University of Alberta

MECE 463: Thermo-Fluids Systems Design
Fall 2011

Lecture Time: TR, 9:30 – 11:00 am
Lecture Room: NRE 2-001
Seminar Time: Either T or R, 2:00-3:50 pm
(Tuesday and Thursday will cover the same content).
Seminar Room: Seminar: Tuesday MECE 4-3
Thursday: NRE 1-001
Computer lab: MecE 3-26
Instructor: Mark Ackerman, Mechanical Engineering
Office: 5-8S Mechanical Engineering Building (5th floor)
Phone: (780) 492-2822
E-mail: Mark.Ackerman@ualberta.ca (start the subject line with MECE463)
Office Hours: by appointment.
Teaching Assistants: Sepehr Pourrezaei Khaligh
E-mail: sepehr@ualberta.ca

Course Description: Design and optimization of thermo-fluid systems, heating and
ventilating equipment and load calculations, system design, piping networks, heat exchanger
analysis and design, computer-aided design projects.

Course Prerequisites: MECE 330 and 340. Co-requisite: MECE 370

Course Objectives:
At the end of this course, students will be able to
• Estimate heating loads for residential or commercial buildings
• Calculate air flow rates necessary to achieve good indoor air quality
• Design air distribution systems for residential and commercial buildings, including duct
  sizing and fan selection
• Design piping systems including pipe sizing and pump selection
• Analyze refrigeration and heat pump cycles and select appropriate pumps
• Design using heat exchangers

Required Textbook:
• Lecture notes and handouts will be made available on eClass

Recommended or Optional Learning Resources:
of the 2009 Edition is available through the Knovel Database on the U of A Library site]
(Good resource for most of the course).
and Design”, 5th or 6th Edition, John Wiley & Sons, Inc., (Good resource for most of the
course).
Seminars: Since a major portion of the course grade is based on a design project, the majority of the seminars will be used to help the students complete the design project. The instructor will aid students to work on the background calculations needed to complete the design project.

Grade Evaluation:

<table>
<thead>
<tr>
<th>Exams</th>
<th>Date</th>
<th>Weighting</th>
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</thead>
<tbody>
<tr>
<td>Assignment</td>
<td>Various</td>
<td>10%</td>
</tr>
<tr>
<td>Midterm examination</td>
<td>October 18th (tentative date)</td>
<td>20%</td>
</tr>
<tr>
<td>Design projects (3, 10% ca)</td>
<td>See schedule below</td>
<td>30%</td>
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<tr>
<td>Final Exam</td>
<td>December 14 @ 9:00 AM</td>
<td>40%</td>
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</table>

*Note 1:* 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 and weighted appropriately to produce a total numerical score, which will be converted to a letter grade by comparing it to the class range of total numerical scores.

Assignments: Assignments will consist of problem sets related to the course material. You will receive an assignment approximately every two weeks and the assignment will be due one week after it is given. Assignments are to be handed in to the appropriate bin in the assignment box on the 4th floor of Mechanical Engineering.

Design Project:

The design project for this course will deal with a residential structure and the minimization of energy use. Each “sub-project” is related in that the first deals with the determination of the energy requirements of a “code minimum” structure while the follow on portions of the project look at ways of reducing energy use in a rational and economic manner. The sub-projects will build on each other so every attempt will be made to grade projects quickly and provide feedback in a timely manner.

Background

The project for this course will be the complete design of a low energy residential structure and required systems. Design groups, consisting of four students, will be given a basic floor plan of a structure. As a group you will be required to specify the building envelope, window placement and heating/cooling systems. The structure will be located in Edmonton, connected to electrical and natural gas utilities (if needed).

Deliverables

There will be four project deliverables: a letter of intent indicating the group members and, two progress reports and a final report. All progress reports should be submitted using the same format:

- Letter of transmittal
- Executive summary (one page, 250 word max): summary of design
- Report body (2,500 word maximum)
- Necessary figures and tables (properly referenced)
- Appendix I: containing supporting calculations in standard format
- Appendix II: Equipment specifications (if applicable)
Format of Exams: Exams will consist of problems similar to those covered either in class or in the assignments. The exams will be closed book. A formula sheet will be provided (to be posted on eClass before the examination). Only approved non-programmable calculators can be used.

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.
Lecture Schedule (tentative):

<table>
<thead>
<tr>
<th>Week</th>
<th>Tuesday</th>
<th>Thursday</th>
<th>Deliverable or Event</th>
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<tbody>
<tr>
<td>Sept 5 – Sept 9</td>
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<td>Introduction, Rationale for Course</td>
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<td>Sept 19 – Sept 23</td>
<td>Heating Loads</td>
<td>Heating Loads</td>
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<td>Sept 26 – Sept 30</td>
<td>Heating Loads</td>
<td>Psychrometrics/Processes</td>
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<td>Oct 3 – Oct 7</td>
<td>Psychrometrics/Processes</td>
<td>Air System Design</td>
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<td>Oct 10 – Oct 14</td>
<td>Air System Design</td>
<td>Air System Design</td>
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<tr>
<td>Oct 17 – Oct 21</td>
<td>Midterm Examination (October 18th)</td>
<td>Piping Systems</td>
<td>Project Report #1 due October 14th (10%)</td>
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<td>Oct 24 – Oct 28</td>
<td>Piping Systems</td>
<td>Piping Systems</td>
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<td>Oct 31 – Nov 4</td>
<td>Piping Systems</td>
<td>Heat Pumps and Refrigeration Cycles</td>
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<td>Nov 7 – Nov 11</td>
<td>Heat Pumps and Refrigeration Cycles</td>
<td>Remembrance Day</td>
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<td>Nov 21 – Nov 25</td>
<td>Heat Exchangers</td>
<td>Heat Exchangers</td>
<td>Project Report #2 due November 14th (10%)</td>
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<td>Nov 28 – Dec 2</td>
<td>Heat Exchangers</td>
<td>Heat Exchangers</td>
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<tr>
<td>Dec 5 – Dec 9</td>
<td>Review</td>
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<td>Final Project Report due December 6th (10%)</td>
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<td>December 14, 9:00</td>
<td>Final Examination</td>
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