, Physics, or Chemistry

**Required Main Textbook:**

**Supplementary Texts:** Handout slides and reading assignments are provided in class.

**Readings:** All lecture notes will be available on DEN.

**Grading:**

- Homework 10%
- Presentation 20%
- Midterm Exam 30%
- Final exam 40%
### Weekly Schedule

<table>
<thead>
<tr>
<th>Week</th>
<th>Subject</th>
<th>Readings</th>
<th>HW</th>
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<tbody>
<tr>
<td>1</td>
<td>Introduction and overview</td>
<td>Chapters 1, 5</td>
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<tr>
<td>2</td>
<td>Thermal dynamics laws, state functions, and</td>
<td>Chapter 6,8,9,10</td>
<td>W: HW 1 Assign</td>
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<td></td>
<td>thermal engines</td>
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<td>3</td>
<td>Energy conversion, internal combustion engine</td>
<td>Chapter 11,12,13</td>
<td>W: HW 1 Due</td>
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<td></td>
<td>, steam turbine, gas turbine</td>
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<td>4</td>
<td>Nuclear power introduction, structure,</td>
<td>Chapter 16, 17</td>
<td>M: HW 2 Assign</td>
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<td>properties, and decay of nuclei</td>
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<tr>
<td>5</td>
<td>Fission and fusion, nuclear power plant,</td>
<td>Chapter 18, 19</td>
<td>M: HW 2 Due</td>
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<td>nuclear power externalities</td>
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<td>W: HW 3 Assign</td>
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<td>6</td>
<td>Solar energy fundamentals, solar thermal</td>
<td>Chapters 20, 21, 22, 23, 24</td>
<td>W: HW 3 Due</td>
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<td>7</td>
<td>Photovoltaic, biological Energy, biomass,</td>
<td>Chapter 25</td>
<td>M: HW 4 Assign</td>
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<td>biofuel</td>
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<td>8</td>
<td>Ocean energy flow, Wind resources</td>
<td>Chapters 26, 27, 28</td>
<td>M: HW 4 Due</td>
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<td>9</td>
<td>Midterm Exam: basic fluid dynamics</td>
<td>Chapter 29</td>
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<td>10</td>
<td>Wind turbines, hydro, wave, tidal, and marine</td>
<td>Chapter 30, 31</td>
<td>M: HW 5 Assign</td>
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<td>current</td>
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<td>11</td>
<td>Geothermal energy, fossil Fuels</td>
<td>Chapter 32, 33</td>
<td>M: HW 5 Due, HW 6 Assign</td>
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<td>12</td>
<td>Energy and climate, earth’s climate: past,</td>
<td>Chapter 34, 35</td>
<td>M: HW 6 Due</td>
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<td>present, and future</td>
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<td>W: HW 7 Assign</td>
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<td>13</td>
<td>Energy efficiency and conservation, storage</td>
<td>Chapter 36, 37</td>
<td>W: HW 7 Due</td>
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<td>14</td>
<td>Electricity generation and transmission,</td>
<td>Chapter 38</td>
<td>W: HW 8 Assign</td>
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<td>smart grid</td>
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<td>15</td>
<td>Student presentations</td>
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<td>HW 8 Due</td>
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**Final exam**: Refer to the final exam schedule in the USC Schedule of Classes at [http://www.usc.edu/soc](http://www.usc.edu/soc)

**Homework**

Some homework questions are from the textbook, and some homework questions (mainly something to think about) are from the instructor.
Final presentation:

Every two students form a team to perform literature research on a topic relating to power and energy. The topic is selected by each team based on their interest. At the end of the semester, each team gives a 10-minute presentation to report their literature research to the class. All presentations are graded by other students.
Statement on Academic Conduct and Support Systems

Academic Conduct:

Plagiarism – presenting someone else’s ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in SCampus in Part B, Section 11, “Behavior Violating University Standards” policy.usc.edu/scampus-part-b. Other forms of academic dishonesty are equally unacceptable. See additional information in SCampus and university policies on Research and Scholarship Misconduct.

Students and Disability Accommodations:

USC welcomes students with disabilities into all of the University’s educational programs. The Office of Student Accessibility Services (OSAS) is responsible for the determination of appropriate accommodations for students who encounter disability-related barriers. Once a student has completed the OSAS process (registration, initial appointment, and submitted documentation) and accommodations are determined to be reasonable and appropriate, a Letter of Accommodation (LOA) will be available to generate for each course. The LOA must be given to each course instructor by the student and followed up with a discussion. This should be done as early in the semester as possible as accommodations are not retroactive. More information can be found at osas.usc.edu.

You may contact OSAS at (213) 740-0776 or via email at osasfrontdesk@usc.edu.

Support Systems:

Counseling and Mental Health - (213) 740-9355 – 24/7 on call
studenthealth.usc.edu/counseling
Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.
National Suicide Prevention Lifeline - 1 (800) 273-8255 – 24/7 on call
suicidepreventionlifeline.org
Free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week.
Relationship and Sexual Violence Prevention Services (RSVP) - (213) 740-9355(WELL), press “0” after hours – 24/7 on call
studenthealth.usc.edu/sexual-assault
Free and confidential therapy services, workshops, and training for situations related to gender-based harm.

Office for Equity, Equal Opportunity, and Title IX (EEO-TIX) - (213) 740-5086
eeotix.usc.edu
Information about how to get help or help someone affected by harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants.

Reporting Incidents of Bias or Harassment - (213) 740-5086 or (213) 821-8298
usc-advocate.symplicity.com/care_report
Avenue to report incidents of bias, hate crimes, and microaggressions to the Office for Equity, Equal Opportunity, and Title for appropriate investigation, supportive measures, and response.

The Office of Student Accessibility Services (OSAS) - (213) 740-0776
osas.usc.edu
OSAS ensures equal access for students with disabilities through providing academic accommodations and auxiliary aids in accordance with federal laws and university policy.
USC Campus Support and Intervention - (213) 821-4710
campusssupport.usc.edu
Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

*Diversity, Equity and Inclusion* - (213) 740-2101
diversity.usc.edu
Information on events, programs and training, the Provost’s Diversity and Inclusion Council, Diversity Liaisons for each academic school, chronology, participation, and various resources for students.

*USC Emergency* - UPC: (213) 740-4321, HSC: (323) 442-1000 – 24/7 on call
dps.usc.edu, emergency.usc.edu
Emergency assistance and avenue to report a crime. Latest updates regarding safety, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible.

*USC Department of Public Safety* - UPC: (213) 740-6000, HSC: (323) 442-120 – 24/7 on call
dps.usc.edu
Non-emergency assistance or information.

*Office of the Ombuds* - (213) 821-9556 (UPC) / (323-442-0382 (HSC)
ombuds.usc.edu
A safe and confidential place to share your USC-related issues with a University Ombuds who will work with you to explore options or paths to manage your concern.

*Occupational Therapy Faculty Practice* - (323) 442-3340 or otfp@med.usc.edu
chan.usc.edu/otfp
Confidential Lifestyle Redesign services for USC students to support health promoting habits and routines that enhance quality of life and academic performance.