University of Alberta

MECE 443: Energy Conversion
Fall 2011

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 1-3pm or by appointment.

Teaching Assistant: Samantha Miller
E-mail: smiller@ualberta.ca
Office Hours: Friday 1-3pm or by appointment @ MECE 2-22.

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, ocean 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)

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>10%</td>
</tr>
<tr>
<td>Midterm examination</td>
<td>October 19 @ 5-7pm in MECE 2-1</td>
<td>20%</td>
</tr>
<tr>
<td>Research project</td>
<td>See schedule below</td>
<td>30%</td>
</tr>
<tr>
<td>Final Exam</td>
<td>December 19 @ 9-12am</td>
<td>40%</td>
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</table>

Note: If a student misses the midterm examination, for any valid reason, the final course assessment will be based on a 60% 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.

Assignments: There are six assignments in this course. Assignment marks will be computed using the best five assignment grades (each of the best five will weight 2%). 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 (25% of the total mark per day).

Mid-Term Exam: October 19, 2011. Time: 17:00 - 19:00. 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.

Research Project: This will be a significant component of the course. The class will form groups of four students. Each student group will be given a project assignment. The progress of the project will be communicated in four phases according to the schedule listed below. Late submission will be penalized (25% of the total mark per day).

 Schedule:

  Letter of intent (Mandatory): Create groups of four students and submit a letter of intent (in PDF format) stating the name of the group, the students in the group and the group leader. Due on Friday September 16, 2011 via e-mail.

  Proposed project topic (Mandatory): Submit proposed project topic, abstract (max. 200 words), and list of 3 references\(^1\) (in PDF format). Due on Wednesday September 21, 2011 via e-mail.

\(^1\) At least 2 references must be from peer-reviewed scientific or engineering journals. Additional reference may include the course text, other books, reports, or web-based info.
Preliminary report (10%): Submit a 8-10 page draft of written review citing at least 10 references (in PDF format). Due on Friday, October 28, 2011.

Oral presentation (5 %): Oral presentation by the group. Total 15 minutes in class (12 minute oral presentation + 3 minutes Q&A). During week #13 of classes, i.e. between Nov. 28 – Dec. 3 according to published schedule.

Attendance in and evaluation of student presentations (Mandatory): Attend student presentations, and fill out questionnaires to technically evaluate each seminar.

Final project report (15%): Submit final project report. Due on Wednesday December 10, 2011.

More information about the project such as project suggestions, report style and presentation outlines, will be provided in a separate handout.

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.

Course Schedule (very, very, 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. 5-9)</td>
<td>-</td>
<td>0. Preliminaries</td>
<td>1. Introduction to energy conversion</td>
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<tr>
<td>#2 (Sept. 12-16)</td>
<td>1. Introduction to energy conversion</td>
<td>2. Conventional energy resources</td>
<td>2. Conventional energy resources</td>
<td>Assignment #1 due</td>
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<tr>
<td>#3 (Sept. 19-23)</td>
<td>2. Conventional energy resources</td>
<td>3. Introduction to energy systems</td>
<td>3. Introduction to energy systems</td>
<td>Letter of intent</td>
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<tr>
<td>#6 (Oct. 10-14)</td>
<td>Thanksgiving Day</td>
<td>5. Nuclear power plants (Dr. Lipsett)</td>
<td>5. Nuclear power plants (Dr. Lipsett)</td>
<td>Assignment #3 due</td>
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<tr>
<td>#7 (Oct. 17-21)</td>
<td>Review</td>
<td>Midterm</td>
<td>5. Nuclear power plants (Dr. Lipsett)</td>
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<tr>
<td>#9 (Oct. 21- Nov. 4)</td>
<td>7. Solar energy (introduction)</td>
<td>7. Solar energy (thermal)</td>
<td>7. Solar energy (thermal)</td>
<td>Assignment #4 due</td>
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<tr>
<td>#10 (Nov. 7-11)</td>
<td>7. Solar energy (photovoltaic)</td>
<td>7. Solar energy (photovoltaic)</td>
<td>Remembrance Day</td>
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<tr>
<td>#11 (Nov. 14-18)</td>
<td>8. Wind energy</td>
<td>8. Wind energy</td>
<td>9. Geothermal energy</td>
<td>Assignment #5 due</td>
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<tr>
<td>#12 (Nov. 21 - 25)</td>
<td>9. Geothermal energy</td>
<td>10. Electrochemical energy (Fuel cells)</td>
<td>10. Electrochemical energy (Fuel cells)</td>
<td>Voluntary (after class) fuel cell tour</td>
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<tr>
<td>#13 (Nov. 28 – Dec. 3)</td>
<td>11. Presentations (15min each)</td>
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<td>11. Presentations (15min each)</td>
<td>Final project presentations</td>
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<tr>
<td>#14 (Dec. 5-10)</td>
<td>12. Bio-fuels (Dr. Kumar)</td>
<td>Final Review</td>
<td>-</td>
<td>Assignment #6 due</td>
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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).

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