University of Alberta

MECE 443: Energy Conversion
Fall 2012

Lecture Time: MWF, 10:00 – 10:50 pm
Lecture Room: MECE 3-1
Instructor: Marc Secanell, Assistant Professor, Mechanical Engineering
Office: 4-31F Mechanical Engineering Building (4th floor)
Phone: (780) 492-6961
E-mail: secanell@ualberta.ca (Please start the subject line with MECE443)
Office Hours: Wednesday 2-5pm or by appointment.
Teaching Assistant: Madhur Bhaiya
E-mail: bhaiya@ualberta.ca
Office Hours: Friday 2-4pm or by appointment @ MECE 2-22.
Web Page: eClass

Course Description: Sources, flow and overall efficiency of use of various energy forms in society, thermodynamic analysis of energy conversion devices such as thermoelectric and magnetohydrodynamic generators, solar and fuel cells, energy from fission and fusion reactors.

Course Prerequisites: MECE 340.

Course Objectives: At the end of this course, students will be able to

- Describe the environmental impact of current energy technologies
- Develop energy system diagrams highlighting their main components
- Estimate the future availability of non-renewable energy resources
- Describe the operating principles of conventional power plants
- Demonstrate a working knowledge of the basic principles of combustion
- Analyze conventional power plant thermodynamic cycles and select the most adequate components
- Describe the operating principles of nuclear fission power plants
- Describe the operating principles of non-conventional energy conversion technologies such as solar, wind and fuel cell technologies
- Analyze the resource requirements of non-conventional energy technologies

Required Textbook:
- Lecture notes and handouts will be made available on eClass
Recommended or Optional Learning Resources:

  (available at http://www.sciencedirect.com/science/book/9780123750259 via the University of Alberta library and ScienceDirect)
- Kenneth C. Weston, Energy Conversion (1992)
  (available at http://www.personal.utulsa.edu/~kenneth-weston/)

Grade Evaluation:

<table>
<thead>
<tr>
<th>Exams</th>
<th>Date</th>
<th>Weighting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assignment</td>
<td>See schedule below</td>
<td>30%</td>
</tr>
<tr>
<td>Midterm examination</td>
<td>October 22 @ 5-8pm in MECE 2-1</td>
<td>30%</td>
</tr>
<tr>
<td>Final Exam</td>
<td>December 18 @ 9-12am</td>
<td>40%</td>
</tr>
</tbody>
</table>

Note: If a student misses the midterm examination, for any valid reason, the final course assessment will be based on a 70% final examination.

Note 2: All examinations and assignments will receive a numerical score. These will be added to produce your total numerical score, which will be converted to a letter grade by comparing it to the class range of total numerical scores and using the University of Alberta Marking and Grading Guidelines.

Assignments: There are six assignments in this course. Each assignment will be worth 5% of your grade. The assignments will consist of a set of problems related to the topics being covered in the course. Assignments will be posted on eClass. They are due at midnight on the date posted on the assignment. Please drop the assignments in the course mailbox in the 4th floor. Late assignments will be penalized (20% of the total mark per day).

Mid-Term Exam: October 22, 2012. Time: 5:00 p.m – 8:00 p.m. Room MECE 2-1. The exam will consist of problems similar to those covered either in class or in the assignments. The exams will be closed book. A double-sided, one page formula sheet will be allowed in the exam. Thermodynamic data and other tables will be provided in the exam. Only approved non-programmable calculators can be used. Previous midterm examinations will be posted in eClass before the midterm examination.

Final Exam: The exam will consist of problems similar to those covered either in class or in the assignments. The exams will be closed book. A double-sided, one page formula sheet will be allowed in the exam. Thermodynamic data and other tables will be provided in the exam. Only approved non-programmable calculators can be used. Previous final examinations will be posted in eClass before the examination.
Course Schedule (tentative):

<table>
<thead>
<tr>
<th>Week</th>
<th>Monday (lecture) 10:00-10:50</th>
<th>Wednesday (lecture) 10:00-10:50</th>
<th>Friday (lecture) 10:00-10:50</th>
<th>Important dates</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1 (Sept. 3-7)</td>
<td>-</td>
<td>0. Preliminaries</td>
<td>1. Introduction to energy conversion</td>
<td></td>
</tr>
<tr>
<td>#2 (Sept. 10-15)</td>
<td>1. Introduction to energy conversion</td>
<td>2. Conventional energy resources</td>
<td>2. Conventional energy resources</td>
<td></td>
</tr>
<tr>
<td>#3 (Sept. 17-21)</td>
<td>2. Conventional energy resources</td>
<td>3. Introduction to energy systems</td>
<td>3. Introduction to energy systems</td>
<td>Assignment #1 due</td>
</tr>
<tr>
<td>#5 (Oct. 1-5)</td>
<td>4. Conventional power plants (Introduction)</td>
<td>4. Conventional power plants (Coal power)</td>
<td>4. Conventional power plants (Coal power)</td>
<td>Assignment #2 due</td>
</tr>
<tr>
<td>#6 (Oct. 8-12)</td>
<td>Thanksgiving Day</td>
<td>4. Conventional power plants (Coal power)</td>
<td>4. Conventional power plants (Gas power)</td>
<td></td>
</tr>
<tr>
<td>#7 (Oct. 15-19)</td>
<td>4. Conventional power plants (Gas power)</td>
<td>4. Conventional power plants (IGCC)</td>
<td></td>
<td>Midterm review Assignment #3 due</td>
</tr>
<tr>
<td>#8 (Oct. 22 – 26)</td>
<td>Midterm</td>
<td>5. Nuclear power plants (Dr. Lipsett)</td>
<td>5. Nuclear power plants (Dr. Lipsett)</td>
<td>Voluntary CHPP tour</td>
</tr>
<tr>
<td>#9 (Oct. 29- Nov. 2)</td>
<td>5. Nuclear power plants (Dr. Lipsett)</td>
<td>6. Hydropower energy</td>
<td>6. Hydropower energy</td>
<td></td>
</tr>
<tr>
<td>#10 (Nov. 5-9)</td>
<td>7. Solar energy (introduction)</td>
<td>7. Solar energy (introduction)</td>
<td>7. Solar energy (introduction/thermal)</td>
<td>Assignment #4 due</td>
</tr>
<tr>
<td>#11 (Nov. 12-16)</td>
<td>Remembrance Day</td>
<td>7. Solar energy (thermal)</td>
<td>7. Solar energy (thermal)</td>
<td></td>
</tr>
<tr>
<td>#12 (Nov. 19 - 23)</td>
<td>7. Solar energy (thermal/photovoltaic)</td>
<td>7. Solar energy (photovoltaic)</td>
<td>7. Solar energy (photovoltaic)</td>
<td>Assignment #5 due</td>
</tr>
<tr>
<td>#13 (Nov. 26 – 30)</td>
<td>8. Wind energy</td>
<td>8. Wind energy</td>
<td>10. Electrochemical energy (Fuel cells)</td>
<td>Voluntary fuel cell tour</td>
</tr>
<tr>
<td>#14 (Dec. 3-7)</td>
<td>10. Electrochemical energy (Fuel cells)</td>
<td>Final Review</td>
<td>-</td>
<td>Assignment #6 due</td>
</tr>
</tbody>
</table>

Student Responsibilities:

**Academic integrity:** ‘The University of Alberta is committed to the highest standards of academic integrity and honesty. Students are expected to be familiar with these standards regarding academic honesty and to uphold the policies of the University in this respect. Students are particularly urged to familiarize themselves with the provisions of the Code of Student Behaviour (online at www.ualberta.ca/secretariat/appeals.htm) and avoid any behaviour which could potentially result in suspicions of cheating, plagiarism, misrepresentation of facts and/or participation in an offence. Academic dishonesty is a serious offence and can result in suspension or expulsion from the University.’

All forms of dishonesty are unacceptable at the University. Cheating, plagiarism and misrepresentation of facts are serious offenses. Anyone who engages in these practices will receive at minimum a grade of zero for the exam or paper in question and no opportunity will be given to replace the grade or redistribute the weights. Any offense will be reported to the Senior Associate Dean of Science who will determine the disciplinary action to be taken. Typical sanctions for serious violations of the Code have included disciplinary grade reductions, disciplinary failing grades, suspension or permanent expulsion from the University.

**Exams:** Your student photo I.D. is required at exams to verify your identity. Students will not be allowed to begin an examination after it has been in progress for 30 minutes. Students must
remain in the exam room for at least 30 minutes from the time the exam commenced. Electronic equipment other than calculators is not to be brought to exam.

**Students with disabilities:** Students who require accommodation in this course due to a disability are advised to discuss their needs with Specialized Support & Disability Services (2-800 Students’ Union Building).

**Academic support center:** Students who require additional help in developing strategies for better time management, study skills or examination skills should contact the Academic Support Centre (2-703 Students’ Union Building).

**Audio or video recording:** Audio or video recording of lectures, labs, seminars or any other teaching environment by students is allowed only with the prior written consent of the instructor or as a part of an approved accommodation plan. Recorded material is to be used solely for personal study, and is not to be used or distributed for any other purpose without prior written consent from the instructor.

**Note:** Policy about course outlines can be found in section 23.4(2) of the University Calendar.